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S.N.	Vol.no. Page No.	Clause	Subject of clause	Description of clause	Contractors queries	Response of Employer
1	Vol.1 page 3&4 of 73	1.1.3.2	Eligibility criteria	A. Work Experience: The bidders will be qualified only if they have completed work(s) during last 10 years ending 31.03.2016 as given below: (i) At least one work of similar nature (i.e. RCC framed structure building(s) G+5 Storey or one Metro Railway Depot or Metro station) of value of INR 150 crores or more, and At least one site formation works of value of at least INR 122 Crores If the above work of INR 272 crores has been done by the foreign partner of JV and the work was done in the country of the foreign partner then in addition to this, the foreign partner must have done works equal to INR 136 crores outside the country of the foreign partner. OR (ii) Two works of similar nature(i.e. RCC framed structure building(s) G+5 Storey or one Metro Railway Depot or Metro station) each of value of INR 100 crores or more, and two site formation works, each of value of at least INR 70 Crores If the above work of INR 170 crores each (i.e. totaling to Rs.340 Crores) has been done by the foreign partner of JV and the work was	We request you to modify the Clause (i) as below: The bidders will be qualified only if they have completed work(s) during last 10 years ending 31.03.2016 as given below: (i) At least one work of similar nature (i.e. RCC framed structure building(s) G+5 Storey or one Metro Railway Depot or Metro station) of value of INR 150 crores or more. If the above work of INR 272 crores has been done by the foreign partner of JV and the work was done in the country of the foreign partner then in addition to this, the foreign partner must have done works equal to INR 136 crores outside the country of the foreign partner. OR Two works of similar nature(i.e. RCC framed structure building(s) G+5 Storey or one Metro Railway Depot or Metro station) each of value of INR 100 crores or more. If the above work of INR 170 crores each (i.e. totalling to Rs.340	Please refer to addendum no.1

				done in the country of the foreign partner then in addition to this, the foreign partner must have done works equal to INR 136 crores outside the country of the foreign partner. OR (iii) Three works of similar nature (i.e. RCC framed structure building(s) G+5 Storey or one Metro Railway Depot or Metro station) each of value of INR 82crores or more. and three site formation works each of value of at least INR 54 Crores If the above work of INR 136 crores each (i.e. totalling to Rs.408 Crores) has been done by the foreign partner of JV and the work was done in the country of the foreign partner then in addition to this, the foreign partner must have done works equal to INR 136 crores outside the country of the foreign partner Notes: Similar nature of work include, RCC framed structure building(s), of minimum G+5 storey or at least one Metro Station or Metro Depot, steel structures and site formation works tree cutting, retaining walls, cut and fill earthworks in both hard and soft materials. Notes: Similar nature of work include, RCC framed structure building(s), of minimum G+5 storey or at least one Metro Station or	Crores) has been done by the foreign partner of JV and the work was done in the country of the foreign partner then in addition to this, the foreign partner must have done works equal to INR 136 crores outside the country of the foreign partner. OR (iii) Three works of similar nature (i.e. RCC framed structure building(s) G+5 Storey or one Metro Railway Depot or Metro station) each of value of INR 82crores or more. If the above work of INR 136 crores each (i.e. totalling to Rs.408 Crores) has been done by the foreign partner of JV and the work was done in the country of the foreign partner then in addition to this, the foreign partner must have done works equal to INR 136 crores outside the country of the foreign partner Notes: Similar nature of work include, RCC framed structure building(s), of minimum G+5 storey or at least one Metro Station or Metro Depot, steel structures and site formation works tree cutting, retaining walls,	

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				Metro Depot, steel structures	cut and fill earthworks in both hard and soft materials. Notes: Similar nature of work include, RCC framed structure building(s), of minimum G+5 storey or at least one Metro Station or Metro Depot, steel structures . We understand that the RCC framed structure building(s) varying up to five stories will be considered in line with this criteria for qualification. Please Confirm. Work executed for Special Purpose Vehicle(SPV)/ Developer for PPP Project will be considered for Eligibility. Please clarify.	
2	Vol.1 page 3&4 of 73	1.1.3.2	Eligibility criteria		Bidders understand that Experience of executed Underground /Elevated Metro Station of required value will be accepted for Qualifying purpose. Please Confirm. Bidder understand that Experience of roadwork of required value will be accepted for Site Formation Work. Please Confirm. Bidder request you to modify the similar work definition as	Tender conditions shall prevail, and Please refer to addendum no.1

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					" Similar nature of work include, RCC framed structure building(s), of minimum G+5 story or at least one Metro Station or Metro Depot or steel structures and / or site formation works tree cutting, retaining walls and 450,000 cubic meters of cut and fill earthworks in both hard and / or soft materials". Please Confirm.	
3	Vol.1 page 3&4 of 73	1.1.3.2	Eligibility criteria		we request you to reduce the value from INR 150 crores or more for RCC frame structure building G + 5 Storey to INR 130 crores considering 5% annual escalation for the completed value of work OR Annual escalation of 10% for the completed value of work should be considered as have been applied for other Bid invitations of MMRDA so that we reach the single value of completed work of INR 150 crores as provided in your Tender.	Tender conditions shall prevail & Please refer to addendum no. 1
4	Vol.1 page 3&4 of 73	1.1.3.2	Eligibility criteria		We propose to attach the Purchase Orders, Completion certificate and the drawing as our credential towards this requirement. Kindly confirm	Tender conditions shall prevail.
5	Vol.1 page 3&4 of 73	1.1.3.2	Eligibility criteria		Further in addition to the experience of building work and experience in site formation work	Please refer to addendum no. 1

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					of value of at least INR 122 crores is provided. We request you to kindly delete the value of site formation works however the Tender requirement of 4.50 lakhs Cubic Meters earth work, in cutting and filling shall be retained as have been provided in the Tender.	
6	Vol.1 page 3&4 of 73	1.1.3.2	Eligibility criteria		As the document, does not specifically ask for the qualifying works to be from only government customers, We presume that work done for non- government organizations /institutions (Private Clients) will be accepted for qualification criteria. Please confirm.	Tender conditions shall prevail
7	Vol.1 page 3&4 of 73	1.1.3.2	Eligibility criteria		We request to consider work executed for private client as these work experience amounts shall be certified by CA. This practice is accepted in all State / Central Government Departments. This shall allow wide competition and ensure competitive offers for MMRC.	Tender conditions shall prevail
8	Vol.1 page 3&4 of 73	1.1.3.2	Eligibility criteria		In our opinion, the experience of Key activity is inherited part of a depot construction and thus eligibility to qualify for the bid should be solely on the basis of depot construction work	Please refer to addendum no. 1

					experience only. We also opine that since "Experience of Key Activity" covers the "site formation works", there is no requirement of work experience for bidders of "site formation Works" separately, which may please be ignored	
9	Vol.1 page 3&4 of 73	1.1.3.2	Eligibility criteria		1. In general one Metro station cost will be less than Rs. 50 Crores. Whether one single Contract consist of multiple Metro Stations, of completed Value more then 50 Crores will be considered as similar work. Please clarify. 2. (i) Site formation work is defined as tree cutting, retaining walls ,cut & fill earth work in both hard and soft material. Whether road project consist of the above items of completed value more than rs. 122 crores will be considered as site formation work. Please clarify. (ii)Whether on going similar nature of work/ site formation work with a completed value more than rs. 122 crores will be considered as site formation work. Please clarify.	Please refer to addendum no.1
10	Vol.1 Page 4of 73	1.1.3.2	**Experience of Key Activity**	**Experience of Key Activity.** In addition to above, the contractor should also have construction	We request you to modify the Clause (i) as below: The contractor should also have	Tender conditions shall prevail, and please refer to

				experience of following Quantities, in any two conjugative year of last 10 years. (i)construction of commercial steel shed of Min. 10,000 (Ten Thousand) square meter. (ii)4.5 Lakh cubic meters earth work, in cutting and filling. He can demonstrate his experience of key activities, in work, having more than one similar work. The tenderer shall submit details of works executed by them in the Performa of **Appendix- 17 of FOT** for the works to be considered for qualification of work experience criteria. Documentary proof such as completion certificates from client clearly indicating the nature/scope of work, actual completion cost and actual date of completion for such work should be submitted. Experience certificate of any person/official below the rank of Executive engineer will not be accepted as proof for Eligibility. **The offers submitted without this documentary proof shall not be evaluated**. The work, executed for	construction experience of following Quantities, in any two conjugative year of last 10 years. (i) construction of commercial steel shed of Min. 10,000 (Ten Thousand) square meter/ Minimum 35, 000 MT Fabrication & Erection of Structural Steel works for Building Works (ii) 4.5 Lakh cubic meters earth work He can demonstrate his experience of key activities, in work, having more than one similar work. 'Bidder understand that the experience of Key activities can be shown in other projects rather than Similar work experience project. Please confirm. Bidder also request to consider the Airport terminal building Roof shed with steel structure more than 10000 sqm to consider the experience of steel shed. Please confirm.	addendum no.1

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				private client will not be considered for eligibility evolution.		
11					A. Experience of key activity may be considered as follow.; The contractor should also have construction experience of following Quantities, in last 10 years. (i) construction of commercial steel shed of Min. 10,000 (Ten Thousand) square meter. (ii) 4.5 Lakh cubic meters earth work, in cutting and filling. B . Experience of above key activities in on going work may please be considered.	Tender conditions shall prevail
12	Vol.1 page 9	clause	1.1.10 (ii)	I Earnest Money Deposit Earnest money deposit for this work will be Rs. 3,40,35,000/- only. EMD Payment as mentioned above has to be made through RTGS / NEFT mode using the System Generated Challan. Bidders should ensure that the payment of the EMD is made at-least 5 working days prior to the last date of Bid Preparation and Submission of the Tender Schedule to have seamless submission. Bidders need to upload scanned copy of EMD paid receipt during bid preparation. Bidders should mention the beneficiary details for EMD refund in the Earnest Money	We request that instead of RTGS/ NFT submission , BG be permitted. Kindly confirm. Bidder request to accept the EMD in form of Bank Guarantee. If so please provide the format of Bank Guarantee. Bank Guarantee issued by Nationalised / Schedule Bank may please be accepted toward earnest money deposit.	Please refer to addendum no.1

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				Deposit Form for fields marked as details required for Refund. MMRC / MMRDA or e-Tendering Service Provider will not be liable for delays caused in EMD refund due to incorrect beneficiary details. Bidders failing to complete the payment of EMD using the above mentioned process of RTGS / NEFT after downloading the system generated challans will not be able to submit their bids.	Kindly confirm whether EMD can be deposited in form of FDR. Further it is requested to accept EMD in form of Bank Guarantee.	Please refer to addendum no.1
13	Vol.2 Page 17	F5	Performance Security/ Security Deposit:	F5.1 Details of Initial Security Deposit: The successful tenderers shall have to pay Five percent of estimated cost put to tender or contract price of work, whichever is higher as security deposit by Demand Draft/Pay Order in favour of "Mumbai Metro Rail Corporation Ltd" payable at Mumbai or Bank Guarantees issued by any Nationalized bank or banks promoted by All India Financial Institutions issued by a branch in Mumbai in format acceptable to MMRC while accepting the tender that is before issuing work order and Five percent of estimated cost put to tender or contract price of work, whichever is higher deducting from Running Account Bills at the discretion of the Engineer-in-charge (at 7.5% of each Running Account Bill till the full security deposit is recovered or alternatively from the first and second Running Account Bills) so that, the total deposit equivalent to five percent (10%) of the estimated cost put to	It is requested consider 5% of the Contract value as the Performance Security amount. And the validity period of the Bank Guarantee against the Performance Security shall be up to the Defects Liability Period only. Bidder request to accept the performance security 10% of contract value only. Request to Limit up to 5% only within 30 days of LOA and no deduction from interim payments	Please refer to addendum no.1

				tender or contract price of work, whichever is higher made up and held by the MMRC as Security Deposit. The Bank Guarantee towards initial security deposit (i.e. 5 %) shall be pledged & valid for 6 Months beyond the end of defect liability period. The contractor shall be responsible to pay stamp duty as payable under Bombay Stamp Duty Act, 158 for Deposits paid in Demand Draft / Bank Guarantee, etc and shall furnish a copy of Challan having paid the same to Government. Failure to furnish within 3 months from the date of work order the same will be recovered at the rates in prevalence as per Stamp Duty Act, from the bills and resubmitted to Government.		
14	Vol.1 page 5 of 73	T1	Liquidity	This shall be seen from the balance sheets and/or from the banking reference.Net current assets and/or documents including banking reference, should show that the applicant has access to or has available liquid assets, lines of credit and other financial means to meet cash flow of INR 24 crores for this contract, net of applicant's commitments for other Contracts. Banking reference (as per Annexure-8 of ITT) should contain in clear terms the amount that bank will be in a position to lend for this work to the applicant/member of the Joint Venture/Consortium. In case the Net Current Assets (as seen from the Balance Sheets) are negative, only the Banking references will be	We would like to inform that in the current FY 16-17, some major financial directives have been initiated by the Government of India and Banks viz. Notification of NITI AYOG and S4A scheme to increase the liquidity in the infrastructure segment. With the above initiatives by the Government of India, the submitted financial figures will undergo major changes in the present liquidity of the Company, which will be positive. Hence we request that the liquidity for the project be	Tender conditions shall prevail

				considered. Otherwise the aggregate of the Net Current Assets and submitted Banking references will be considered for working out the Liquidity.	considered for the current year FY 16-17.	
15	Vol.1 FOT	Appendix 1 of FOT and Appendix 2B of section VIID appendices	Liquidated damages	Liquidated damages will be levied @ 0.01% of Contract value for per week delay in achieving the key date targets as mentioned in appendix 2B of employers requirement: (i) The maximum limit of Liquidated Damages shall be 10% of the total Contract Value.	It is requested to reduce the no. of key dates since 28 key dates are too stringent. Request to limit maximum limit of LD to 10% instead of 15%. It is requested to provide the condition for the refund of the levied LD against slippage of any interim key date, in the event of successful completion of subsequent key date by the Contractor. If the contractor achieves the final completion and the handing over within the contractual milestone, request the employer to reimburse the liquidated damages if any levied against intermediate milestones. We request for liquidated damages to be levied on overall project completion only. The maximum limit of Liquidated Damages shall be 2.5% of the total Contract Value.	Tender conditions shall prevail, & Please refer to addendum no.1

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16	Vol.2 GCC 39 of58	11.2.2	Advance against plant and machinery	The advance will be given only if the plant/machinery has been purchased for the this contract and not for those which are already in the books of the contractor. Amount of advance is 5%	It is requested to consider the plant and materials advance shall also given for those plants purchased and already in the books of the Contractor. Request to consider 10% interest free Mobilisation advance instead of 5% of total contract value.	Tender conditions shall prevail, and Please refer to addendum no.1
17	Vol.2 GCC	GCC CL. 11.2.1	Mobilization advance	Mobilization Advance shall be generally 5% of original contract value payable in two equal instalments or as mentioned in the special Conditions of Contract. The first instalment shall be paid after mobilization has started and next instalment shall be paid after satisfactory utilization of earlier instalment. Mobilization advance shall be paid interest free against acceptable Bank Guarantee from a scheduled commercial bank in India. The value of Bank Guarantee taken towards security of "Mobilization advance" shall be 110% of the advance taken by the contractor. The Contractor, once the 50% mobilization advance has been recovered, shall have a one-time option to reduce the Bank Guarantee for the mobilization advance by the amount recovered	'Bidder request to provide 10% of contract value interest free mobilization Advance as the other metro like NMRCL are allowed the same. Request to consider 10% interest free Mobilisation advance instead of 5% of total contract value.	Tender conditions shall prevail
18	1 of 4 NIT		Last date of Submission of RFQ	Last date of Submission of tender is 21.02.2017	We are in discussion with some highly reputed construction companies to form a Joint Venture	Please refer to addendum no.1

				'Online submission up till 18:00 Hrs. on 21/02/2017.	for a World class delivery of these Projects. This process requires sufficient time to finalize Joint Venture and other formalities for submission of this bid. Hence, we request to kindly extend the date of submission of tender by one month, i.e. up to 21st March, 17. Kindly consider an extension of 3 weeks for the said bid submission. Bidder request to extend the bid submission date at least 1 month from 21/02/2017. Please Confirm.	
19	Vol.2 Page 17 of 29	SSC	Project Specific Conditions	For disposal of excavated material lead of 25 Km is considered in the estimate. However, if the lead is less than 25 Km, then the BOQ rates will be reduced proportionally as approved by the Engineer. For addition lead above 25 Km, there will be no additional payment.	We request for additional lead above 25 Km, extra over to be paid at actuals. There should be same rule to be applied for additional lead above 25Km. For the additional payment	Tender conditions shall prevail
20	Vol.1 18 of 73	ITT C-2.6(C)	Change in tax and duties	The contract price shall be adjusted to take into account any change in taxes, duties, levies or introduction of any new tax, duty or levy till the completion date including the date of extended period of contract.	It is requested to consider the Contract Price adjustment for the changes in taxes, duties and levies including the introduction of new taxes, duties and levies subsequent to the bid submission. 'Bidder understand that if GST is imposed during the contract period or after submission of tender, the effect of GTS will be adjusted by MMRC. Please	Tender conditions shall prevail

					confirm.	
21	Vol.2 8 of 58	GCC cl.2.2	Access to and Possession of the Site	If the Contractor suffers delay from failure on the part of the Employer to grant right of access to, or possession of the Site, the Contractor shall give notice to the Engineer in a period of 28 days of such occurrence. After receipt of such notice the Engineer shall proceed to determine any extension of time to which the Contractor is entitled and shall notify the Contractor accordingly. For any such delay in handing over of site, Contractors will be entitled to only reasonable extension of time and no monetary claims whatsoever shall be paid or entertained on this account.	It is requested consider the necessary cost reimbursement to the Contractor for the delays suffered due to this Clause.	Tender conditions shall prevail
22	Vol.2 13 of 58	GCC cl.4.4g	Facilities for and co-ordination with Others	If the Contractor shall suffer delay by reason of failure by any Designated Contractor to meet the specified installation interfacing and co-ordination. completion dates, which delay shall be caused otherwise than by fault of the Contractor, or, if compliance with subclause (f) herein shall involve the Contractor in delay beyond that which could be reasonably foreseen by an experienced contractor at the time of tender, then the Engineer shall take such delay into account in determining any extension of time to which the Contractor is entitled under the Contract.	It is requested to consider the reasonable compensation of cost incurred by the Contractor due to the delays.	Tender conditions shall prevail
23	Vol.2 20of58	GCC Cl.4.23	Unforeseeable Physical Conditions	In this Clause "physical conditions" means natural physical conditions, which the Contractor encounters at Site.	It is requested to consider the time extension to the Contractor due to the delays.	Tender conditions shall prevail

				for any proper and reasonable measures approved by the Engineer which the Contractor may take in the absence of specific instructions from the Engineer, as a result of such conditions or obstructions being encountered. The decision of the Engineer as to the additional cost shall be final and binding.		
24	Vol.2 21 of58	GCC Cl.4.29	Discoveries	All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest, in addition to oil and other minerals discovered on the Site shall be the absolute property of the Government of India and the Contractor shall take all the necessary precautions to prevent its workmen or its sub-contractors' workmen or any other person from removing or damaging any such article or thing and shall immediately upon discovery thereof. acquaint the Engineer of such discovery and carry out the instructions of the Engineer.	It is requested consider the reimbursement of time and cost for any delays suffered due to the event by the Contractor.	Tender conditions shall prevail
25	Vol.2 31 of58	GCC Cl. 7.11	Tests after Completion		It is requested consider the reimbursement of time and cost for any delays suffered due to the event by the Contractor.	Tender conditions shall prevail
26	Vol.2 42 of58	GCC Cl. 11.6	Interim Payment	After preliminary scrutiny and certification by the Engineer, payment of 80% of the certified interim amount shall be made by the Employer within 14 days. The amount certified shall account for all deductions, including statutory deductions, recoveries for advances and any amounts due from the	It is requested to consider the entitlement of interest to the Contractor on the delayed payment by the Employer after 28 days time period, which shall be "State Bank of India PLR plus 2% per annum or 10% per annum	Tender conditions shall prevail

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				Contractor. The balance 20% shall be paid within 28 days, from the date of the preliminary certification of the bill by the Engineer.	whichever is higher" in accordance with the clause 11.2.5 of this conditions.	
27	Vol.2 14of29	SCC Cl. 11.1.4	Changes in cost due to legislation	The Contract Price shall not be adjusted due to any of the above two conditions and its impact shall be considered covered in the price indices of various components and thus compensated in Price Variation Clause. Also, the Contract price shall not be adjusted on account of fluctuations in the rates of exchange between the foreign currencies of the Contract and Indian Rupees from the last date of submission of tender.	It is requested consider the necessary extension of time and the adjustment of contract price for the changes in cost due to legislation to the Contractor. The Price variation Clause doesn't cover the changes in law.	Tender conditions shall prevail
28		ITB CL. A7 (II)	Site visit	'The Bidder and any of his personnel will be granted permission by the Employer to enter upon his premises and lands for the purpose of such inspection, but only upon the express condition that the Tenderer, and his personnel, will release and indemnify the Employer and his personnel from and against all liability in respect thereof and will be responsible for death or personal injury, loss of or damage to property and any other loss, damage, costs and expenses incurred as a result of the inspection.	Bidder request to provide the contact person Name & contact no. for site visit purpose. Bidder also request to grant the permission for site visit.	The site is open ground and therefore the site visit can be undertaken by the contractor at their own, no permission is required for the visit.
29	Vol.1 ITT	Annexure-3	Project personals	'The figures indicated below are the minimum number of Project-Personnel required which are to be deployed as per the minimum level of supervision and qualification/experience of site-staff is given under Annexure-4.	'The project person number indicated in the list is in higher side, Particularly for 20 nos. Site engineer. Bidder request to reduce this no up to 10 no. (5+5) Please confirm.	Please refer to addendum no.1

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30	Vol.2	GCC CL.4.21	Contractor site facilities	All temporary works necessary for the proper execution of the works shall be provided and maintained by the Contractor at his cost and subject to the consent of the Engineer shall be removed by Contractor at his own expense when they are no longer required and in such manner as the Engineer shall direct.	Bidder understand that contractor can make his site establishment including labour hutment, Batching plant, cement godown, store etc. with in the site premises without disturbing the work execution, free of any charge. Please confirm.	Tender conditions shall prevail and please refer to addendum no.1
31	Vol.2	'SCC CL. 20. sub cl.11.1.3	CPWD Index for Price Variation	'Ws = All India Price Index (with base Oct' 12=100) for Reinforcement bars (TMT-500) for primary manufacturers, issued by Central Public Works Department (CPWD) for the period of work under consideration. Wc = All India Price Index (with base Oct' 12=100) for Cement (OPC) issued by Central Public Works Department (CPWD) for the month in which the tender was opened.	Bidder request to clarify ,CPWD which Chief Engineer Zone Index will be consider for price variation ?	Please refer to addendum no.1
32	Vol1 ITB, Annexure -5,	SCC CL. IX of project specific condition.	Ready Mix Concrete	'All concrete shall be by Ready Mix Concrete only except where permitted otherwise by the Engineer.	Bidder understand that if outside Ready Mix Concrete from RMC vendors is approved for the project, then no batching plant are required to install as per Annexure 5 of ITD. Please confirm	Please refer to addendum no.1
33	Vol-3	Cl.2.11(ii)	Technical requirement	'In addition, the contractor has to provide one office each for use of the Employer and Engineer duly furnished with Air conditions, computers furniture etc. as per direction of the employer.	Bidder request to provide the details of Employer office accommodation, like size of office, list of furniture require etc. Bidder also understand that the land for	appendix 2A,Vol. 3 section vii D, 5000 Sqm land provided, shall be used for the office of Engineer and

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					office accommodation will be provided by MMRC free of charge. Please confirm.	employer. Each of 100 sqm. Plinth area including meeting hall. AC & Furniture shall be bare minimum required.
34	Vol.3 Employer's requirement	Cl.3.11	Site Barricading	'The Contractor shall erect barricades as per Tender Drawing and gates around its areas of operations to prevent entry by unauthorised persons to his Works Areas and necessary identity cards /permits should be issued to workers and staff by the contractor. The cost of this barricade is included in quoted price.	'Normally all item rate metro projects the barricade has been paid through BOQ items. So bidder request to provide a BOQ item with specification of barricade.	Please refer to addendum no.1
35	Vol. 3 Employer's requirement	, Apendix 10	Approved Manufacturer List	Reinforcement steel -SAIL/RINL/TATA	Bidder request to incorporate the manufacturer like JSW/ ESSAR STEEL/ JSPL in approved steel supplier.	Please refer to addendum no.1
36	Vol.2 SCC project specific condition	CL. I.	Tree cutting & replanting	'The scope of work includes tree removal, transplantation & new tree plantation, etc. The Contractor shall have to appoint expert agency, who has carried out the similar work as per MCGM specifications, with the prior approval of Employer. The Contractor shall have to carry out detailed survey, obtain all types of necessary permissions from MCGM Tree Authority or other concerned authorities required for tree removal work.	Bidder request to provide the authorised agencies Name and contact no. for tree cutting & plantation as per MCGM.	Please contact tree authority of MCGM
37	Vol.6 BOQ	Item no.5.1	Reinforcement	'Providing and fixing in position TMT Bars Reinforcement (Fe 500D or more) of various diameters for R.C.C. pile caps, footings, foundations,	Bidder has not found the pile foundation item in the BOQ, SO reinforcement for R.C.C. Pile cap in the description of item may be	Tender conditions shall prevail

				slabs, beams, columns, canopies, staircases, newels, chajjas, lintels, pardies, coping, fins, arches, etc. as per detailed designs, drawings and schedules including cutting, bending, hooking the bars, binding with wires or tack welding and supporting as required complete.	wrongly putted. Bidder understand that all Laps, chair, Hooks, spacer etc will be measured and paid. Please confirm.	
38	VOLUME 6 4 of 79	clause2	Cutting down trees	Statutory approval towards tree cutting	It is presume that necessary Statutory approval from Tree Authority towards tree cutting will be obtained by Client. It is requested to confirm the same.	Tender conditions shall prevail
39	Vol.2 Page5of29	Sub-Clauses 4.13	Programmes	The contractor will be responsible to obtain require approval/permission, from various authorities for electric & power connection, traffic diversion, shifting of utilities, tree cutting etc.	Further It is requested to consider the reimbursement of time and cost for any delays towards the statutory approvals	Tender conditions shall prevail
40	VOLUME 6 Page 13 of 79	Item no. 4	Reinforced Cement Concrete	Providing and laying RMC ……. RCC work ……. as per IS 456:2000 including formwork,	It is requested to confirm if crushed / machine sand can be used for concrete works	Fine aggregate as per specifications can be used.
41	VOLUME 6 Sub Section 4	Item no. 4.1	Reinforcement & Structural Steel	High Tensile Steel Wire / Strands	It is requested to provide the approved makes	No make has been approved. However the material should be as per Specifications.
42	VOLUME 6 Sub section 4	Item no. 5.4	Roofing	Providing and fixing of - 65/400 Self Supported Secret Fix Aluminium STANDING SEAM ROOFING SYSTEM	It is requested to provide the approved makes	No make has been approved. However the material should be as per Specifications.
43	Vol.1 page 18 of 73	Clause C2.6	Service tax	Service Tax- The bidders shall examine their own assessment in regard to service tax liability in the contract. No separate service	Please clarify whether Service tax is applicable to this work.	Tender conditions shall prevail

Name of work:- Construction of the Depot cum Workshop Buildings, Metro station building, sub-way, earthwork and all associated works at Aarey colony, for the Mumbai Metro Line -3 Project
(Reply/clarification of Contractor's queries)

				tax reimbursement will be made by MMRC		
44	Vol.6 BOQ	Item no.13.2	Sub section-13	Laying and joining of GI pipe	Rate and quantity are same for all entire diameters. Please clarify it is ok.	Please refer to addendum no.1
45	Vol.6 BOQ		Bill of Quantity		Rate in figure and word is not matching. Please clarify what rate we account.	Please refer to addendum no.1
46	Vol.6 BOQ		Sub section-12		The given Sub Total Amount is Rs 13,76,47,323.35 and Actual total by calculation is Rs.13,61,33,847.35 Which is Less by 15.13 Lacs	Please refer to addendum no.1
47	Vol.6 BOQ		Sub section-15		The given Sub Total Amount is Rs 3,50,46,577 and Actual total by calculation Rs.3,53,96,77 Which is Increase by 3.5 Lac	Please refer to addendum no.1
48	Vol.6 BOQ		Sub section-22		The given Sub Total Amount is Rs 2,41,39,619and Actual total by calculation Rs.2,49,17,161 Which is Increase by 7.77Lac	Please refer to addendum no.1
49	Vol.6 BOQ		BOQ		The given BOQ total Amount is Rs 340,34,58,000.00 and Actual total by calculation Rs. 340,16,17,559.00 Which is less by 18.4Lacs	Please refer to addendum no.1
50	Vol.2 page17	Clause 4.18	Water & electricity arrangement	The Contractor shall be responsible for making his own arrangements at his own cost to obtain supply of water, electricity or gas for the Works.	As per Location Drawing there are Water pipe line laid on plot. Shall we take connection from same or Boring is allowed at site, For construction purpose	MCGM permission require for the connection from pipeline as well as for Boring.
51	Vol.2 Page 21/58	GCC cl.4.27	Security		Request to consider various cost incurred by Civil contractor in case services used by designated	Tender conditions shall prevail

Name of work:- Construction of the Depot cum Workshop Buildings, Metro station building, sub-way, earthwork and all associated works at Aarey colony, for the Mumbai Metro Line -3 Project
(Reply/clarification of Contractor's queries)

					system vide contractors.	
52	Vol.2 Page 41/58	GCC cl.11.6	Security	After preliminary scrutiny and certification by the Engineer, payment of	We request the payment of 80% of the certified interim amount shall be made by the Employer within 7 days from the date of submission of monthly invoice. At the same time it is requested to release the balance 20% payment within 21 days from the date of submission of monthly invoice.	Tender conditions shall prevail
53	General		General	80%of the certified interim amount shall be made by the Employer within 14 days.	Request to issue Good For Construction (GFC) drawings within 7 days of issue of LOA. Request that all Technical &Engineering proposals may please be approved within 7 days from the date of submission.	Tender conditions shall prevail
54	Vol. 2 Page 17/58	GCC Cl. 4.12	Right of way		Request to provide the Right of way within 7 days of issue of LOA.	Tender conditions shall prevail
55	General		General		Request you to provide Excel copies of BOQs.	Not accepted at this stage
56	General		General		Request you to provide Auto Cad copies of the drawing.	Not accepted at this stage
57	General		General		We presume that the removal, restoration and protection of the existing utilities including underground services if any shall be taken care by MMRC.	Tender conditions shall prevail
58	Vol.1 ITT	Annexure-3	Personnel required	The figures indicated below are the minimum number of Project-Personnel required which are to be deployed as per the	We shall be allowed to deploy the staff as per job requirement and not necessarily require to maintain	Please refer to addendum no. 1

				minimum level of supervision and qualification/experience of site-staff is given under Annexure-4.	the minimum requirement as specified in Annexure 3	
59	Vol.1 ITT	Annexure-5	Plant & Equipment proposed		We shall be allowed to deploy the Plant and Equipment as per job requirement and not necessarily require to maintain the minimum requirement as specified in Annexure 5	Please refer to addendum no. 1
60	Vol.2 Page 2 of 29	SCC Sub Cl.4.5	Sub-Contractors	Payments to be made to such sub-contractors will be deemed to have been included in the Contract price. However, for major sub-contracts (each costing over Rs. Five Million), it will be obligatory on the part of the Contractor to obtain consent of the Employer. The Employer will give his consent after assessing and satisfying himself of the capability, experience and equipment resources of the sub-contractor. In case the Employer intends to withhold his consent, he should inform the Contractor within 15 days to enable him to make alternative arrangements to fulfil his programme.	Request to delete the sub-clause	Tender conditions shall prevail
61	Vol.2 Page 16 of 29	SCC	Project specific conditions	The scope of work includes tree removal, transplantation & new tree plantation, etc. The Contractor shall have to appoint expert agency, who has carried out the similar work as per MCGM specifications, with the prior approval of Employer. The Contractor shall have to carry out detailed survey, obtain all types of necessary permissions from MCGM Tree Authority or other concerned authorities required for tree removal work.	All approvals required for tree removal, transplantation & new tree plantation, etc. shall be obtain by MMRC.	Tender conditions shall prevail

Name of work:- Construction of the Depot cum Workshop Buildings, Metro station building, sub-way, earthwork and all associated works at Aarey colony, for the Mumbai Metro Line -3 Project
(Reply/clarification of Contractor's queries)

62	Vol.2 Page 17 of 29	SCC	Project specific conditions	All types of NOC/permissions of competent authorities required for building constructions, SWD, water supply, sewerage, electrical works before start of work and also obtaining certificates like drainage completion, occupation, building completion certificates, and any other certificates necessary from competent authorities / local bodes, after completion shall be the responsibility of contractor at no extra cost to Employer	All types of NOC/permissions shall be taken by MMRC.	Tender conditions shall prevail
63	Vol.2 Page 17 of 29	SCC	Project specific conditions	All concrete shall be by Ready Mix Concrete only except where permitted otherwise by the Engineer.	Request you to allow setting up of batching plant at site.	Tender conditions shall prevail
64	Vol.2 Page 17 of 29	SCC	Project specific conditions	MMRC will allot alternate plot for transplantation & new plantation of trees preferably at any location in Aarey colony. Contractor shall have to maintain these trees for The period of 3 years minimum from plantation if directed by Employer.	Distance for replantation to be specified. MMRC shall maintain these trees.	Tender conditions shall prevail
65	General		General		We shall be permitted to submit further queries.	Tender conditions shall prevail

MUMBAI METRO RAIL CORPORATION (MMRC)			
		Name of work:- Construction of the Depot cum Workshop Buildings, Metro station building, sub-way, earthwork and all associated works at Aarey colony, for the Mumbai Metro Line -3 Project "	
		Addendum no. 1	
S.N.	**Reference of clause & description**	**Existing clause**	**To be replaced as**
1	1.1.2 Key details, (Tender schedule)	Bid Preparation and Submission 10/01/2017 10.01 hrs.To 21/02/2017 18.00 hrs.	Bid Preparation and submission 10/01/2017 10.01 hrs. To 02/03/2017 18.00 hrs.
2	1.1.2 Key details, (Tender schedule)	Tender Closing 22/02/2017 10.00 hrs. To 22/02/2017 18.00 hrs.	Tender Closing 03/03/2017 10.00 hrs. To 03/03/2017 18.00 hrs.
3	1.1.2 Key details, (Tender schedule)	Online Control Transfer of Bid 22/02/2017 18.01hrs. To 23/02/2017 18.00hrs.	Online Control Transfer of Bid 03/03/2017 18.01hrs.To 04/03/2017 18.00hrs.
4	1.1.2 Key details, (Tender schedule)	Opening of Envelope A, Tender Fee, EMD on 24/02/2017 10.00 hrs to 18.00 hrs	Opening of Envelope A, Tender Fee, EMD on 06/03/2017, 10.00 hrs to 18.00 hrs
5	1.1.2 Key details, (Tender schedule)	Opening of Envelope B Technical Bid on 24/02/2017 10.00 hrs to 18.00 hrs	Opening of Envelope B Technical Bid on 06/03/2017 10.00 hrs to 18.00 hrs
6	1.1.2 Key details, (Tender schedule)	Opening of Envelope C Financial Bid, on 03/03/2017 10.00 hrs. to 18.00 hrs.	Opening of Envelope C, Financial Bid, on 06/04/2017 10.00 hrs. to 18.00 hrs.
7	1.1.3.1 (v) i	i. The Central / State government department / public sector undertaking / other government entity or local body must not have banned business with the bidder (any member in case of JV) as on the date of tender submission. Also no contract of the bidder should have been rescinded / terminated during last 5 years due to non-performance of the bidder or any of JV /Consortium members.	Tenderers should not have been blacklisted or deregistered by the Central Government, State Government of Maharashtra,any PSU of Government of India or Government of Maharashtra or any public sector Metro rail corporation in India during the last 5 years. Also the tenderer must not have failed to take possession or to commence any contract after the award of contract.

		Addendum no. 1	
S.N.	**Reference of clause & description**	**Existing clause**	**To be replaced as**
8	Vol. 1 FOT Appendix 19	i. We submit the undertaking that, any Central / State government department / public sector undertaking / other government entity or local body have not banned business with the bidder (any member in case of JV) during last 5 years due to non-performance of the bidder or any of JV/Consortium members, as on the date of tender submission.	i. We submit the undertaking that, any Central / State governmentof Maharastra / any PSU of Government of India or Government of Maharashtra or any public sector Metrorail corporation in India , have not blacklisted or deregistered to the bidder (any member in case of JV) during last 5 years due to non-performance of the bidder or any of JV/Consortium members, as on the date of tender submission. we also submit that we have not failed to take possession or to commence any contract after the award of contract during last 5 years.
9	1.1.3.1A	A. Work Experience: The bidders will be qualified only if they have completed work(s) during last 10 years ending 31.03.2016 as given below: (i) At least one work of similar nature (i.e. RCC framed structure building(s) G+5 Storey or one Metro Railway Depot or Metro station) of value of INR 150 crores or more, and At least one site formation works of value of at least INR 122 Crores If the above work of INR 272 crores has been done by the foreign partner of JV and the work was done in the country of the foreign partner then in addition to this, the foreign partner must have done works equal to INR 136 crores outside the country of the foreign partner. OR (ii) Two works of similar nature(i.e. RCC framed structure building(s) G+5 Storey or one Metro Railway Depot or Metro station) each of value of INR 100 crores or more, and two site formation works, each of value of at least INR 70 Crores If the above work of INR 170 crores each (i.e. totaling to Rs.340 Crores) has been done by the foreign partner of JV and the work was done in the country of the foreign partner then in addition to this, the foreign partner must have done works equal to INR 136 crores outside the country of the foreign partner. OR (iii) Three works of similar nature (i.e. RCC framed structure building(s) G+5 Storey or one Metro Railway Depot or Metro station) each of value of INR 82crores or more. and three site formation works each of value of at least INR 54 Crores	A. Work Experience: The bidders will be considered to qualify only if they have completed work(s) during last 10 years ending 31.03.2016 as given below: (i) At least one work of similar nature* of value of INR 272 crores or more. If the above work of INR 272 crores has been done by the foreign partner of the JV and the work was done in the country of origin of the foreign partner then in addition to this, the foreign partner must have done works equal to INR 136 crores outside the country of origin of the foreign partner. OR (ii) Two works of similar nature* each of value of INR 170 crores or more, If the above works of INR 170 crores each, have been done by the foreign partner of the JV and the work was done in the country of origin of the foreign partner then in addition to this, the foreign partner must have done works equal to INR 136 crores outside the country of origin of the foreign partner. OR (iii) Three works of similar nature* each of value of INR 136crores or more. If the above works of INR 136 crores each have ,been done by the foreign partner of JV and the work was done in the country of origin of the foreign partner then in addition to this, the foreign partner must have done works equal to INR 136 crores outside the country of the origin of foreign partner. **Notes:-** Similar nature* of work would include, RCC frame structure building(s), Metro Station or work of Metro Depot,either individually or in combination of these works within one contract.

		Addendum no. 1	
S.N.	**Reference of clause & description**	**Existing clause**	**To be replaced as**
		If the above work of INR 136 crores each (i.e. totaling to Rs.408 Crores) has been done by the foreign partner of JV and the work was done in the country of the foreign partner then in addition to this, the foreign partner must have done works equal to INR 136 crores outside the country of the foreign partner. Notes: Similar nature of work include, RCC framed structure building(s), of minimum G+5 storey or at least one Metro Station or Metro Depot, steel structures and site formation works tree cutting, retaining walls, cut and fill earthworks in both hard and soft materials.	
10	1.1.3.1, page-4 , Vol.1	Experience of key activity.:- Experience of Key Activity. In addition to above, the contractor should also have construction experience of following Quantities, in any two conjugative year of last 10 years. (i) construction of commercial steel shed of Min. 10,000 (Ten Thousand) square meter. (ii) 4.5 Lakh cubic meters earth work, in cutting and filling. He can demonstrate his experience of key activities, in work, having more than one similar work. • The tenderer shall submit details of works executed by them in the Performa of Appendix-17 of FOT for the works to be considered for qualification of work experience criteria. Documentary proof such as completion certificates from client clearly indicating the nature/scope of work, actual completion cost and actual date of completion for such work should be submitted. Experience certificate of any person/official below the rank of Executive engineer will not be accepted as proof for Eligibility. The offers submitted without this documentary proof shall not be evaluated. The work, executed for private client will not be considered for eligibility evolution. • Value of successfully completed portion of any on-going work up to last date of submission will also be considered for qualification of work experience criteria. • For completed works, value of work done shall be updated to 01-04-2017 price level assuming 5% inflation for Indian Rupees every year and 2% for foreign currency portions per year. The exchange rate of foreign currency shall be applicable 28 days before the submission date of tender	Experience of Key Activity. In addition to above, the contractor should also have construction experience of following activities in last 5 years: (i) construction of Industrial steel sheds of 10,000 (Ten Thousand) square meter or more. (ii) 4.5 Lakh cubic meters earth work in cutting / filling. Experience can be demonstrated in more than one work. These works can be works other than the ones, specified by the bidder in work experience clause1.1.3.2(A) • The tenderer shall submit details of works executed by them to fulfil the work experience criteria, in the Appendix- 17 of FOT. Documentary proof such as completion certificates from client clearly indicating the nature/scope of work, actual completion cost and actual date of completion for such work should be submitted. Experience certificate by an official below the rank of Executive engineer or equivalent will not be accepted as proof for Eligibility. The offers submitted without this documentary proof shall not be evaluated. The work, executed for private client will not be considered for eligibility evaluation. However the work executed under public sector, government under taking semi government companies , will be considered for Eligibility evaluation. • Value of successfully completed portion of any on-going work up to last date of submission will also be considered for evaluation of work experience . • For completed works, value of work done shall be updated to 01-04-2017 price level assuming 5% inflation for Indian Rupees every year and 2% for foreign currency portions per year. The exchange rate of foreign currency shall be applicable 28 days before the submission date of tender

		Addendum no. 1	
S.N.	**Reference of clause & description**	**Existing clause**	**To be replaced as**
11	1.1.10(ii) EMD	ii. Earnest Money Deposit Earnest money deposit for this work will be Rs. 3,40,35,000/- only. EMD Payment as mentioned above has to be made through RTGS / NEFT mode using the System Generated Challan. Bidders should ensure that the payment of the EMD is made at-least 5 working days prior to the last date of Bid Preparation and Submission of the Tender Schedule to have seamless submission. Bidders need to upload scanned copy of EMD paid receipt during bid preparation. Bidders should mention the beneficiary details for EMD refund in the Earnest Money Deposit Form for fields marked as details required for Refund. MMRC / MMRDA or e-Tendering Service Provider will not be liable for delays caused in EMD refund due to incorrect beneficiary details. Bidders failing to complete the payment of EMD using the above mentioned process of RTGS / NEFT after downloading the system generated challans will not be able to submit their bids.	ii. Earnest Money Deposit / Tender Security :- Earnest money deposit for this work will be Rs. 3,40,35,000/- only.The Tenderer shall submit with his Tender a Tender Security for the sum mentioned in NIT in the following forms: a. An amount of INR 1,00,000 (Rupees one Lac) Through RTGS/NEFT/Net Banking/Credit card/Debit Card b.For the balance Tender Security, Irrevocable bank guarantee issued by a Nationalized bank in India, in the form given in Annexure 6, of the Instruction to Tenderers (ITT) payable at Mumbai . (In case of joint venture/consortia, Bank Guarantee for Tender Security shall be in the name of joint venture/consortia and not in name of individual members.) The Tender Security shall remain valid for a period of 240 days from the last date of submission of tender. The tenderer shall upload the scanned copy of the Bank Guarantee as part of Envelope A on the online MMRDA e-tendering portal only. The bidder shall submit the original Bank Guarantee ,two days before the Date of opening of Envelope A, up to 15.00 hrs at the office of the Chief Project Manager-5, MMRC Ltd. Plot No. 13, NaMTTRI Building, E-Block,Bandra Kurla Complex Bandra –East, Mumbai-400051, India
12	Tender document Vol.1 to 6	Where ever the word schedule" commercial/schdule bank" is written	It should be replaced by the word "Nationalized bank"

		Addendum no. 1	
S.N.	**Reference of clause & description**	**Existing clause**	**To be replaced as**
13	Vol.1 Section II F-5, Page 28 fo 73	F5.1:-Details of Initial Security Deposit: The successful tenderers shall have to pay Five percent of estimated cost put to tender or contract price of work, whichever is higher as security deposit by Demand Draft/Pay Order in favour of "Mumbai Metro Rail Corporation Ltd" payable at Mumbai or Bank Guarantees issued by any Nationalized bank or banks promoted by All India Financial Institutions issued by a branch in Mumbai in format acceptable to MMRC while accepting the tender that is before issuing work order and Five percent of estimated cost put to tender or contract price of work, whichever is higher deducting from Running Account Bills at the discretion of the Engineer-in-charge (at 7.5% of each Running Account Bill till the full security deposit is recovered or alternatively from the first and second Running Account Bills) so that, the total deposit equivalent to five percent (10%) of the estimated cost put to tender or contract price of work, whichever is higher made up and held by the MMRC as Security Deposit. The Bank Guarantee towards initial security deposit (i.e. 5 %) shall be pledged & valid for 6 Months beyond the end of defect liability period. The contractor shall be responsible to pay stamp duty as payable under Bombay Stamp Duty Act, 158 for Deposits paid in Demand Draft / Bank Guarantee, etc and shall furnish a copy of Challan having paid the same to Government. Failure to furnish within 3 months from the date of work order the same will be recovered at the rates in prevalence as per Stamp Duty Act, from the bills and resubmitted to Government.	F5.1 The Performance Security required in accordance with Clause 4.2 of the GCC shall be for 10% of the Estimated amount put to tender or Contract price, whichever is more, in the currency in which the Contract Price is payable. The Performance Security shall be furnished to the Employer within 30 (thirty) days of receipt of the Letter of Acceptance. The Security Deposit can be paid as bank guarantee issued by a Nationalized bank or bank promoted by all India Financial institute issued by a branch in Mumbai in the format given in annexure 7of Vol. 1 ITT.

		Addendum no. 1	
S.N.	**Reference of clause & description**	**Existing clause**	**To be replaced as**
14	Form of tender Vol 1, Section III,Appendix 1	10% of the Contract Price (5% within 30 days of LOA & 5% to be deducted from interim payment),	10% of the Contract Price within 30 days of LOA
15	Vol. 1 Section II,	Annexure-3 [As per clause C12.1] RESOURCES PROPOSED FOR THE PROJECT – PERSONNEL The figures indicated below are the minimum number of Project-Personnel required which are to be deployed as per the minimum level of supervision and qualification/experience of site-staff is given under Annexure-4. S.No. Designation of Project Personnel Minimum no. of Project-Personnel required 1 Project Manager 1 2 Deputy Project Manager 2 3 Interface Manager 2 4 Planning Engineer. 2 5 Civil Engineer (degree holder-10 & diploma -10 Nos.). 10+10 6 Architect Engineer 2 7 Quality control and Quality Assurance Engineer 3 8 Electrical Engineer 2 9 SHE Manager 2 10 Environment specialist 1 11 Surveyor 4	Annexure-3 [As per clause C12.1] RESOURCES PROPOSED FOR THE PROJECT – PERSONNEL The figures indicated below are the Minimum number of Personnel which may require to complete the project in time & to maintain the require progress of the work . However ,if more number of personnel are required to achieve the desired progress , contractor has to deploy more personnel as directed by Employer/ Engineer . S.No. Designation of Project Personnel Minimum no. of Project-Personnel required 1 Project Manager 1 No. 2 Interface Manager 1No. 3 Planning Engineer. 1No. 4 Civil Engineer - 7 Nos. 5 Quality control and Quality Assurance Engineer 2No. 6 Electrical Engineer 1No. 7 SHE Manager 1No. 8 Environment specialist 1No. 9 Surveyor 1No.
16	Vol-1 section II	Annexure-4 [As per clause C12.1] MINIMUM ORGANISATION STRUCTURE REQUIRED S.No. 8:- Civil Engineer Graduate / Diploma in Civil Engineering Minimum 5 Year Experience No. Field of experience 10 RCC 2 Water Supply 2 Sewer & Drainage 2 Road & sub way 2 Steel Structure 2 E/W for Formation &Geo tech.Expert	Annexure-4 [As per clause C12.1] MINIMUM ORGANISATION STRUCTURE REQUIRED S.No. 8:- Civil Engineer Graduate / Diploma in Civil Engineering Minimum 5 Year Experience .

		Addendum no. 1	
S.N.	**Reference of clause & description**	**Existing clause**	**To be replaced as**
17	Vol. 1 Section II,	Annexure-5 [As per clause C 13] RESOURCES PROPOSED FOR THE PROJECT- PLANTS & EQUIPMENTS The figures indicated below are the minimum number of equipment required. S. No. Type of equipment required for the work Minimum No. of Units of equipment required for the work Maximum Permissible Age in Years 1 Construction Equipment a) Fully Automatic and Computerized Batching Plant 30 Cum/h minimum with an RO of suitable capacity for proper quality of water. 2 10 b) Stationary Concrete Pumps with sufficient pipes 4 10 c) Cranes 10T to 20T capacity 2 15 d) Transit Mixtures 6 10 e) 2nd Generation Pick and Carry Hydra (M/s Escorts Construction Equipment Ltd., Model F-15 & K-10 or equivalent) 5 10 f) JCB and Pockalin 2 10 g) Weiding machines 2 10 h) Tipper & water tanks 10 10 i) Reinforcement binding & cutting equipment 2 10 j) Concrete needle/plate vibrators 6 10 k) Survey Instruments (Total Station) 1 10 l) Lab Testing equipments-fully equipped for site tests. As per requirement Note: These resources are for peak period of each activity. All plants and equipments need not to be mobilized simultaneously, plants and equipment's as required as per the progress of the work shall be brought at site in advance as directed by the Engineer-in-Charge.	Annexure-5 [As per clause C 13] RESOURCES PROPOSED FOR THE PROJECT- PLANTS & EQUIPMENTS Note: All plants and equipment's of adequate capacity and numbers as required to maintain the desired progress as per approved construction programme of the work, shall be brought at site , as directed by the Engineer-in-Charge.
18	Volume 1 Page 9	Upload the digitally signed copy of Tender document and Quotation in company's Letter head under the template" Price Bid- Covering Letter" bidder shall upload scanned copy of Financial Proposal (Financial Package) Volume 5 of Tender document duly Quoted/Filled.	Upload the digitally signed copy of Tender document and Quotation in company's Letter head under the template" Price Bid- Covering Letter" bidder shall upload scanned copy of Financial Proposal (Financial Package) Volume 6 of Tender document duly Quoted/Filled.

		Addendum no. 1	
S.N.	**Reference of clause & description**	**Existing clause**	**To be replaced as**
19	Vol2 SCC clause 11.1.3	Wso = All India Price Index (with base Oct' 12=100) for Reinforcement bars (TMT-500) for primary manufacturers, issued by Central Public Works Department (CPWD) for the month in which the tender was opened. Ws = All India Price Index (with base Oct' 12=100) for Reinforcement bars (TMT-500) for primary manufacturers, issued by Central Public Works Department (CPWD) for the period of work under consideration. Wco = All India Price Index (with base Oct' 12=100) for Cement (OPC) issued by Central Public Works Department (CPWD) for the month in which the tender was opened. Wc = All India Price Index (with base Oct' 12=100) for Cement (OPC) issued by Central Public Works Department (CPWD) for the period of work under consideration.	Wso =Whole sale Price Index for Reinforcement bars, issued by Office of economic Advisor, for the month in which the tender was opened. Ws = Whole sale Price Index for Reinforcement bars , issued by Office of economic Advisor for the period of work under consideration. Wco = Whole sale Price Index) for Cement (OPC) issued by Office of economic Advisor for the month in which the tender was opened. Wc = Whole sale Price Index for Cement (OPC) issued by Office of economic Advisor for the period of work under consideration.
20	Volume 2 SCC Project specific conditions	VIII.Temporary structures such as godown, site office, field lab, labour camp etc. for proper execution of the project can be constructed by the Contractor at his own cost as per prevailing rules and regulation of Govt. Semi Govt. Department etc. after obtaining necessary permission from concerned Department / Authority. The structures / offices are to be maintained by the Contractor at his own cost inclusive of payment towards Electricity / Telephone / Water / Sewerage Charges etc.	VIII.Temporary structures such as godown,all site offices, field lab, for proper execution of the project can be constructed by the Contractor at his own cost, after obtaining necessary permission from concerned Department / Authority. The structures / offices are to be maintained by the Contractor at his own cost inclusive of payment towards Electricity / Telephone / Water / Sewerage Charges etc. If there is surplus land, the contractor, after getting written permission of engineer, can use the surplus land, for labour camps, but he has to pay the rental charges of the land as per rules, or as fixed by the engineer, while according the permission.
21	Volume 2 SCC Project specific conditions	XVI. Refund of security deposit: The full amount of security deposit lodged by the contractor shall be refunded six months after the completion of defect liability period (DLP).i.e., upto which the contractor has agreed to maintain the work in good order is over. The bank guarantee towards initial security deposit (i.e., 5%) shall be placed and valid for six months beyond the defect liability period. On completion of work as certified by the employer, out of the security in cash, 50% amount of it (i.e., 2.5%) shall be allowed to be converted into bank guarantee and the balance 50% (i.e., 2.5%) shall be retained in cash.	XVI. Refund of security deposit: The full amount of security deposit lodged by the contractor shall be refunded six months after the completion of defect liability period (DLP).i.e., upto which the contractor has agreed to maintain the work in good order . The bank guarantee towards security deposit (i.e. 10%) shall be placed and valid for six months beyond the defect liability period.
22	Volume 3 Section vii D appendix 10	APPENDIX 10 APPROVED MANUFACTURERS / SUPPLIERS 2 Reinforcement bar SAIL, Rashtriya Ispat NigamLtd, TATA Steel	APPENDIX 10 APPROVED MANUFACTURERS / SUPPLIERS 2 Reinforcement bar SAIL, Rashtriya Ispat NigamLtd, TATA Steel, JSW,ESSAR STEEL,

		Addendum no. 1	
S.N.	**Reference of clause & description**	**Existing clause**	**To be replaced as**
23	Vol.3, Section viiD appendices	Appendix 2B;- Key dates	Appendix 2B(Revised) Key Dates
24	Vol.3, Section viiD appendices Page 160 to 221	Appendix 19;-SYSTEM INTERFACE MANAGEMENT	Appendix 19(Revised) SYSTEM INTERFACE MANAGEMENT
25	Vol.3, Section viiD appendices , Page 22**to 246**	Appendix 20;- Schedule of Dimention.	Appendix 20(Revised):- Schedule of Dimention.
26	Vol. 2 SCC clause no. 12, Variation	For payment of extra items, the Engineer may decide to pay on the basis of 'Day Work' concept instead of paying as per clause no. 12.5(ii) of GCC	For payment of extra items, the Engineer may decide to pay on the basis of 'Day Work' concept instead of paying as per clause no. 12.5(g) of GCC
27	Volume 6 BOQ	Volume 6 (Bill of Quantity)	Revised Volume 6 (Bill of Quantity)
28	SCC Cl.11.2.2	Advance against Plant & Machinery: This advance is payable for plant, equipment and machinery, provided the same have reached the site, or in the case of new items meant specifically for the works, firm purchase order has been placed and the invoices received. The plant and machinery shall be valued by the Engineer as follows: a. New items: 80% of purchase price. b. Used items in working order: 80% of the depreciated value as assessed by the Engineer. c. Items valued at less than: Not to be considered Rs. 25,000 per unit. . The total advance for Plant and Machinery shall be limited to 5% of the fixed Lump Sum price quoted in Schedule 'A' of BOQ/Price document and shall be paid against 12 acceptable Bank Guarantees of equal amount from a nationalised Bank of India.	Advance against Plant & Machinery: This advance is payable for new plant, equipment and machinery, meant specifically for the works, firm purchase order has been placed and the invoices received. The plant and machinery shall be valued by the Engineer as follows: a. New items: 80% of purchase price. b. Items valued at less than Rs. 10,00,000/- per unit , will not to be considered for the advance. The total advance for Plant and Machinery shall be limited to 5% of the fixed Lump Sum price quoted in Schedule 'A' of BOQ/Price document and shall be paid against 12 acceptable Bank Guarantees of equal amount from a nationalised Bank of India. No advance shall be payable against, purchase of used plant or machinery items and the items, already exist in books of the contractor.

		Addendum no. 1	
S.N.	**Reference of clause & description**	**Existing clause**	**To be replaced as**
29	Vol.3, Section vii D, appendix 2A	B. A plot of land of approx. 5000 Sq.m will be made available by MMRC for Casting Yard, Batching Plants, Site Office, Site Laboratory etc. on as is where is basis adjoining to the work site free of cost.	B. A plot of land of approx. 5000 Sq.m will be made available by MMRC for Site Offices, Site Laboratory,site store etc. on as is where is basis adjoining to the work site free of cost.

MUMBAI METRO LINE 3
(COLABA-BANDRA-SEEPZ)

CONTRACT NO: MM 3-CBS-DPT

Construction of the Depot cum Workshop Buildings, Metro station building, Sub-Way, earthwork and all associated works at Aarey colony, for the Mumbai Metro Line -3, Project

VOLUME 6 OF 6

BILL OF QUANTITIES

DECEMBER 2016 (R1)

Mumbai Metro Rail Corporation Ltd.
Namttri Building,
Bandra - Kurla Complex,
Bandra (East), Mumbai – 400051, India

MUMBAI METRO LINE 3 – AAREY DEPOT

COMPOSITION OF DOCUMENTS

Volume I	**Bidding Procedure**
Section I	Notice Inviting Tender (NIT)
Section II	Instructions to Bidders
Section III	Tender Documents
Section IV	Preparation of Tenders
Section IV - A	Appendices 1 - 19
Volume II	**Conditions of Contract and Contract Forms**
Section V	Special Conditions of Contract (SCC)
Section VI	General Conditions of Contract (PCC)
Section VII	OHS & E Manual
Volume III	**Employer's Requirement**
Section VIII - A	General
Section VIII – B	Functional
Section VIII – C	Construction
Section VIII – D	Special Conditions of Contract (SCC)
Section VIII - E	Appendices
Volume IV	**Employer's Requirement – Technical Specifications**
Volume V	**Tender Drawings**
Section IX – A	Architectural Drawings
Section IX – B	Structural Drawings
Section IX – C	Utility Drawings
Volume VI	**Bill of Quantities**

1. PREAMBLES

1) The Pricing Document shall be read in conjunction with technical Specification, Employers Requirement, BOQ's for the works and other provisions-of the tender documents, schematic tender drawings etc. including Annexure, Appendix, Addendum *I* corrigendum and any - other document forming part of the Tender Document.

2) The Bill of Quantities shall be read in conjunction with the Instructions to the Tenderer, General Conditions of Contract, Special Condition of Contract, Employers Requirement, Scope of work, Technical specifications etc. If the specifications in the scope of work, Employers requirement., Technical specifications are inferred with respect to relevant codes and standards then provision of the Codes and Standards shall prevail and vice versa. The decision of the Engineer regarding this issue shall be binding on the contractor.

3) The Quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for tendering. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Engineer and valued at the rates and prices tendered and accepted in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix within the terms of the Contract. The quantities may vary with reference to tender BOQ.

4) The rates and prices to be tendered in the Bill of Quantities are for completed and finished items of work and complete in all respects. It will be deemed to have included all constructional plant, tools, machinery, labour, supervision, materials, fuel, oil, consumables, electric power, water,, transportation, all leads and lifts, dewatering, all temporary works and false works, construction of temporary stores and buildings, fencing, watering, lighting, erection maintenance, night working, inspection facilities, safety measures at work sites casting yard for workmen and road users, preparation of design and drawings pertaining to the casting yard, staging, shuttering, form work, stacking yard etc., establishment and overhead charges, labour camps, insurance costs for labour and works, contractor's profit, all taxes, royalties, duties, cess, Octroi, VAT and other levies and other charges together with all general risks, liabilities and obligations set out or implied in the contract and including remedy of any defects during the Defect Liability Period, unless otherwise provided in BOQ. Reinforcement Steel (Including supply, cutting, bending, placing in position, tying etc.) shall be paid separately than the concrete items under the mentioned item of Steel Reinforcement unless otherwise mentioned in BOQ.

5) General directions and descriptions of work and materials are not necessarily repeated or detailed in the Bill of Quantities. References to the relevant specifications and sections of the contract documentation should be made before quoting rates in the Bill of Quantities.

6) The rates are deemed to be inclusive of all lead (except as otherwise specifically provided in the description of the particular item), lifts, ascend, descend, handling, re handling, crossing of Nallah/Streams/Tracks any other obstructions.

7) All enabling works for executing the work e.g. approach road to site, procuring right of way, arrangement of water and electricity and any other incidental works which can be reasonably be inferred to be required for completing the works including working in more than 1 shift is to be arranged/managed by the contractor at his own cost and deemed to be included in the quoted rates

8) Storage of Material: All the material at site will have to be properly stacked & stored so as to facilitate inspection. The material should be properly protected from the detrimental effects of nature and fire, theft etc. The contractor shall be responsible for watch & ward and any loss or deterioration on account of above shall lead to rejection of material and contractor has to replace the same at his own cost.

9) The method of measurement of completed work for payment shall be in accordance with provisions in Contract/Specifications except as otherwise specifically provided in the description of item or particular bill of quantities or explanatory notes to the particular bill of quantities.

10) Obtaining prior permission for felling of trees including payment of royalty and taxes etc. shall be contractor's responsibility and deemed to be included in the rates. MMRC will only provide necessary letters/documents to co-ordinate with concerned departments.

11) Tenderer may please note that to perform this contract, nothing extra shall be payable on account of field constraints, availability of front, preparation of detailed scheme for taking necessary clearance and approval from the concerned authority and other local bodies etc. This is solely responsibility of the contractor

12) In all concreting items, all material, equipment, labour, casting beds, stress frames, form work staging, scaffolding, etc. is to be arranged by the contractor within the quoted rates.

13) All activities not specifically covered in BOQ /Schedule of Items, but required to be executed in order to complete the Scope of work have to be deemed as covered with in these mentioned items of the Schedule/BOQ.

14) Errors will be corrected by the Employer for any arithmetical errors in computation or summation as indicated in Contract Document.

15) Repairs to damage of existing carriage way etc. during construction work shall be carried out by contract at his own cost as per the technical specification. Prior to start of repairing work, scheme of repair work shall be got approved from-engineer.

16) Geo technical data given is indicative only for tendering purpose. The successful tenderer will have to carry out the Geotechnical Investigations if required to perform this contract.

17) The Tenderer is required to furnish the PAN for all members of Group.

18) Only the lowest evaluated tender will be negotiated for necessary decision regarding Deviations (Price of unqualified withdrawal) offered by Tenderer.

Aarey Colony Depot --- Estimated Total		
Section No	**Description**	**Total in INR**
Section 1	Survey & Tree Cutting Works	6,26,10,621.39
Section 2	Excavation & Disposal	54,10,45,286.29
Section 3	Plain Cement Concrete	6,57,80,370.85
Section 4	Reinforced Cement Concrete	93,85,67,763.08
Section 5	Reinforcement & Structural Steel	1,10,01,49,358.88
Section 6	Block Work / Brick Work	634,64,817.23
Section 7	Flooring	818,38,966.75
Section 8	Internal / External Wall Painting	10,89,95,411.30
Section 9	Doors / Windows	1,28,73,324.58
Section 10	Sanitary Items	16,71,469.56
Section 11	Water Proofing	130,90,770.02
Section 12	Roofing	13,76,47,323.35
Section 13	Fresh Water Supply Network	60,68,101.56
Section 14	Diversion of Existing Water Pipeline	5,46,39,698.40
Section 15	Storm Water Drain / Boundary Wall / Retaining Wall	3,53,33,780.52
Section 16	Rain Water Harvesting Wells & Pumps	39,29,970.92
Section 17	Rain Water Harvesting Pits	77,40,000.00
Section 18	Effluent Treatment Plant	1,57,24,800.00
Section 19	Sewerage Treatment Plant	1,90,58,206.73
Section 20	Road Works	8,43,69,710.70
Section 21	Plumbing Works	2,39,55,176.00
Section 22	Miscellaneous Works	2,49,03,072.32
Total Estimated Cost		**340,34,58,000.00**

2. Part A - Bill of Quantities (BOQ)

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
1	2	3	4	5	6	7
	Sub Section 1 – Survey & Tree Cutting Works					
1.1	**Clearing and Grubbing** Depot land including uprooting rank vegetation, grass, bushes, shrubs, sapling and trees of girth upto 150mm, removal of stumps of trees cut earlier and disposal of unserviceable material and stacking of serviceable material to be used or auctioned upto a lead 1000 m by Mechanic means in any area, etc. complete as directed by Engineer-in-charge.	Sqm	2,64,019.69	5.20	Rupees Five and Twenty Paisa Only	**13,72,902.39**
1.2	**Cutting down trees** including trunks and branches and stacking the materials neatly with all leads, etc. complete as directed by Engineer-in-charge.					
	a) The tree of girth above 50mm Upto 150mm	No	198.00	940.00	Rupees Nine Hundred Forty Only	**1,86,120.00**
	b) The tree of girth above 150mm Upto 300mm	No	536.00	4,037.00	Rupees Four Thousand Thirty Seven Only	**21,63,832.00**
	c) The tree of girth above 300mm. Upto 450mm	No	657.00	5,444.00	Rupees Five Thousand Four Hundred Forty Four Only	**35,76,708.00**
	d) The tree of girth above 450mm. Upto 600mm	No	3.00	7,296.00	Rupees Seven Thousand Two Hundred Ninety Six Only	**21,888.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	e) The tree of girth above 600mm. Upto 900mm	No	787.00	10,847.00	Rupees Ten Thousand Eight Hundred Forty Seven Only	**85,36,589.00**
	f) The tree of girth above 900mm to 1200.	No	492.00	14,274.00	Rupees Fourteen Thousand Two Hundred Seventy Four Only	**70,22,808.00**
	g) The tree of girth above 1200mm to 1500.	No	216.00	18,352.00	Rupees Eighteen Thousand Three Hundred Fifty Two Only	**39,64,032.00**
	h) The tree of girth above 1500mm to 1800.	No	87.00	22,431.00	Rupees Twenty Two Thousand Four Hundred Thirty One Only	**19,51,497.00**
	i) The tree of girth above 1800mm to 2100.	No	55.00	26,509.00	Rupees Twenty Six Thousand Five Hundred Nine Only	**14,57,995.00**
	j) The tree of girth above 2100mm	No	153.00	28,548.00	Rupees Twenty Eight Thousand Five Hundred Forty Eight Only	**43,67,844.00**
1.3	**Transplantation of trees**: Providing trenches of required depth and width in soil around the tree of any girth, watering the soil, uprooting the tree with soil ball and roots by lifting the tree using canvas sling and Crane (Hydra), providing hormonal treatment to the roots of the tree and wrapping them with gunny cloth, proper transporting with all leads of the tree to the approved location to ground for replanting by excavating, placing the tree in the pit, backfilling the pit with available soil and manure and watering.					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	Adequate care to be taken for survival of the replanted tree as per guidelines of Tree Authority, etc. complete as directed by Engineer-in-charge.					
	a) Release of payment towards completion of transplantation works and sprouting. (**30% of Total Item Rate)**	No	200.00	1,381.80	Rupees One ThousandThree Hundred Eighty One and Eighty Paisa Only	**2,76,360.00**
	b) Completion of 3 years Maintenance and handing over trees. (**70% of Total Item Rate)**	No	200.00	3,224.20	Rupees Three Thousand Two Hundred Twenty Four and Twenty Paisa Only	**6,44,840.00**
1.4	**Deposit with concerned** authorities for cutting & transplanting of trees as per Govt. norms, etc. complete as directed by Engineer-in-charge.	No	200.00	4,606.00	Rupees Four Thousand Six Hundred Six Only	**9,21,200.00**
1.5	**Supplying, stacking & Planting of approved trees** of at least 1.0 m height above GL in excavated pit of size 1.2 m x 1.2m x 1.2m, at the site shown by the Engineer, back filing the pit by putting the manure & soil, including deposing the excavated earth, etc. complete as directed by Engineer-in-charge.	No	9,552.00	1,583.00	Rupees One Thousand Five Hundred Eighty Three Only	**1,51,20,816.00**
1.6	Carrying out **Topographical Survey**, contouring of all terrain (all types), covering Nallah, pipelines, roads, bunds, electrical poles, all the trees, cart roads, pedestrian ways etc. by using Electronic Total Station surveying instruments (3 second Least Count) with its all accessories tools, plants including preparing necessary plans such as L-sections cross sections, contouring, topographical detail survey plan by processing data on computer, preserving processed data on CD's or any other advanced type computer	Ha	30.73	10,000.00	Rupees Ten ThousandOnly	**3,07,300.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	hardware including all manpower i.e. electronic total station operator, computer engineer, trained supervisor, skilled labours, machineries, computer with latest configuration, materials such as stationary required for printing processed data, plotting drawings of required sizes, submission of processed data and plans in properly bound book, etc. complete as directed by Engineer-in-charge.					
1.7	Providing and fixing **the C.C. stone at every 50m/100m grid** or at every turning points and as directed of size 150X150X600mm long, 300mm buried in C.C. 1:3:6 shall be painted by P.O. red colour and written the Chainage/ co-ordinate, etc. complete as directed by Engineer-in-charge.	No	39.00	550.00	Rupees Five Hundred Fifty Only	**21,450.00**
1.8	Carryout the **tree survey, preparation of tree removal proposal** including location drawing, tree species details, girth & height measurements as per the requirement and format of approving authority. Work includes coordinating site visits, making necessary arrangements and obtaining permission from approving authority for cutting and transplantation of trees, etc. complete as directed by Engineer-in-charge.	No	3,184.00	35.00	Rupees Thirty Five Only	**1,11,440.00**
1.9	Carrying out **Plate Load Test** complete with necessary and adequate Kent ledge loads, equipment and instruments etc. as per specifications for determination of bearing capacity of soil as specified and directed and submitting reports in duplicate, etc. complete as directed by Engineer-in-charge.	No	5.00	75,000.00	Rupees Seventy Five Thousand Only	**3,75,000.00**
1.10	Portal Barricading - Installation of a steel portable barricade with horizontal rail 300mm wide, 2.5 m in length fitted on a 'A' frame made with 45x45x5mm angle iron section, 1.5 m in height, horizontal rail painted (2 coats) with yellow and white stripes, 150 mm in width at an angle of 450, 'A' frame painted with 2 coats of yellow paint,	Per Barricade	1000.00	2,839.00	Rupees Two Thousand Eight Hundred Thirty Nine Only	**28,39,000.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	complete as per IRC: SP:55-2001 complete.					
	Permanent Type Barricade – Construction of a permanent type barricade made of steel components, 1.5 m high from road level,fitted with 3 horizontal rails 200 mm wide and 4 m long on 50 x 50 x 5 mm angle iron vertical support, painted with yellow and white strips, 150 mm in width at an angle of 450, complete as pr IRC:SP:55-2001 complete.	Per Barricade	1000.00	4,456.00	Rupees Four Thousand Four Hundred Fifty Six Only	44,56,000.00
	Providing and fixing corrugated GI sheet barricading of 0.64 mm thick sheets with zinc coating not lessthan 275 gm /sqm fixed with polymer coated J or L hooks, bolts, nuts, 6 mm dia with bitumen and glimpse washers or with GI limpet washers filled with white lead and including a cost of approved steel primer and two coats of approved paint on two side complete.	Rmt.	500.00	5,830.00	Rupees Five Thousand Eight Hundred Thirty Only	29,15,000.00
	Sub Section 2 – Excavation & Disposal					
	Excavation Over Depot Area					
2.1	**Excavation** for in all types of soil, soft murrum, hard murrum, hard murrum with boulders, in all conditions and nature, including clearing, taking spot levels, excavating to required depth, line, level and slope, leveling and dressing and consolidating the excavated surface, sorting out and stacking serviceable and unserviceable materials including conveying the excavated material with a lead upto 50 m within depot site, etc. complete as directed by Engineer-in-charge. ***Note : All payments towards the royalty, fees, taxes etc. shall be borne by the contractor.***	Cum	1,17,562.21	171.00	Rupees One Hundred Seventy One Only	**2,01,03,137.91**
2.2	**Excavation in soft rock** in all conditions and nature, including clearing, taking spot levels, excavating to required depth, line, level and slope, leveling and dressing and consolidating the excavated surface,	Cum	1,58,230.84	289.00	Rupees Two Hundred Eighty Nine Only	**4,57,28,712.76**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	dewatering by all means upto any extent of water accumulated from any source, sorting out and stacking serviceable and unserviceable materials, including conveying the excavated material with all lead within depot site, etc. complete as directed by Engineer-in-charge. ***Note : All payments towards the royalty, fees, taxes etc. shall be borne by the contractor.***					
2.3	**Excavation in Hard Rock** including clearing, taking spot levels, excavating to required depth, line, level and slope, leveling and dressing and consolidating the excavated surface, dewatering by all means upto any extent of water accumulated from any source, sorting out and stacking serviceable and unserviceable materials, including conveying the excavated material with all lead within depot site, etc. complete as directed by Engineer-in-charge ***Notes : All payments towards the royalty, fees, taxes etc. shall be borne by the contractor.***	Cum	8,327.94	392.00	Rupees Three Hundred Ninety Two Only	**32,64,552.48**
	Excavation in Foundation, Trenches, Pipelines, Drains					
2.4	**Excavationfor in all types of Soil**, soft murrum, hard murrum, hard murrum with boulders, in all conditions and nature, including clearing, taking spot levels, excavating to required depth, line, level and slope, leveling and dressing and consolidating the excavated surface, sorting out and stacking serviceable and unserviceable materials including conveying the excavated material with a lead upto 50 m within depot site, etc. complete as directed by Engineer-in-charge. ***Note : All payments towards the royalty, fees, taxes etc. shall be borne by the contractor.***					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	Lift upto 1.5 m	Cum	88,892.16	259.00	Rupees Two Hundred Fifty Nine Only	**2,30,23,069.44**
	Lift 1.5 m to 3.0 m	Cum	33,475.11	324.00	Rupees Three Hundred Twenty Four Only	**1,08,45,935.64**
	Lift above 3.0 m	Cum	7,383.71	389.00	Rupees Three Hundred Eighty Nine Only	**28,72,263.19**
2.5	**Excavation in soft rock** in all conditions and nature, including clearing, taking spot levels, excavating to required depth, line, level and slope, leveling and dressing and consolidating the excavated surface, dewatering by all means upto any extent of water accumulated from any source, sorting out and stacking serviceable and unserviceable materials, including conveying the excavated material with all lead within depot site, etc. complete as directed by Engineer-in-charge. ***Note : All payments towards the royalty, fees, taxes etc. shall be borne by the contractor.***					
	Lift upto 1.5 m	Cum	10,753.72	630.00	Rupees Six Hundred Thirty Only	**67,74,843.60**
	Lift 1.5 m to 3.0 m	Cum	8,697.53	813.00	Rupees Eight Hundred Thirteen Only	**70,71,091.89**
	Lift above 3.0 m	Cum	19,397.85	996.00	Rupees Nine Hundred Ninety Six Only	**1,93,20,258.60**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
2.6	**Excavation in hard rock/ Manjra rock/concrete structure** by wedging, chiseling or line drilling including dressing, sectioning to the required Formation Level and including conveying the excavated material with all lead within depot site, etc. complete as directed by Engineer-in-charge. ***Notes : All payments towards the royalty, fees, taxes etc. shall be borne by the contractor.***					
	Lift upto 1.5 m	Cum	2,845.18	1,130.00	Rupees One Thousand One Hundred Thirty Only	**32,15,053.40**
	Lift 1.5 m to 3.0 m	Cum	5,150.00	1,271.00	Rupees One Thousand Two Hundred Seventy One Only	**65,45,650.00**
	Lift above 3.0 m	Cum	17,477.00	1,412.00	Rupees One Thousand Four Hundred Twelve Only	**2,46,77,524.00**
	Earthwork for Embankment					
2.7	**Providing earthwork in embankmentwith approved materials obtained from the cutting** with all lead within depot site, laying in compacted layers of 20 cms in thickness, breaking clods, dressing to the required lines, curves, grades, and section with watering and compacting with vibratory power rollers with 98% M.P.D., etc. complete as directed by Engineer-in-charge. ***Notes : All payments towards the royalty, fees, taxes etc. shall be borne by the contractor.***	Cum	58,781.11	168.00	Rupees One Hundred Sixty Eight Only	**98,75,226.48**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
2.8	**Providing earthwork in embankment with approved materials obtained from Borrow Area selected by Contractor**at depot site including all lead and all lifts, laying in compacted layers of 20 cms in thickness, breaking clods, dressing to the required lines, curves, grades, and section with watering & compacting with vibratory power rollers with 98% M.P.D., etc. complete as directed by Engineer-in-charge. ***Notes : All payments towards the royalty, fees, taxes etc. shall be borne by the contractor.***	Cum	5,64,801.25	302.00	Rupees Three Hundred Two Only	**17,05,69,977.50**
2.9	Providing compacted layer of **Blanket material** on compacted sub grade at track area and as directed by the Engineer with approved materials obtained from contractors own source including all lifts, laying in compacting in two layers, dressing to the required lines, levels and section with watering and compacting with vibratory power rollers etc. complete as per the Technical specification, RDSO guidelines for Railway Embankments, etc. complete as directed by Engineer-in-charge. **Note - All payments towards the royalty, fees, taxes etc. shall be borne by the contractor.**	Cum	43,380.00	1,294.00	Rupees One Thousand Two Hundred Ninety Four Only	**5,61,33,720.00**
	Disposal of Surplus Material& Dewatering					
2.10	**Disposal of surplus excavated materials** from depot site to dumping site selected by contractor upto all lead including loading, unloading, stacking and spreading, etc. complete as directed by Engineer-in-charge.	Cum	3,00,304.467	431.46	Rupees Four Hundred Thirty one and Fourty Sixpaisa Only	**12,95,69,365.40**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
2.11	**Dewatering** by 10 H.P. & above but less than 20 H.P. Pump including diversion of stream & providing coffer dams / bunds etc. as may be necessary for foundation or pipe trenches and steer parts of the work and bailing out water during and after excavation, etc. complete as directed by Engineer-in-charge.	Hour	8,712.00	167.00	One Hundred Sixty Seven Only	**14,54,904.00**
	Sub Section 3 – Plain Cement Concrete					
3.1	Providing **rubble filling/soling of trap stones in foundations** of approved quality including sand packing and filling gravel in voids, etc. complete as directed by Engineer-in-charge.	Cum	11,319.62	915.00	Rupees Nine Hundred Fifteen Only	**1,03,57,452.30**
3.2	Providing and laying **RMC M-20 grade for PCC work in foundation** like raft, grillage, strip foundation as per IS 456:2000 including formwork, transportation, pouring, compaction and finishing the concrete with all contractors labour, machinery, material, lead, lift, etc. complete as directed by Engineer-in-charge.	Cum	8,196.69	6,720.00	Rupees Six Thousand Seven Hundred Twenty Only	**5,50,81,756.80**
3.3	Providing **Preconstruction Anti termite Treatment** as per IS: 6313 (Part-III) by treating the bottom surface, the sides of excavation, backfill in immediate contact with foundation, treating the top surface of plinth filling at the rate of 5 liters of emulsion concentrate of 0.5 % of chloropyiifos or equivalent per square meter of surface area covering 10 years' guarantee, etc. complete as directed by Engineer-in-charge.	Sqm	3,914.65	87.15	Rupees Eight Seven and Fifteen Paisa Only	**3,41,161.75**
	Sub Section 4 – Reinforced Cement Concrete					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
4.1	Providing and laying **RMC M-35 grade for RCC work in foundation** like raft, grillage, strip foundation, footing as per IS 456:2000 including formwork, transportation, pouring the concrete, compaction, finishing with all contractors labour, machinery, material, lead, lift, etc. complete as directed by Engineer-in-charge. ***(Excluding reinforcement and structural steel).***	Cum	36376.78	6,849.26	Rupees Six Thousand Eight Hundred Forty nine and Twenty six paisa Only	**24,91,54,024.20**
4.2	Providing and laying **RMC M-35 Grade for RCC beams, lintels, sunshades** work as per IS 456:2000 including formwork, scaffolding, transportation, pouring the concrete, compaction, with all contractors labour, machinery, material, lead, lift, etc. complete as directed by Engineer-in-charge. ***(Excluding reinforcement and structural steel).***	Cum	3,661.37	8,969.26	Rupees Eight Thousand Nine Hundred Sixty Nine and Twenty Six Paisa Only	**3,28,39,779.49**
4.3	Providing and laying **RMC M-35 Grade for RCC slab, landing, overhead tank** work as per IS 456:2000 including formwork, scaffolding, transportation, pouring the concrete, compaction, with all contractors labour, machinery, material, lead, lift, etc. complete as directed by Engineer-in-charge. **(Excluding reinforcement and structural steel).**	Cum	32026.77	9,093.55	Rupees Nine Thousand Ninety Three and Fifty Five paisa Only	**29,12,37,034.30**
4.4	Providing and laying **RMC M-35 Grade for RCC Column, pedestal work** as per IS 456:2000 as per detailed drawings and designs including formwork, scaffolding, transportation, pouring the concrete, compaction, with all contractors labour, machinery, material, lead, lift, etc. complete as directed by Engineer-in-charge. **(Excluding reinforcement and structural steel).**	Cum	18198.06	10,290.63	Rupees Ten Thousand Two Hundred Ninety and Six three paisa Only	**18,72,69,502.20**
4.5	Providing and casting in situ dense and impervious cement concrete **RCC M35 of trap metal for R.C.C. Pardi of 75 mm thick or more as per detailed** designs and drawings or as directed including providing and erecting steel Centering and shuttering with strutting, propping etc. and removal of formwork	Cum	3,748.38	11,071.64	Rupees Eleven Thousand Seventy One and Sixty Four paisa Only	**4,15,00,713.94**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	necessary compaction, roughening the surface if special finish IS to be provided and curing. ***(Excluding steel reinforcement)***					
4.6	Providing and casting in situ dense and impervious cement concrete **RCC M35 of trap metal for RC.C. Waist slabs, steps and Parapet** as per detailed designs and drawings or as directed including providing and erecting steel Centering and shuttering with strutting, propping etc. and removal of formwork, necessary compaction, roughening the surface if special finish is to be provided and curing. (Excluding steel reinforcement)	Cum	207.37	9,478.77	Rupees Nine Thousand Four Hundred Seventy Eight and Seventy Seven paisa Only	**19,65,612.54**
4.7	Furnishing and Placing Reinforced Cement Concrete with **M40 in Foundation** as per Drawing and Technical Specification	Cum	3,329.67	6,492.25	Rupees Six Thousand Four Hundred Ninety two and Twenty Five paisa Only	**2,16,17,050.06**
4.8	Furnishing and Placing **Reinforced /Prestressed Cement Concrete with M60 in Sub Structure** as per Drawing and Technical Specification	Cum	3,133.59	6,922.42	Rupees Six Thousand Nine Hundred Twenty Two and Forty Two paisa Only	**2,16,92,026.09**
4.9	Furnishing and Placing **Reinforced /Prestressed Cement Concrete with M60 in Super Structure** as per Drawing and Technical Specification	Cum	8,247.54	11,069.00	Rupees Eleven Thousand Sixty Nine Only	**9,12,92,020.26**
	Sub Section 5 – Reinforcement & Structural Steel					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
5.1	Providing and fixing in position **TMT Bars Reinforcement (Fe 500D or more)** of various diameters for R.C.C. pile caps, footings, foundations, slabs, beams, columns, canopies, staircases, newels, chajjas, lintels, pardies, coping, fins, arches, etc. as per detailed designs, drawings and schedules including cutting, bending, hooking the bars, binding with wires or tack welding and supporting as required complete.	MT	12282.14	67,817.65	Rupees Sixty Seven Thousand Eight Hundred Seventeen and Sixty Five paisa Only	**83,29,45,871.80**
5.2	Providing **Fusion Bonded Epoxy Coating (FBEC)** to reinforced bars of Fe 500D as per IS: 13620-1993 specifications for a thickness of 175micron Permissible variation of 50 micron including testing of coating at plant extra cost for careful handling using PVC coating, binding wires instead of G. 1. wires to and from Plant) touching up the material supplied repair work etc. complete as per detailed specifications. (Lead 200km from plant) etc. complete. ***(Item shall be used for new structures.)***					
A]	Diameter 8 mm	MT	819.02	16,092.00	Rupees Sixteen Thousand Ninety Two Only	**131,79,669.84**
B]	Diameter 10 mm	MT	9.03	14,645.70	Rupees Fourteen Thousand Six Hundred Forty Five and Seventy paisa Only	**1,32,250.67**
C]	Diameter 12 mm	MT	827.12	13,533.30	Rupees Thirteen Thousand Five Hundred Thirty Three and Thirty paisa Only	**111,93,663.10**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
D]	Diameter 16 mm	MT	1,622.56	13,115.70	Rupees Thirteen Thousand One Hundred Fifteen and Seventy paisa Only	**212,81,010.19**
E]	Diameter 20 mm	MT	2,443.82	11,976.30	Rupees Eleven Thousand Nine Hundred Seventy Six and Thirty paisa Only	**292,67,921.47**
F]	Diameter 25 mm	MT	2,429.63	11,086.20	Rupees Eleven Thousand Eighty Six and Twenty paisa Only	**2,69,35,364.11**
5.3	Providing **Structural Steel Work** in rolled sections. M.T. fixed with connecting plates or angle cleats as in main and cross beams, hip and jack rafters, purlins connecting to truss members and the like as per detailed designs and drawings or as directed including cutting, fabricating, hoisting, erecting, fixing in position, making riveted/ bolted/ welded connections and Red Oxide Zinc Chromate primer and two coat of synthetic enamel paint scaffolding etc. complete.	MT	1,721.34	83,009.00	Rupees Eighty Thousand Nine Only	**14,28,86,712.10**
5.4	**High Tensile Steel Wire** / Strands including all accessories for stressing, stressing operations and grouting complete as per Technical Specifications	MT	120.80	1,73,717	Rupees One Lac Seventy Three Thousand Seven Hundred Seventeen Only	**2,09,85,013.60**
5.5	Supplying, fitting & fixing in position true to line and level **Elastomeric Bearing** confirming to IRC 83 Part II section IX and Clause 2005 of MORT&H	Cu Cm	8,24,000.00	1.10	Rupees One and Ten Paisa Only	**9,06,400.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
5.6	**Drainage Spout** Complete as per drawing and Technical Specification	m	46.00	9,467.00	Rupees Nine Thousand Four Hundred Sixty-Seven Only	**4,35,482.00**
	Sub Section 6 – Block Work / Brick Work					
6.1	Providing and laying **Autoclaved aerated (cellular) cement blocks** masonry in Building works with more than 200 mm thick AAC blocks in cement mortar 1:4 (1 cement : 4 coarse sand) including RCC stiffeners, rate includes providing and placing in position 2 Nos 6 mm Dia M.S. bars at every third course of masonry work, racking of joints, scaffolding and curing, etc. complete as directed by Engineer-in-charge.	Cum	11,651.27	5,447.03	Rupees Five Thousand Four Hundred Forty Seven and Three Paisa Only	**6,34,64,817.23**
	Sub Section 7 – Flooring					
7.1	Providing and laying **Polished Granite Tiling** of approved colour, origin and shade, 16mm to 18mm thick laid on floor, counter tops, copings and in skirting's cement mortar 1:4 (1 cement: 4 coarse sand), sprinkled with white cement and jointed with white cement slurry mixed with pigment to match the shade of the slabs including rubbing and polishing, rates include coordination with other agencies for cutouts, holes and finishing of the same, etc. complete as directed by Engineer-in-charge.	Sqm	14,882.48	2,469.00	Rupees Two Thousand Four Hundred Sixty Nine Only	**3,67,44,843.12**
7.2	Providing and laying **600 x 600 Vitrified Tiles** of approved colour, finish and shade, for flooring and skirting, size laid over average 20/10mm thick in cement mortar 1:4 (1cement :4coarse sand) and joints shall be treated with colored epoxy grout to match	Sqm	5,740.66	1,097.00	Rupees One Thousand Ninety Seven Only	**62,97,504.02**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	colour of tile, rate includes coordination with other agencies for cutouts, holes and finishing of the same, etc. complete as directed by Engineer-in-charge.					
7.3	Providing and laying **Cement Concrete Flooring (Trimix) 50 mm** with M-20 cement concrete laid to proper line level and slope in alternate bays including compaction, filling joints, marking lines to give the appearance of tiles of 30 cm x 30 cm or other size as specified and laid diagonally or square, finishing smooth (with extra cement) m any colour as directed and curing complete.	Sqm	2,980.83	451.00	Rupees Four Hundred Fifty One Only	**13,44,354.33**
7.4	Providing and fixing removable **Raised/false Access Flooring** with system and its components of approved make for different plenum height with possible height adjustment upto 50 mm, comprising of modular load bearing floor panels supported on G.I. rectangular stinger frame work and G.I. Pedestal etc. all complete, as per the architectural drawings, as specified and as directed by Engineer-in-charge consisting of Stringers system in all steel construction hot dipped galvanized of rectangular size 570 x 20 x 30 x 0.80mm thick having holes at both ends for securing the stringers on to the pedestal head using fully threaded screws ensuring Stringers system in all steel construction hot dipped galvanized of rectangular size 570x20x30x0.80mm thick having holes at both ends for securing the stringers on to the pedestal head using fully threaded screws ensuring	Sqm	3,837.91	3,999.50	Rupees Three Thousand Nine Hundred Ninety Nine and Fifty paisa Only	**153,49,721.05**
7.5	15mm cement concrete topping 1:2 (1cement: 2 aggregate of size 4.75mm and below by volume) laid over and finished **Granolithic** with structure slab. by **Granolithic** with base concrete including fixing of glass strip as direction by Engineer-In- Charge.	Sqm	6,767.54	145.00	Rupees One Hundred Forty Five Only	**9,81,293.30**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
7.6	Providing and fixing 8mm thick hard wood laminated **wooden flooring** of quality AC-4, light commercial use of make bello floor, stark floor, e-floor or equivalent make, having the properties of high fire resistance, friendly to allergic and chemical resistance, easy cleaning and stain resistance, wear resistance etc. The wooden flooring is to be laid over 2mm thick foam and 0.2mm thick polyethylene sheet etc. complete as per direction of Engineer-In-Charge.	Sqm	1,332.16	1,536.50	Rupees One Thousand Five Hundred Thirty Six and Fifty Paisa Only	**20,46,863.84**
7.7	**52 mm thick cement concrete flooring with concrete hardener topping**, under layer 40 mm thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) and top layer 12 mm thick cement hardener consisting of mix 1:2 (1 cement hardener mix : 2 graded stone aggregate 6 mm nominal size) by volume, hardening compound mixed @ 2 litre per 50 kg of cement or as per manufacturer's specifications.	Sqm	22,836.74	535.25	Rupees Five Hundred Thirty Five and Twenty Five Paisa Only	**122,23,365.09**
7.8	Supplying & applying Epoxy Coatingfor maintaining shine of floors using mechanical polishing as approved by Engineer in charge	Sqm	22,836.74	300.00	Rupees Three Hundred Only	**68,51,022.00**
	Sub Section 8 – Internal / External Wall Painting					
8.1	Providing and applying **Royale Luxury Emulsion** Sqm. of Asian / Berger / Nerolac / Dulux Paint or equivalent make on internal wall surface as detailed below Scrapping for surface with emery paper and wiping clean for area. Applying Asian / Berger / Nerolac / Dulux or equivalent wall primer with brush by adding mineral turpentine oil by 8 to 10 % or water by 15 to 20% Allowing too dry for 6 to 8 hours applying Asian / Berger / Nerolac / Dulux Paints or equivalent acrylic wall putty with appropriate proportion of water of allowing to dry for period of 4 to 6 hours of activity. Scrapping with emery paper and wipe clean Applying paints Royale Luxury emulsion	**Sqm**	**25,679.33**	**181.00**	Rupees One Hundred Eighty One Only	**46,47,958.73**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	1st coat with brush water content water 40 to 45% if applied by brush or 65 to 70% if applied by roller by role Applying paints Royale luxury emulsion 2nd coat with brush with water content 40 to 45 % or 65 t070 % by roller.					
8.2	Providing and applying **Washable oil-bound distemper** of approved quality colour and shade to old/new surfaces in including scaffolding, preparing the surfaces to receive the paint and applying putty (excluding priming coat) complete.	**Sqm**	**25,031.17**	55.00	Rupees Fifty Five Only	**13,76,714.35**
8.3	Providing and laying **Polished Granite Tiling** of approved colour, origin and shade, 16mm to 18mm thick laid on floor, counter tops, copings and in skirting's cement mortar 1:4 (1 cement: 4 coarse sand), sprinkled with white cement and jointed with white cement slurry mixed with pigment to match the shade of the slabs including rubbing and polishing, rates include coordination with other agencies for cutouts, holes and finishing of the same, etc. complete as directed by Engineer-in-charge.	Sqm	**5,240.79**	2,469.00	Rupees Two Thousand Four Hundred Sixty Nine Only	**1,29,39,510.51**
8.4	Providing and fixing 1st quality **Ceramic Glazed Wall Tiles** 300mm X 300mm of 6mm thick of approved make in all colours, shades, size in skirting, wall cladding, border tiles and dados over 12 mm thick bed of cement Mortar 1:3 (1 cement : 3 coarse sand) and jointing with approved grouting material with pointing in white cement mixed with pigment of matching shade, etc. complete as directed by Engineer-in-charge.	**Sqm**	**2,727.87**	**723.00**	Rupees Seven Hundred Twenty Three Only	**19,72,250.01**
8.5	Providing and applying two coats of **Exterior Acrylic latex paint** of approved colour and shade to the plastered surface as per manufacturers specification including scaffolding preparing the surface and primer coat, etc. complete as directed by Engineer-in-charge.	**Sqm**	**4,038.655**	**131.00**	Rupees One Hundred Thirty One Only	**5,29,063.81**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
8.6	Providing and applying first coat of approved cement paint and **two coats of textured exterior paint** of an approved make and colour as per manufacturers specifications to textured sand faced or other surfaces, upto 10m height from ground level and at all locations as directed including preparing surfaces for painting by any approved means, watering, scaffolding, cleaning and curing, etc. complete as directed by Engineer-in-charge.	**Sqm**	**4,038.655**	**245.00**	Rupees Two Hundred Forty Five Only	**9,89,470.48**
8.7	Providing and applying **12 mm cement plaster** of mix 1:5 for internal surfaces on concrete or brick surface in all positions including scaffolding, curing, etc. complete as directed by Engineer-in-charge.	**Sqm**	**72,237.97**	**214.00**	Rupees Two Hundred Fourteen Only	**1,54,58,925.58**
8.8	Providing **sand face plaster externally** to concrete, stone or brick surfaces using approved screened sand including preparing the base, watering and applying base coat of 15 mm thick in cement mortar 1:4 using water proofing compound at the rate of 1 Kilogram me per cement bag and curing the same for not less than two days and keeping the surface of base coat rough to receive the sand faced treatment not to exceed 8mm thickness in cement mortar 1:4 and finishing the surface by taking out grains and curing for 14 days and scaffolding, etc. complete as directed by Engineer-in-charge.	**Sqm**	**22,935.82**	**623.00**	Rupees Six Hundred Twenty Three Only	**1,42,89,015.86**
8.9	Providing and applying one **priming coat** including preparing of the surface by thoroughly cleaning oil, grease, dirt and other foreign matter with wire brushing, fine fire steel wool, and sand paper, scaffolding etc. complete.	**Sqm**	**93,669.18**	**26.00**	Rupees Twenty Six only	**24,35,398.68**
8.10	2" thick **Acoustic Wall Panel system** - The Melamine Wall panel Providing and fixing acoustical panel system on finished masonry partition with BASF Melamine Foam of approved specifications and thickness 50 mm, having NRC value of 0.80 or higher. The edge finish should be square type and of	**Sqm**	**796.95**	**6,638.92**	Rupees Six Thousand Six Hundred Thirty Eight and Ninety Two Paisa Only	**52,90,887.29**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	600mmx1200mm size or as defined Perforated Vinyl /Fabric Finish of maximum 1mm or as approved thickness of approved Supply & Installation of Acoustical Wall Systems for Auditorium					
8.11	Providing and fixing **Aluminum composite sheet wall panel cladding** for band, facia, walls, columns (square) in 4mm thickness of approved make, colour and shade, shaped to profiles as required including perimeter extrusions, extruded stiffeners, gaskets, sealants, stainless steel fasteners, GI substructure as required for installation for all height. The work includes preparation of shop drawing, etc. complete as directed by Engineer-in-charge.	**Sqm**	**7,920.20**	**4,580.00**	Rupees four Thousand Five Hundred Eighty Only	**3,62,74,516.00**
8.12	Unitized **Curtain Glazing** as per Drawings and Technical Specification	**Sqm**	**2,131.95**	**6,000.00**	Rupees Six Thousand Only	**1,27,91,700.00**
	Sub Section 9 – Doors / Windows					
9.1	Providing and fixing superior quality factory made single or double leaf Phenol Bonded **Solid Core flush door shutters commercial type** hot pressed conforming to IS:2202 (PartI,II) 1991 including 12 mm thk teakwood lipping all around with one coat of primer, putty and 2coats of synthetic enamel paint on both faces, etc. complete as directed by Engineer-in-charge.	**Sqm**	**416.11**	**2,618.00**	Rupees Two Thousand Six Hundred Eighteen Only	**10,89,375.98**
9.2	Providing and fixing **Standard Stainless Steel handles** of 200 mm long, manufactured as per IS:208- 992 for doors and windows and with necessary materials and fixtures like screws, etc. complete as directed by Engineer-in-charge.	**Nos**	**151.00**	**159.00**	Rupees One Hundred Fifty Nine Only	**24,009.00**
9.3	Providing and fixing **Standard stainless steel tower bolts** of 200 mm long conforming to IS:204-992 (PartI,II) for doors & windows with necessary materials and labour, etc. complete as directed by	**Nos**	**151.00**	**259.00**	Rupees Two Hundred Fifty Nine Only	**39,109.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	Engineer-in-charge.					
9.4	Providing and fixing **double/ single acting brass spring hinges** of 150mm long as per manufactures or relevant standards for doors with all labour, materials and necessary fixtures, etc. complete as directed by Engineer-in-charge.	**Nos**	**151.00**	**684.00**	Rupees Six Hundred Eighty Four Only	**1,03,284.00**
9.5	Providing and fixing **Stainless steel door stopper** of approved as per IS:1823-1992 for doors with necessary materials and labour cost, etc. complete as directed by Engineer-in-charge.	**Nos**	**151.00**	**80.00**	Rupees Eighty Only	**12,080.00**
9.6	Providing and fixing Chromium plated Brass mortise latch and lock of approved make manufactured as per IS:2209 and 6607 and as described below for doors with necessary fixtures and materials and labour, etc. complete as directed by Engineer-in-charge.	**Nos**	**151.00**	**812.00**	Rupees Eight Hundred Twelve Only	**1,22,612.00**
9.7	Detail shop design, supply, delivery, storage & installation of **2 Hours Fire Rated Metal Doors** assembly conforming to BS:476 Part II, IS:3614 Part II, complete with shutters, frames, hinges etc. conforming to the M&W specifications and design intent. All fire doors must conform to the requirements of Fire Authority having jurisdiction and as per prototype tested by approved fire testing agency acceptable to fire authority having jurisdiction. Door shutter and frames to have all hardware preparations must be prepunctured at the factory for fixing of said hardware. Shutters & frames to be filled with suitable fillers, insulation to meet the required fire resistance criteria as specified, with all grouting, reinforcements, flushed lock seam joints including all seals, washers, linings etc. complete. All fire doors to be primered and painted with approved painting system as per tested prototype and to approved colour. Provision of mortise sash lock (ML 100A) with	**Sqm**	**541.08**	**6,500.00**	Rupees Six Thousand Five Hundred Only	**35,17,020.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	S.S. lever handles and door closers heavy duty (imported) LCN 1461 with standard arm on every leaf, stainless steel hinges as per approved shop drawing, etc. complete as directed by Engineer-in-charge. All fixtures will be paid separately.					
9.8	Providing and fixing **SS Ball Bearing Hinges** Of Size 100x75x3mm Of DORMA Make 3090 F, etc. complete as directed by Engineer-in-charge.	**Nos**	**249.00**	**330.00**	Rupees Three Hundred Thirty Only	**82,170.00**
9.9	Providing and fixing **Mortise Dead Lock** of DORSTE Make ML 100 D with Cylinder, etc. complete as directed by Engineer-in-charge.	**Nos**	**83.00**	**1,860.00**	Rupees One Thousand Eight Hundred Sixty Only	**1,54,380.00**
9.10	Providing and fixing **Panic Bar of DORMA Make** PHB 3000 1 - Point modular, etc. complete as directed by Engineer-in-charge.	**Nos**	**83.00**	**15,308.40**	Rupees Fifteen Thousand Three Hundred Eight and Forty Paisa Only	**12,70,597.20**
9.11	Providing and fixing **Panic Bar** of DORMA Make PHB 3000 2 - Point modular, etc. complete as directed by Engineer-in-charge.	**Nos**	**83.00**	**26,656.80**	Rupees Twenty Six Thousand Six Hundred Fifty Six and Eighty Paisa Only	**22,12,514.40**
9.12	Providing and fixing **outside Excess Trim** for Operation of Panic Bar installed door from Pull side of DORMA Make PHT-3905 Make, etc. complete as directed by Engineer-in-charge.	**Nos**	**83.00**	**4,616.40**	Rupees Four Thousand Six Hundred Sixteen and Forty Paisa Only	**3,83,161.20**
9.13	Providing and fixing in **position four track aluminum window** of extruded modular and anodized aluminum sections of approved make and of size 122.2mmx4.5mmx1.3mmthk (wt1.829kg/Rm) for bottom and 122.2mmx31.75mmx1.2mmthk. (wt1.093kg/Rm) for top and sides mounted on anodized aluminum rectangular frame of size 127mm x25.4mmx1.3mm (1.052kg/m) The shutter	**Sqm**	**795.60**	**4,295.00**	Rupees Four Thousand Two Hundred Ninety Five Only	**34,17,102.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	comprising of bearing bottom and top of size 40mmx18mmx1.25mmthk (wt.0.417Kg/Rm) Interlocking section of size 40mmx26.7mmx 1.10mmthk. (Wt.0469kg /Rm) and hand sides of 40mm x 18mm x 1.25mmthk (wt.0.417kg/Rm) with 5mm thick plain/ frosted/ tinted glass fixed in shutter including approved quality neoprene gasket, fixtures, fastenings and accessories like PVC rollers, PVC weep holes, locks, handles, etc. complete as directed by Engineer-in-charge. (Note: anodic film must not be less than 15microns i.e. AC-15 as per IS, the anodizing must be scaleted by keeping the anodized section in boilingde-anodized water for a period of one hour)					
9.14	Providing and fixing in position **Aluminum Louvered window** with anodized aluminum frame of approved make and of size 40mmx20mmx2.0mm (wt.0.605kg/Rm) including adjustable aluminum frame, 4to6mmthk. frosted glass, fixture sand fastenings, etc. complete as directed by Engineer-in-charge.	**Sqm**	**121.80**	**3,661.00**	Rupees Three Thousand Six Hundred Sixty One Only	**4,45,909.80**
	Sub Section 10 – Sanitary Items					
10.1	Providing and fixing white **vitreous china pedestal type water closet** (European type) with seat and lid, 10 liter low level white vitreous china flushing cistern & C.P. flush bend with fittings & C.I.brackets, 40mm flush bend, overflow arrangement with specials of standard make and mosquito proof coupling of approved municipal design complete including painting of fittings and brackets, cutting and making good the walls and floors wherever required W.C. pan with ISI marked white solid plastic seat and lid, etc. complete as directed by Engineer-in-charge.	Each	**84.00**	4,964.11	Rupees Four Thousand Nine Hundred Sixty Four and Eleven Paisa Only	**4,16,985.24**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
10.2	Providing and fixing **Wash Basin with C.I. brackets**, 15 mm C.P. brass pillar taps,32 mm C.P. brass waste of standard pattern, including painting of fittings and brackets, cutting and making good the walls wherever require White Vitreous China Wash basin size 550x400 mm with a pair of 15 mm C.P. brass pillar taps, etc. complete as directed by Engineer-in-charge.	Each	**96.00**	1,977.72	Rupees One Thousand Nine Hundred Seventy Seven and Seventy Two Paisa Only	**1,89,861.12**
10.3	Providing and fixing **white vitreous china flat back half stall urinal** of size 580x380x350mm with white PVC automatic flushing cistern, with fittings, standard size C.P. brass flush pipe, spreaders with unions and clamps (all in C.P. brass) with waste fitting as per IS : 2556, C.I. trap with outlet grating and other couplings in C.P. brass including painting of fittings and cutting and making good the walls and floors wherever required Range of three half stall urinals with 10 liter P.V.C. automatic flushing cistern, etc. complete as directed by Engineer-in-charge.	Each	**54.00**	13,493.32	Rupees Thirteen Thousand Four Hundred Ninety Three and Thirty Two Paisa Only	**7,28,639.28**
10.4	Providing and fixing **PTMT towel ring** trapezoidal shape 215mm long, 200mm wide with a minimum distance of 37mm from wall face with concealed fittings arrangement of approved quality and colour. Weighing not less than 88 gms, etc. complete as directed by Engineer-in-charge.	Each	**34.00**	181.49	Rupees One Hundred Eighty One and Forty Nine Paisa Only	**6,170.66**
10.5	Providing and fixing **PTMT grating** of approved quality and colour with 150 mm nominal size square 100 mm diameter of the inner hinged round grating, etc. complete as directed by Engineer-in-charge.	Each	**212.00**	134.90	Rupees One Hundred Thirty Four and Ninety Paisa Only	**28,598.80**
10.6	Providing and fixing **PTMT liquid soap container** 109mm wide, 125mm high and 112mm distance from wall of standard shape with bracket of the same materials with snap fittings of approved quality and colour. weighing not less than 105 gms, etc. complete as directed by Engineer-in-charge.	Each	**96.00**	195.01	Rupees One Hundred Ninety Five and One Paisa Only	**18,720.96**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
10.7	Providing and fixing **Paper Dispenser** including cutting and making good the wall wherever required, etc. complete as directed by Engineer-in-charge. .(Euronics, Kimberly Clark or equivalent make)	Each	**16.00**	4,007.00	Rupees Four Thousand Seven Only	**64,112.00**
10.8	Providing and fixing **toilet mirror** in 6 mm thick clear float glass with beveled and polished at edge, fixed on wall with 38mm dia75mm long stainless steel stud, etc. complete as directed by Engineer-in-charge.	Sqm	**54.50**	4,007.00	Rupees Four Thousand Seven Only	**2,18,381.50**
	Sub Section 11 – Water Proofing					
11.1	Providing waterproofing in W.C. and Bath including brick bat coba in all positions consisting of specialized materials as per manufacturer's specifications and covering ten years guarantee on requisite stamp paper including all leads, lifts and curing etc. complete as directed by Engineer-in-charge.	Sqm	**908.20**	256.00	Rupees Two Hundred Fifty Six Only	**2,32,499.20**
11.2	Providing and laying waterproofing treatment of 112 mm average thickness consisting of 12 mm thick layer in cement mortar 1:3 with water proofing compound at the rate of 1 kg per bag of cement as base, constructing and laying brick bat coba in cement mortar 1:5 with waterproofing compound at the rate of 1 kg. per bag of cement and having average thickness of 80mm and finishing with 20mm thick cement plaster layer in cement mortar 1:4, water proofing compound at the rate of 1 kg per bag, laying in required position flooring of broken China mosaic (broken pieces of china chips) of approved colour and pattern including neat cement float, giving proper slopes, compaction, curing, finishing etc. including all lead, lifts and laid to proper slope to drain off water entirely including Watta, Bell head or Champhered portion at the junction of parapet and work up to height of 300mm or as directed and covering the whole treatment with ten years guarantee, on requisite stamp paper, etc. complete as directed by	Sqm	**10,559.21**	1,048.00	Rupees One Thousand Forty Eight Only	**1,10,66,052.08**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	Engineer-in-charge.					
11.3	Finishing **the terrace slab integrally** with cement mortar 1:3 proportion with 20mm thick layer including curing, finishing using water proofing compound at the rate of 1 kg./bag of cement, cleaning the surface, etc. complete as directed by Engineer-in-charge.	Sqm	**8,872.37**	202.00	Rupees Two Hundred Two Only	**17,92,218.74**
	Sub Section 12 – Roofing					
12.1	Providing and fixing of - 65/400 Self Supported Secret Fix Aluminum STANDING SEAM ROOFING SYSTEM in 0.9 mm thick in AA-5052 Aluminum Alloy	Sqm	18,720.00	4,785.00	Rupees Four Thousand Seven Hundred Eighty Five Only	**8,95,75,200.00**
12.2	Supply and Fixing of 0.90 mm thick Aluminium Flashing (Specification same as Sr. No. 1 above) maximum girth of 500 mm.	Sqm	2,060.00	1,550.00	Rupees One Thousand Five Hundred Fifty Only	**31,93,000.00**
12.3	Supply and fixing of 2 mm Aluminium gutter, EPDM Expansion joints for every 12m length, Down take spout dia 150 mm for every 9 m gutter length, & other accessories and butt welding at joints with 100 mm strip and full welding inside and stitch welding outside. The Girth of gutter would be 1200mm. With galvalume bottom sheet 0.5 mm thick, Rockwool insulation 50mm thick & 60kg/m3 density, Galvanized steel Z-girt 1.5 mm thick , vapour control layer - double sided Aluminium foil 0.15mm thick	Sqm	672.00	8,750.00	Rupees Eight Thousand Seven Hundred Fifty Only	**58,80,000.00**
12.4	Supply and installation of polycarbonate multicell system, complete assembly of extruded cellular multi cell profile UV polycarbonate glazing panels incorporated into a complete system. Trained and factory authorized labour with supervision to	Sqm	1,160.00	5,500.00	Rupees Five Thousand Five Hundred Only	**63,80,000.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	complete the entire panel installation. Providing & installation of tight cell – multi cell polycarbonate panel system of minimum 16mm thickness of approved colour and shade confirming to specification mentioned below.					
12.5	Supply & Installation of Aluminium Flashings at Skylight periphery in 2mm thick Aluminium, including all formation, welding and High density Rigid Insulation 50 mm thick, 120 Kg/m3 density, 500mm maximum width around the skylights and other areas if required. COLOUR TO MATCH THE ROOF.		840.00	10,750.00	Rupees Ten Thousand Seven Hundred Fifty Only	**90,30,000.00**
12.6	Providing & Installing Roof Hatch System	Nos	4.00	4,15,000.00	Rupees Four Lac Fifteen Thousand Only	**16,60,000.00**
12.7	S-5 MINI Clamps (to fix solar panels on the roof): Supply of photovoltaic mini Clamp from M/s. S-5, USA, to fix solar panels on the roof without piercing / damaging the roof sheet. The S-5 mini Clamps are a handy way to install PV modules and the electrical cable trays. Approved by Rigidal-Kingspan for the application. (considering 3000 Sq. mtr of Solar panel area & 1 clamp per Sqm).	Sqm	6,570.00	625.00	Rupees Six Hundred Twenty Five Only	**41,06,250.00**
12.8	Supply & Installation of Checkline Fall Protection System with Topfix Post with patented rubber energy absorber suitable for Standing Seam Roofing sheets and fixed using 4 x Aluminium clamps below 4 corners of the base plate. along with 2 nos of removable trolleys for max. 2 users. System to have CE mark and hold EC declaration of conformity. Must comply with BS EN 795 Class A & Class C and BS 7883. The Checkline Topfix posts with patented rubber energy absorber will be fixed to the base plate made up of stainless steel powder coated along with 8mm	Sqm	840.00	7,450.00	Rupees Seven Thousand Four Hundred Fifty Only	**62,58,000.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	diameter, 7x7 stainless steel wire rope. The system is configured with intermediate post, end post, corner post, stand alone, cross over post and T-junction post - which are made of stainless steel SS 316. The system has a unique load cell to maintain the tension on the Stainless steel wire rope between 40kg to 200kg and allows for thermal movement of the roof structure. The system's end connection to be connected to wire rope using Checkmate Modular Energy Absorber which has the ability to control maximum system forces to allow for fixing to different roof thicknesses. All end connection must be swagged on. The distance between two posts should not exceed more than 9 metres. The system length comprising start post to end post including all intermediate posts shall not exceed 200m (for straight line System) and 150 m (in case of bends/corners). Test report of salt sprays testing to 1000 hours with no corrosion shall also be provided. The system allows for multi-purpose brackets which can rotate through 180° and lock into position. The system allows for a range of multi-purpose corners, to suit any turn, corner, deviation or incline to suit the roof layout and design. The system consists of identity plates fixed to entry/exit post to indicating: Name and Address of the manufacturer, System type, Nos. of users, Test load, Serial Number, Date of installation and Next date of inspection. SYSTEM WARRANTY - 20 Years based on annual inspection by Checkline approved installer.					
12.9	Supply and Installation of 24'' (600mm) Diameter Wind Driven (Natural draft) Aluminum Turbo Ventilator system along with 1000mm x 1600 mm x 2mm Aluminum Base Plate. **Note :** We have considered cost of Aluminium base Plate (Flashing) which will be welded to the roof sheet, to make the joint permanently leak proof.	Sqm	82.00	18,500.00	Rupees Eighteen Thousand Five Hundred Only	**15,17,000.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
12.10	Providing and Fixing of Luxalon 84R Plain Panel Canopy Sun Louvres along with SL-2 Carrier System of approved colour, consisting of Panels 84mm wide x 16mm deep x 0.5mm thick round edges panels length upto 6 mtrs. Coil Coated on a continuous paint line double baked and roll formed from enameled corrosion resistance Aluminum Alloy AA5050 including Magnesium Mg for higher strength and good roll forming characteristics. Panel shall be clipped to baked enameled panel stringer of 38mm wide and 98mm deep x 0.95 mm thick in a standard length of 5 mtrs made of double baked enameled Aluminium Alloy AA 5050 (Al. Mg.) with cutouts to hold the panel horizontally on the stringer in a module of 74mm centre to centre at a distance of maximum 1.2mtr. The Stringer shall be fixed to suitable structure by means of rigid fixing details	Sqm	800.00	5,500.00	Rupees Five Thousand Five Hundred Only	**44,00,000.00**
12.11	Providing and fixing **corrugated pre coated Sqm. Galvanized Iron Sheet** Roofing having thickness 0.80 mm along with necessary accessories like self-drilling and tapping screws with weather cap, self-drilling and tapping screws EPDM with weather cap for flush at both side including ridge 300 x 300 mm x 0.80 mm thick with all leads and lifts scaffolding etc. complete.	Sqm	**3,168.33**	1,385.00	Rupees One Thousand Three Hundred Eighty Five Only	**43,88,137.05**
12.12	Providing and laying lead flashing of best quality of 400 mm or more width as required and 1.5 to 2 mm thick either in rolled section or strips whichever is available in market for **valley gutters and in both roof and parapet** including proper fixing, cutting sheet with machinery with required width, length and shape etc. complete. The item to also include providing for overlap joints in case of the total width of valley gutter is more than the width of available lead sheet.	Sqm	**486.00**	2,592.05	Rupees Two Thousand Five Hundred Ninety Two and Five Paisa Only	**12,59,736.30**
	Sub Section 13 – Fresh Water Supply Network					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
13.1	Providing & Supplying, loading, transporting on site, unloading, lowering in trenches, assembling and jointing Ductile Iron pipes (K-9) including chamfering cut edges of pipes and specials and fixing with Styrene Butadiene Rubber (SBR) Ring Gaskets for following diameters (Tyron joint pipes). The pipe shall confirm IS: 8329 & SBR Ring Gasket shall confirm IS: 5382 &IS: 12820. The rate is inclusive of cleaning, flushing & testing of water mains up to 6 kg/sq.cm etc. complete in all respect and as directed by Engineer in Charge (Pipe shall be coated with cement mortar lining from inside and zinc coating followed by bitumen coating from outside as specified).					
	100 mm	Rmt	100.00	1,427.50	Rupees One Thousand Four Hundred Twenty Seven and Fifty Paisa Only	**1,42,750.00**
	150 mm	Rmt	300.00	2,092.86	Rupees Two Thousand Ninety Two and Eighty Six Paisa Only	**6,27,858.00**
13.2	Supplying, providing laying and jointing GI pipes in trenches of following class and diameter by wrapping them by hessian cloth with tar coating and including any nominal pipe length required to be laid above ground level, conveyance from stores to site work, all labour, necessary excavation, backfilling, giving satisfactory hydraulic test, etc. complete in all respect as directed by Engineer in Charge. Note : Only MCGM approved GI pipe brands shall be used, all pipe and pipe fittings shall be C class (heavy grade) having ISI marking.					
	25 mm	Rmt	2700.00	317.52	Rupees Three Hundred Seventeen and Fifty Two Paisa	**8,57,304.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
					Only	
	40 mm	Rmt	500.00	462.42	Rupees Four Hundred Sixty Two and Forty Two Paisa Only	**2,31,210.00**
	50 mm	Rmt	1775.00	604.80	Rupees Six Hundred Four and Eighty Paisa Only	**10,73,520.00**
	80 mm	Rmt	800.00	1,001.70	Rupees One thousand One and Seventy Paisa Only	**8,01,360.00**
13.3	Supplying, Loading, transporting on site, unloading, ISI markGlandless Doubled Flanged sluice valves of PN 1.6conforming to IS - 14846 along with its completeappurtenances (i.e. including two nos. of tail pieces) & nuts,bolts, washers, packings etc., stacking the same as directeddiameters. Note : (1) Sluice valves and all other materials					
	100 MM	Rmt	6.00	24,823.42	Rupees Twenty Four Thousand Eight Hundred Twenty Three and Forty Two Paisa Only	**1,48,940.52**
	150 MM	Rmt	6.00	36,616.64	Rupees Thirty Six Thousand Six Hundred Sixteen and Sixty Four Paisa Only	**2,19,699.84**
13.4	Providing and fixing C class (heavy) GI union couplings with embossed ISI mark including cutting and threading of pipe of following diameters etc. complete in all respect as directed by Engineer in Charge .Note : Only MCGM approved GI pipe brands shall be used.					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	25 mm	Each	300.00	241.30	Rupees Two Hundred Forty One and Thirty Paisa Only	**72,390.00**
	40mm	Each	100.00	299.72	Rupees Two Hundred Ninety Nine and Seventy Two Paisa Only	**29,972.00**
	50mm	Each	150.00	381.00	Rupees Three Hundred Eighty One Only	**57,150.00**
	80 mm	Each	140.00	864.87	Rupees Eight Hundred Sixty Four and Eighty Seven Paisa Only	**1,21,081.80**
13.5	Providing and fixing GI elbows (heavy) with embossed ISI mark of following diameters etc. complete in all respect etc. complete as directed by Engineer in Charge. **Note : Only MCGM approved GI pipe brands shall be used.**					
	25 mm	Each	20.00	76.20	Rupees Seventy Six and Twenty Paisa Only	**1,524.00**
	40mm	Each	10.00	134.62	Rupees One Hundred Thirty Four and Sixty Two Paisa Only	**1,346.20**
	50mm	Each	60.00	176.53	Rupees One Hundred Seventy Six and Fifty Three Paisa Only	**10,591.80**
	80 mm	Each	10.00	379.73	Rupees Three Hundred Seventy Nine and Seventy Three Paisa Only	**3,797.30**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
13.6	Providing and fixing GI bends (heavy) of following diameters etc.complete in all respect etc. complete in all respect etc. complete as directed by Engineer in Charge. **Note : Only MCGM approved GI pipe brands shall be used.**					
	25 mm	Each	80.00	125.73	Rupees One Hundred Twenty Five and Seventy Three paisa Only	**10,058.40**
	40mm	Each	25.00	226.06	Rupees Two Hundred Twenty Six and Six Paisa Only	**5,651.50**
	50mm	Each	30.00	306.07	Rupees Three Hundred Six and Seven Paisa Only	**9,182.10**
	80 mm	Each	40.00	814.07	Rupees Eight Hundred Fourteen and Seven Paisa Only	**32,562.80**
13.7	Providing and fixing GI reducing Tees (heavy) with embossed ISI mark of following sizes etc. complete in all respect etc. complete in all respect as directed by Engineer in Charge. Note : Only MCGM approved GI pipe brands shall be used.					
	50 mm x 25mm	Each	25.00	513.08	Rupees Five Hundred Thirteen and Eight Paisa Only	**12,827.00**
	50mm x 40 mm	Each	10.00	828.04	Rupees Eight Hundred Twenty Eight and Four Paisa Only	**8,280.40**
13.8	Making connection of G.I. distribution branch with G.I. main of following sizes by providing and fixing tee,					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	including cutting and threading the pipe etc. complete :					
	25 to 40 mm nominal bore	Each	40.00	464.82	Rupees Four Hundred Sixty Four and Eighty Two Paisa Only	**18,592.80**
	50 to 80 mm nominal bore	Each	30.00	984.25	Rupees Nine Hundred Eighty Four and Twenty Five Paisa Only	**29,527.50**
13.9	Constructing masonry Chamber 30x30x50 cm inside, in brick work in cement mortar 1:4 (1 cement :4 coarse sand) for stop cock, with C. I. surface box 100x100 x75 mm (inside) with hinged cover fixed in cement concrete slab 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size), i/c necessary excavation, foundation concrete 1:4:8 (1 cement : 5 fine sand : 10 graded stone aggregate 40mm nominal size) and inside plastering with cement mortar 1:3 (1 cement : 3 coarse sand) 12mm thick, finished with a floating coat of neat cement complete as per standard design :					
	with common burnt clay FPS (non modular) bricks of class designation 7.5	Each	10.00	4,521.20	Rupees Four Thousand Five Hundred Twenty One and Twenty Paisa Only	**45,212.00**
13.10	Constructing masonry Chamber 60 x 60 x 75 cm inside, in brick workin cement mortar 1:4 (1 cement :4 coarse sand) for stop cock, with C. I. surface box 100x100 x75 mm (inside) with hinged cover fixed in cement concrete slab 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size), i/c necessary excavation, foundation concrete 1:4:8 (1 cement : 5 fine sand : 10 graded stone aggregate 40mm nominal size) and inside plastering with					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	cement mortar 1:3 (1 cement : 3 coarse sand) 12mm thick, finished with a floating coat of neat cement complete as per standard design :					
	with common burnt clay FPS (non-modular) bricks of class designation 7.5	Each	4.00	10,001.25	Rupees Ten Thousand One and Twenty Five Paisa Only	**40,005.00**
13.11	Constructing masonry Chamber 90 x 90 x100 cm inside, in brick work-in cement mortar 1:4 (1 cement :4 coarse sand) for stop cock, with C. I. surface box 100x100 x75 mm (inside) with hinged cover fixed in cement concrete slab 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size), i/c necessary excavation, foundation concrete 1:4:8 (1 cement : 5 fine sand : 10 graded stone aggregate 40mm nominal size) and inside plastering with cement mortar 1:3 (1 cement : 3 coarse sand) 12mm thick, finished with a floating coat of neat cement complete as per standard design :					
	with common burnt clay FPS (non-modular) bricks of class designation 7.5	Each	4.00	10,001.25	Rupees Ten Thousand One and Twenty Five Paisa Only	**40,005.00**
13.12	Gun Metal Gate Valves (SCREWED):(SP-ME-TS-72) (Supplying & Fixing)					
	25 mm	Each	50.00	1,762.76	Rupees One Thousand Seven Hundred Sixty Two and Seventy Six paisa Only	**88,138.00**
	40mm	Each	10.00	3,498.85	Rupees Three Thousand Four Hundred Ninety Eight and Eighty Five Paisa Only	**34,988.50**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	50mm	Each	30.00	5,375.91	Rupees Five Thousand Three Hundred Seventy Five and Ninety One Paisa Only	**1,61,277.30**
	80 mm	Each	25.00	13,792.20	Rupees Thirteen Thousand Seven Hundred Ninety Two and Twenty Paisa Only	**3,44,805.00**
	Monoblock Pump sets (Sp-Me-Ts-14)					
13.13	Providing, installing and testing of Monoblock pump set equipped with all required accessories like priming cup, air vent, suction & delivery pressure gauge etc.					
	Monoblock pump sets: 15 H. P. three phase motor, Head range: (6-36 mtr.) Discharge Range: (9-35 lps) (100 x 80) Pump body: Cast Iron, Impeller: Bronze, Shaft SS410	Each	4.00	100,153.47	Rupees One Lac One Hundred Fifty Three and Forty Seven Only	**4,00,613.88**
13.14	Providing and fixing C class (heavy) GI union couplings with embossed ISI mark for following diameters etc. complete in all respect as directed by Engineer in Charge. **Note : Only MCGM approved GI pipe brands shall be used.**					
	25 mm	Each	50.00	241.30	Rupees Two Hundred Forty One and Thirty Paisa Only	**12,065.00**
	40 mm	Each	50.00	299.72	Rupees Two Hundred Ninety Nine and Seventy Two Paisa Only	**14,986.00**
	50 mm	Each	60.00	381.00	Rupees Three Hundred Eighty One	**22,860.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
					Only	
	80 mm	Each	70.00	864.87	Rupees Eight Hundred Sixty Four and Eighty Seven Paisa Only	**60,540.90**
	Starter for Motors : (Complete with Interconnections & Wiring)					
13.15	Following rating starters. Enclosure for starter shall be Corrosion resistant powder coated CRCA enclosure with IP54 protection class shall be suitable for chemical factories, polluted industrial and dusty agricultural environment. Startersshall be provided with terminal block with proper terminal marking for ease of wiring. Terminal block can accommodate both aluminum & copper cables. Starter shall be provided with ON / OFF Indication lamps and Start / Stop Push buttons. Components for motor starter shall have type 2 co-ordination compliance and built in single phase protection. Colour shade shall be RAL 7032 smoke gray as per IS 5.					
	Automatic Star Delta Starter for 5 H.P to 15 H.P	Each	4.00	13,958.57	Rupees Thirteen Thousand Nine Hundred Fifty Eight and Fifty Seven Paisa Only	**55,384.28**
	Pump Panel					
13.16	Design, fabrication, assembly, supply, installation, testing &commissioning of Pump panel suitable for 415V, 3Ph. 4 wire system. Pump panel shall be wall mounted & shall be fabricated from 1.6mm thick CRCA sheet steel. Pump panel shall be earthed with 8/10 swg earth wire. Colour shade shall be RAL 7032 Siemens gray as per IS 5.	Each	2.00	110,021.37	Rupees One Lac Ten Thousand Twenty One and Thirty Seven Paisa Only	**2,20,042.74**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	415V Pump panel with 100A MCCB as incomer with phase indicator and ammeter & voltmeter with selector switches, 2nos. Of 32A MCB with Star delta Starter, local push button station & contactor of required rating as outgoing.					
	Sub Section 14 – Diversion of Existing Water Pipeline					
14.1	Providingand removing openorclosedshoringandstruttinginthetrenches/pitsforalldepthsasperspecifications/drawingsandorasdirectedbyEngineer-in-charge by including walling, struts, open poling boards, horizontalsheeting,runners,dogspikesby using timber etc. complete	Sqm	1,750.00	357.00	Rupees Three Hundred Fifty Seven Only	**6,24,750.00**
14.2	P/f Polyethylene plastic water/sand fillable Metro Barricades having approx. size 1840mm. X 440mm. X 1900mm., (LxWxD), 32-35 Kgs empty wt. and tank capacity 100-120 lits., manufactured by M/s. B.D. Industries or equivalent ISO Certified Company having minimum experience of 3 years in manufacturing and supplying to the Govt./Semi Govt./Other reputed organizations alongwith necessary fixing arrangement as specified and directed by the Engineer Incharge	Rmt	2,100.00	641.00	Rupees Six Hundred Forty One Only	**13,46,100.00**
14.3	Supplying mild steel pipes to site of work / any municipal store fabricated in any ISI/ ISO certified company, from mild steel plates of approved quality and thickness, confirming to IS 3589.The M.S. plates shall bare corresponding ISI mark. The item includes marking, cutting, rolling bending, welding using automatic submerged arc type welding machine, factory testing of pipes, loading at fabrication yard/ factory transportation to site of work/ any municipal store using truck/ trailer, unloading and stacking near place of work etc. complete as specified and as directed by Engineer in Charge. Each pipe shall be	Rmt	1,160.00	24,830.00	Rupees Twenty Four Thousand Eight Hundred Thirty Only	**2,88,02,800.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	about 5 to 7.5 mtr. long, fabricated as per IS:3589 and suitable for 10 kg/cm2 working pressure (spirally welded pipes fabricated from strips are not acceptable)					
14.4	Transporting within 500 m., laying in position to the correct line and level, M.S. Pipes with/without any out- coating on pedestals or chairs upon prepared formation. The rate to include loading, unloading, hoisting, marginal cutting wherever required, assembling and tack-welding complete as directed by Engineering -Charge.	Rmt	1,160.00	1,390.00	Rupees One Thousand Three Hundred Ninety Only	**16,12,400.00**
14.5	Field welding in all position with required number of runs, for M.S. pipes internally and/or externally including gauzing wherever necessary, fixing appurtenances and other accessories in connection of pipe laying work as per specification etc. complete as specified and as directed by Engineer in Charge. Note:circumference ***1200 mm dia -12 mm plate thickness***	Rmt	1,050.00	1,636.00	Rupees One Thousand Six Hundred Thirty Six Only	**17,17,800.00**
14.6	Field welding in all position with required number of runs, for M.S. pipes internally and/or externally including gauzing wherever necessary, fixing appurtenances and other accessories in connection of pipe laying work as per specification etc. complete as specified and as directed by Engineer-in-Charge. Lap Jointing with convex fillet weld	Rmt	160.00	874.00	Rupees Eight Hundred Seventy Four Only	**1,39,840.00**
14.7	Gas cutting (either square cut or V cut) pipes, plates etc. complete as specified and as directed by Engineer in Charge. of following thickness above 10 mm up to 14 mm	Rmt	2,500.00	221.00	Rupees Two Hundred Twenty One Only	**5,52,500.00**
14.8	Supplying, loading, transporting on site, unloading butterfly valves of PN 1.0 conforming to AWWA C-504 in SGI- IS 1865(Grade 500/7) material with appurtenances and flange adaptors, nuts, bolts, washers, packings etc. stacking the same as directed on site, hoisting, lowering and positioning the same in					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	true plumb and level with tappers, saddles, branchesflangesetc. on CI / DI or MS water mains and for PE pipes along with Long Neck PE and flange for following diameters. (Manually operated). The flange adapter used here conforms to AWWA C-219. Note : Butterfly valves, flange adaptors and all other materials shall be supplied as per the acceptance criteria of MCGM as given in specification.					
	600 mm	Each	2.00	3,13,479.00	Rupees Three Lac Thirteen Thousand Four Hundred Seventy Nine Only	**6,26,958.00**
	1200 mm	Each	2.00	13,70,927.00	Rupees Thirteen Lac Seventy Thousand Nine Hundred Twenty Seven Only	**27,41,854.00**
14.9	Brick work with common burnt clay modular bricks of class designation 7.5 in foundation and plinth in: Cement mortar 1:4 (1 cement : 4 coarse sand)	Cum	80.00	5,387.03	Rupees Five Thousand Three Hundred Eighty Seven and Three Paisa Only	**4,30,962.40**
14.10	Providing 20 mm thick cement plaster in cement mortar 1:2 including neat cement rendering (without water proofing compound) as specified & as directed by Engineer-in-Charge..	Sqm	300.00	240.00	Rupees Two Hundred Forty Only	**72,000.00**
14.11	Providing and fixing MS frame and cover with its complete assembly including supply and fixing of the same etc. complete for sluice valve, butterfly valves and kinetic air valves chambers as directed and as specified by Engineer in charge. The MS plate used for the cover shall be 20 mm thick. The new MS cover shall have anti-skid arrangement. The anti-skid arrangement shall be provided of 4mm thick MS flats of specified mm width and 300 mm center to center by continuous lap welding. \Following are the	Kg	8,000.00	76.00	Rupees Seventy Six Only	**6,08,000.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	Standard weights of MS frame and cover with its complete assembly with anti-skid arrangement. NOTE: Tolerance of +/- 5% of mentioned standard weights acceptable. 900x1200 mm = 281 Kg					
14.12	Cutting of cast iron and CI/DI pipes of all classes with cutting tools etc. complete as directed by the engineer in charge.	Each	150.00	1,375.00	Rupees One Thousand Three Hundred Seventy Five Only	**2,06,250.00**
14.13	Transporting appurtenances or any other fabricated steel materials including loading, unloading, etc. complete upto 2 km.	MT	600.00	995.00	Rupees Nine Hundred Ninety Five Only	**5,97,000.00**
14.14	Extra over the above rate of Item No. WSP-2-13 for transporting the material beyond 2 km. **For additional 20 Km**	MT/Km	12,000.00	847.00	Rupees Eight Hundred Forty Seven Only	**1,01,64,000.00**
14.15	Supplying, transporting on site and fixing Tamper Proof Kinetic Air valves of PN 1.0 conforming to AWWA C-512 with sluice valves (double port) with nuts, bolts, washers etc. Including making holes in the main and fixing saddle pieces,etc.complete. Note : Kinetic air valves with sluice valves (double port) and all other materials shall be supplied as per the acceptance criteria of MCGM as given in specification	Nos	12.00	1,31,501	Rupees One Lac Thirty One Thousand Five Hundred One Only	**15,78,012.00**
14.16	Providing &**applying 3-layer fusion bonded polyethylene (3LPE) coating** to mild steel pipes externally of 3000 microns and internally 2000 microns. The Polyethylene used shall be food grade material and the coating shall confirm to DIN-30670 standard. 100 mm space shall be left uncoated (cutback) on both ends of the mild steel pipe for welding purpose & the same shall be coated after completion of welding at site with 100% solid, cold applied, polymeric coating. The item is inclusive of PE material, process of coating, cleaning of pipe internally by sand blasting and preparing surface dust	Sqm	200.00	1,265.00	Rupees One Thousand Two Hundred Sixty Five Only	**2,53,000.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	free for application of PE coating and also inclusive of welding joint at site and 10cm of each pipe shall coated with Co-Polymer paint PE-80 used for cold application paint for polyethylene coating 500 micronsinside and 500 microns outside, etc. complete in all respect and as directed by Engineer In Charge. NOTE : In any case the PE coated pipes shall not be used for laying above ground and for making bends or specials					
14.17	Providing & applying Internal Fusion Bonded Epoxy coating 400 microns as per IS 3589 Annex C. for above ground application.	Sqm	200.00	1,265.00	Rupees One Thousand Two Hundred Sixty Five Only	**2,53,000.00**
14.18	Fabricating ,Supplying & transporting M.S. material of required thickness suitable for lead joint / mechanical joints to any municipal chowky or site of work , minor fixtures such as man hole frame & covers, pressure and non-pressure type blank flanges, loose flanges, rings, saddle pieces, small pieces to form saddle pieces, collars, clamp collars, bends / tees of various sizes with or without suitable sockets / flanges, small pieces of pipes with or without suitable sockets / flanges, end caps, ladders, platforms, stiffener rings etc. Payment will be made as per actual weight of material.	Kg	2,300.00	70.00	Rupees Seventy Only	**1,61,000.00**
14.19	Hydraulic testing of M.S. Pipeline to the specified pressure for the length upto 1 km. using reciprocating type pumps which should be able to provide specified test pressure, pressure gauges, & other necessary Equipments labour, operation charges, etc. required testing. The rate under this item shall also include cost of re-testing if necessary. Water will be made available free of cost by MCGM for first testing and water charges will be borne by contractor for re-testing.	Km	1.00	25,374.00	Rupees Twenty Five Thousand Three Hundred Seventy Four Only	**25,374.00**
14.20	For Item 14.19 - Extra over and above rates for hydraulic testing beyond 1km for	Km	1.00	2,538.00	Rupees Two Thousand Five	**2,538.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	every additional km or part thereof.				Hundred Thirty Eight Only	
14.21	Supply & filling sand, metal GRAVELLY SAND Corresponded to CLASS II/ CLASS III GRADING of TABLE 100.1of new road Specifications-2006 in trenches upto required depth & watering, ramming etc. complete as directed	Cum	610.00	2,069.00	Rupees Two Thousand Sixty Nine Only	**12,62,090.00**
14.22	Providing & laying, spreading & compacting specified crushed stone in granular subbase course including premixing the material in mechanical mixer (pug mill or approved type), spreading of mixed material in uniform layer of 100mm to 75mm (compacted thickness each) with motor grader or paver on prepared murum surface & compacting with 10 tons vibratory roller to achieve desired density including all material, labour, machinery, lighting barricading to all lifts & lead maintenance of diversion etc. complete (metal gradation from 75mm to 75mm micron as per MCGM Road Specifications clause no.210).	Sqm	70.00	2,484.00	Rupees Two Thousand Four Hundred Eighty Four Only	**1,73,880.00**
14.23	Providing & laying, spreading & compacting graded crushed stone aggregate to wet mix macadam satisfaction including premixing the material with water to OMC in mechanical mix (pug mill) carriage of mix material by tipper to site laying in uniform layer of 75mm to100mm (compacted thickness each)with sensor paver finisher on prepared subbase & compacting with vibratory roller (10 tons) to achieve desired density including lighting, guarding barricading & maintenance of diversion etc. as directed by the Engineer, (Rebate for not using sensor paver should be taken,(metal gradation from 53mm to 75mm micron as per MCGM Road Specifications clause no.240).	Cum	90.00	2,768.00	Rupees Two Thousand Seven Hundred Sixty Eight Only	**2,49,120.00**
14.24	P/L hot Premix Dense bituminous macadam with 4.50% bitumen content of grade 30-40 to the required line,level,and camber rolling with 10/12 M.T.power	Sqm	350.00	721.00	Rupees Seven Hundred Twenty One Only	**2,52,350.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	,vibratory roller & sensor paver etc. complete as specified and as directed to thickness of 75 mm. with antistripping agent at 1.00%by weight of bitumen using grading II of "MORTH"(As per new Road Specification clause no.354)					
14.25	P/L premix hot mix Bituminous concrete with 6.00% of 60/70 Pen bitumen content by weight of mix surface coat to compacted thickness of 40 mm. using new material to the required grade, level and camber rolling with vibratory roller , power roller,pneumatic roller & using sensor paver etc. complete as specified and as directed with addition of lime filler 2% by weight of mix and anti-stripping agent @ 1.00% of bitumen etc.(As per New Road Specifications Clause No. 364)	Sqm	360.00	463.00	Rupees Four Hundred Sixty Three Only	**1,66,680.00**
14.26	Providing and applying TACK COAT with CATIONIC BITUMEN EMULSION (RS) @ 0.25 to 0.30 Kg. of Sq.mt. over prepared surface to receive bituminous mix by applying TACK COAT with mechanical spray bitumen, including cleaning of road surface etc. completed, as directed For GRANULAR SURFACES Treated with PRIMER (Clause No. 314)	Sqm	360.00	28.00	Rupees Twenty Eight Only	**10,080.00**
14.27	Providing and applying TACK COAT with CATIONIC BITUMEN EMULSION (RS) @ 0.2 to 0.25 Kg. of Sq.mt. over prepared surface to receive bituminous mix by applying TACK COAT with mechanical spray bitumen, including cleaning of road surface etc. completed, as directed for NORMAL BITUMINOUS SURFACES & the tack coat shall be left to cure until all the volatiles have evaporated before any subsequent construction is started, which is indicated by change in colour from brown to black (As per New Road Specifications Clause No. 314, curing as per 314.3.4)	Sqm	360.00	26.00	Rupees Twenty Six Only	**9,360.00**
	Sub Section 15 – Storm Water Drain / Boundary Wall / Retaining Wall					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
15.1	Providing & Fixing **100 mm. dia PVC. Pipes** of approved quality as weep holes in Nalla/retaining walls, etc. complete as directed by Engineer-in-charge.	**Rmt.**	6823.36	157.00	Rupees One Hundred Fifty Seven Only	**10,71,267.52**
15.2	Providing and laying of **Filter media** with granular materials/stone crushed aggregates satisfying the requirements laid down in clause 2504.2.2. of Mort&h specifications to a thickness of not less than 600mm with smaller size towards the soil and bigger size towards the wall and provided over the entire surface behind retaining wall to the full height compacted to a firm condition complete as per drawing and technical specification, etc. complete as directed by Engineer-in-charge.	**Cum**	3,036.00	1,109.00	Rupees One thousand One Hundred Nine Only	**33,66,924.00**
15.3	Providing & casting **R.C.C. M-35 grade cement concrete Precast Panel Wall** with one sided texture, wall having dimension 150 mm thick (thickness excluding texture) & 2000 mm height as per IS 456:2000 of trap/ granite / quartzite /gneiss metal as per the detailed drawing, each panel should be cast from column to column & length of each panel may be vary as per site condition or as instructed by Engineer, the texture should be as per detailed drawing, the rates are inclusive of mould, scaffolding, centering, formwork, compacting, texture finishing, curing, lifting, transportation & placing in position, etc. complete as directed by Engineer-in-charge. (Excluding reinforcement and structural steel).	**Cum**	924.00	14,008.00	Rupees Fourteen Thousand Eight Only	**1,29,43,392.00**
15.4	Providing & fixing in position **expansion joint with 25mm thick Bitumen board** as per detailed drawing, etc. complete as directed by Engineer-in-charge.	Sqm	1,137.00	1,016.00	Rupees One Thousand Sixteen Only	**11,55,192**
15.5	Providing and fixing **600 mm dia concertina barbed razer** type coil of 19mm wide ribbon with thickness 5 SWG and central core wire of 12 SWG with antirust coating / Galvanization as per manufacturer specifications, supported over 5 rows of barbed wires of 14 SWG / Type II- conforming IS 278 and IS 4826,	Rmt	2,216.00	361.00	Rupees Three Hundred Sixty One Only	**7,99,976.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	having two ply four points at 75mmc/c, fixed to Y shape angle bracket placed at 2.45m c/c (leg of Y should be fixed with 75x75x6mm thick insert plate , wing of Y should be 0.475m long having a distance of 0.58m between the two wing on the top) made up of 50mmx50mmx6mm M.S.angle fixed in column. The concertina coil should be fixed to angle with M.S.Flat 25mmx5mm thick on both the sides as runner all steel work shall be applied with one coat of red oxide zinc chromate primer and two coat of Synthetic Enamel paint, etc. complete as directed by Engineer-in-charge.					
15.6	Providing and applying two coats of **Hi-Build coal tar epoxy** for SWD, Retaining Wall, Boundary Wall formulation corroseal TE-321 with an interval of minimum 4hours-8hours between application of successive coats including preparing and cleaning the surface thoroughly so as to remove deposited salts, grease, oil, dust, tar etc. using coarse brush, etc. complete as directed by Engineer-in-charge.	Sqm.	36810.00	274.00	Rupees Two Hundred Seventy Four Only	**1,00,85,940.00**
15.7	Providing and fixing **0.90m x 0.60m internal size rectangular air tight composite resin manhole cover and frame** of approved brand with grade designation D400 as per EN-124 standard with bolt and lever type locking arrangement. Covers & frame shall have top abrasion resistant layer conforming to IS-15658:2006 and permissible permanent set value of 3 mm after the application of 2/3 test load in five continuous applications as per EN-124, the testing shall be performed in fully equipped and NABL certified test lab with random batch test (2% of lot size) as per testing procedure stated in EN-124 standard, including testing, inspection of material sample and finished product in presence of Engineer-in-charge. (3 nos.) at Manufacturer's work. Inspection shall be as per guidelines of IS and EN-124 standard specifications, etc. complete as directed by Engineer-	No.	210.00	23,200.00	Rupees Twenty Three Thousand Two Hundred Only	**48,72,000.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	in-charge.					
15.8	Providing & Fixing **0.45m X 0.45m internal size** of rectangular composite **resin gully grating and frame**(with minimum waterway areas 35% of internal size) of approved brand with grade designation D400 as per EN-124 standard with bolt and lever type locking arrangement. gully gratings & frame shall have top abrasion resistant layer conforming to IS-15658:2006 and permissible permanent set value of 1.5 mm after the application of 2/3 test load in five continuous applications as per EN-124, the testing shall be performed in fully equipped and NABL certified test lab with random batch test (2% of lot size) as per testing procedure stated in EN-124 standard, including testing ,inspection of material sample and finished product in presence of Engineer-in-charge (3 nos.) at Manufacturer's work. Inspection shall be as per guidelines of IS and EN-124 standard specifications, including fixing with M-20 concrete and locking arrangement, as per specification no SP-SWD-3, etc. complete as directed by Engineer-in-charge.	No.	35.00	7,159.00	Rupees Seven Thousand One Hundred Fifty Nine Only	**2,50,565.00**
15.9	Providing and laying **300mm dia NP2 class RCC hume pipe** confirming to IS 458:2003, cutting to required length for SWD bellmouth /water entrance locations including jointing, masonry work in mortar 1:2 for water entrance, etc. complete as directed by Engineer-in-charge.	Rmt.	213.00	908.00	Rupees Nine Hundred Eight Only	**1,93,404.00**
15.10	Suppling and fixing **CI steps** weighing 5.44kg each confirming to IS 5455- 1969(Reaffirmed 2003), etc. complete as directed by Engineer-in-charge.	Each	1,720.00	346.00	Rupees Three Hundred Forty Six Only	**5,95,120.00**
	Sub Section 16 – Rain Water Harvesting Wells & Pumps					
16.1	Boring/drilling bore well of required dia for casing/ strainer pipe, by suitable method prescribed in IS:					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	2800 (part I), including collecting samples from different strata, preparing and submitting strata chart/ bore log, including hire & running charges of all Equipments, tools, plants & machineries required for the job, all complete as per direction of Engineer -in-charge, beyond 90 metre & upto 150 metre depth below ground level.					
	in rocky strata including boulders (300 mm)	m	200.00	1,156.55	Rupees One Thousand One Hundred Fifty Six and Fifty Five Paisa Only	**231,310.00**
16.2	Supplying, assembling, lowering and fixing in vertical position in bore well, unplasticized PVC medium well casing (CM) pipe of required Dia, conforming to IS: 12818, including required hire and labour charges, fittings & accessories etc. all complete, for all depths, as per direction of Engineer -in-charge.					
	200 mm nominal size	m	200.00	1,027.96	Rupees One Thousand Twenty Seven and Ninety Six paisa Only	**205,592.00**
16.3	Supplying, assembling, lowering and fixing in vertical position in bore well unplasticized PVC medium well screen (RMS) pipes with ribs, conforming to IS: 12818, including hire & labour charges, fittings & accessories etc. all complete, for all depths, as per direction of Engineer-in-charge.					
	200 mm nominal size		200.00	960.34	Rupees Nine Hundred Sixty and Thirty Four Paisa Only	**192,068.00**
16.4	Supplying, filling, spreading & leveling stone boulders of size range 5 cm to 20 cm, in recharge pit, in the required thickness, for all leads & lifts, all complete as per direction of Engineer-in-charge.	Cum	40.00	589.86	Rupees Five Hundred Eighty Nine and Eighty Six paisa Only	**23,594.40**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
16.5	Supplying, filling, spreading & leveling gravels of size range 5 mm to 10 mm, in the recharge pit, over the existing layer of boulders, in required thickness, for all leads & lifts, all complete as per direction of Engineer-Incharge.	Cum	40.00	1,065.46	Rupees One Thousand Sixty Five and Forty Six paisa Only	**42,618.40**
16.6	Supplying, filling, spreading & leveling coarse sand of size range 1.5 mm to 2 mm in recharge pit, in required thickness over gravel layer, for all leads & lifts, all complete as per direction of Engineer -in-charge.		40.00	997.54	Rupees Nine Hundred Ninety Seven and Fifty Four paisa Only	**39,901.60**
16.7	Gravel packing in tube well construction in accordance with IS: 4097, including providing gravel fine/ medium/ coarse, in required grading & sizes as per actual requirement, all complete as per direction of Engineer in- charge.		40.00	1,155.78	Rupees One Thousand One Hundred Fifty Five and Seventy Eight paisa Only	**46,231.20**
16.8	Providing and fixing factory made precast RCC perforated drain covers, having concrete of strength not less than M-25, of size 1000 x 450x50 mm, reinforced with 8 mm dia four nos longitudinal & 9 nos cross sectional T.M.T. hoop bars, including providing 50 mm dia perforations @ 100 to 125 mm c/c, including providing edge binding with M.S. flats of size 50 mm mm x 1.6 mm complete, all as per direction of Engineer-in-charge.		4.00	1,124.19	Rupees One Thousand One Hundred Twenty Four and Nineteen paisa Only	**4,496.78**
16.9	Supplying, assembling, lowering and fixing in vertical position in bore well, ERW (Electric Resistance Welded) FE 410 plain slotted (having slot of size 1.6/3.2 mm) mild steel threaded and socketed / plain bevel ended pipe (type A) of required dia, conforming to IS: 8110, of reputed and approved make, having wall thickness not less than 5.40 mm, including painted with outside surface with two coats of anticorrosive bitumestic paint of approved brand and manufacture, including hire & labour charges, fittings & accessories, all complete, for all depths, as per direction of Engineer -in-charge.					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	200 mm nominal dia.		100.00	2,015.27	Rupees Two Thousand Fifteen and Twenty Seven Paisa Only	**201,527.00**
16.10	Development of tube well in accordance with IS : 2800 (part I) and IS: 11189, to establish maximum rate of usable water yield without sand content (beyond permissible limit), with required capacity air compressor, running the compressor for required time till well is fully developed, measuring yield of well by "V" notch method or any other approved method, measuring static level & draw down etc. by step draw down method, collecting water samples & getting tested in approved laboratory, i/c disinfection of tube well, all complete, including hire & labour charges of air compressor, tools & accessories etc., all as per requirement and direction of Engineer-in-charge.	hours	100.00	792.09	Rupees Seven Hundred Ninety Two and Nine Paisa Only	**79,209.00**
16.11	Providing and fixing suitable size threaded mild steel cap or spot welded plate to the top of bore well housing/ casing pipe, removable as per requirement, all complete for bore well of:					
	200 mm nominal dia.	Each	4.00	285.36	Rupees Two Hundred Eighty Five and Thirty Six Paisa Only	**1,141.44**
16.12	Providing and fixing M.S. clamp of required dia to the top of casing/housing pipe of tube well as per IS: 2800 (part I), including necessary bolts & nuts required size complete.					
	200 mm nominal dia.	Each	4.00	1,554.93	Rupees One Thousand Five Hundred Fifty Four and Ninety Three Paisa Only	**6,219.72**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
16.13	Providing and fixing Bail plug/ Bottom plug of required dia to the bottom of pipe assembly of tube well as per IS: 2800 (part I).					
	200 mm nominal dia.	Each	4.00	311.04	Rupees Three Hundred Eleven and Four Paisa Only	**1,244.16**
	Geophysical investigation of the aquifer by suitable and accepted method	Each	2.00	10,255.00	Rupees Ten Thousand Two Hundred Fifty Five Only	**20,510.00**
	testing of all water parameters as per IS 10500	Each	2.00	3,845.00	Rupees Three Thousand Eight Hundred Forty Five Only	**7,690.00**
16.14	Providing, erecting and giving test of submersible pump (Grunfoss / KSB / Crompton /Kirloskar)set conforming to IS 8034 and motor conforming to IS 9283, with water proof winding. Pump shall be suitable for various delivery head and discharge with stainless steel shaft. Motor suitable for working on 415 V ± 10%, 3 Ph, 50 Hz A.C. Supply, with cable guard, thrust carbon/fiber bearing to withstand entire hydraulic thrust. The pump set shall be suitable for direct coupling, with suitable suction strainer. Pump should have suitable discharge out let as per manufacturer's design. Antithrust stream lined non return valve shall be provided with the pump. 3 m submersible copper conductor cable in single / double run and 2 pairs of suitable size erection clamp 10 mm thick shall be provided with each pump.					
	Submersible Pump 150 mm dia (with Bronze Impeller) up to 8 stages/7.5 HP	Each	2.00	45,162.28	Rupees Forty Five Thousand One Hundred Sixty Two and Twenty Eight Paisa Only	**90,324.56**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	Supply & installation of wall type weather proof make auto control panel comprising of Voltmeter, Ammeter, SPP, powder coated 16 gauge suitable rating DOL Starter, complete.	Each	2.00	13,740.13	Rupees Thirteen Thousand Seven Hundred Forty and Thirteen Paisa Only	**27,480.26**
16.15	LV Cables of following sizes to be laid buried in ground/ laid in cable trays in readymade trenches, cables shall be fitted on wall / ceiling by the means of saddle & spacers. Miscellaneous items such as cable dressing accessories like nylon tie, Aluminum clamps, GI cleats, cable tags etc. are included in the scope. Removal of empty drums, cartoons and making the site normal as instructed by Engineer in charge					
	3C/2.5 sq.mm	m	50.00	94.50	Rupees Ninety Four and Fifty Paisa Only	**4,725.00**
	3C/ 4sq.mm	m	50.00	105.84	Rupees One Hundred Five and Eight Four Paisa Only	**5,292.00**
16.16	Providing, fixing, jointing and testing in position the following heavy class GI pipes conforming to IS1239 cut to required length including all necessary fittings and specials, such as bends, tees, unions, reducers, flanges & plugs etc. threading, jointing and making proper connections, 100 mm thick fine sand around the pipes, including excavation in all kind of soil (excluding hard rock), for pipe running at minimum 1.0m to 1.2m depth, dewatering, refilling, watering, ramming & removing the surplus excavated material and making good the same complete as required					
	40 mm		320.00	389.00	Rupees Three Hundred Eighty Nine Only	**124,480.00**
	50 mm		50.00	536.00	Rupees Five Hundred Thirty Six Only	**26,800.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	80 mm		300.00	866.00	Rupees Eight Hundred Sixty Six Only	**259,800.00**
	100 mm		1,550.00	1,214.00	Rupees One Thousand Two Hundred Fourteen Only	**1,881,700.00**
16.17	gun metal non - return valve: (screwed) (sp-me- ts-72)					
	25 mm dia.		25.00	932.00	Rupees Nine Hundred Thirty Two Only	**23,300.00**
	40 mm dia.		15.00	1,799.00	Rupees One thousand Seven Hundred Ninety Nine Only	**26,985.00**
	50 mm dia.		15.00	2,527.00	Rupees Two Thousand Five Hundred Twenty Seven Only	**37,905.00**
	80 mm dia.		25.00	7,331.00	Rupees Seven Thousand Three Hundred Thirty One Only	**183,275.00**
	100 mm dia		10.00	13,455.00	Rupees Thirteen Thousand Four Hundred Fifty Five Only	**134,550.00**
	Sub Section 17 – Rain Water Harvesting Pits					
17.1	Providing, Erecting and commissioning of Single Jacket Vee wire weld edge Screen filter fabricated in pipe form from steel wires SS304 having slot opening of 0.15mm with top of the filter capped to ensure the raw water enter horizontally in the screen assembly	Each	18.00	430,300.00	Rupees Four Lac Thirty Thousand Three Hundred Only	**77,40,000.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	and effectively filter out maximum suspended solid from the raw water with non-clogging slots for sustained recharging rate. The specifications and scope are as follows:					
	Filter Dimension shall be at least 150mm Dia X 2mt screen length having minimum flow rate 97000 lit / Hr.					
	Excavation up to a depth of specified in the drawing including removing of debris in all types of soil and cartage of the same to a specified location within 1.0 km radius as specified by Engineer in charge					
	Design, construct Rain water holding tank made in ferrocrete using CM 1:2.5 Pre packed in steel mesh comprising of circular skeletal tor steel 8 mm Dia at 250 c/c both ways, one layer 100x100x12 gauge on weld mesh on the inside face and two layer of chicken mesh 12x12x24 gauge on the both the side of steel skeletal frame fully stretched.					
	Including fabrication and erection of skeletal steel weld mesh, chicken mesh & press filling of mortar on both sides Including finishing the same to ensure a smooth uniform finish. The thickness should be 30 mm. the inside of the tank shall be treated two coats of polymer modified cement base waterproof coating having DFT of 1.5 mm. (refer sketch attached)					
	Hydro test per BIS provisions of 3370 etc. complete.					
	Providingand constructing 300 mm Dia recharging bore including drilling by appropriate method and providing casing for top 6 m using rigid PVC pipe as per appropriate BIS standard include flushing out bore cleaning and capping the same.					
	Work shall also include plumbing, fixing reducer pipe, flange etc., as maybe required to connect to the filter					
	Sub Section 18 – Effluent Treatment Plant					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
18.1	Designing, providing, installations, testing and commissioning of effluent treatment plant including all electrical and mechanical equipment	Each	1.00	145,60,000.00	Rupees One Crore Forty Five Lac Sixty Thousand Only	**145,60,000.00**
	Piping, valves, sleeves, control panels, based on any technology like MBBR,FAB, etc.					
18.2	Including all civil works for the following incoming and outgoing parameters. The design basis considered to size the treatment plant as follows including as required in the specifications	Year	1.00	11,64,800.00	Rupees Eleven Lac Sixty Four Thousand Eight Hundred Only	**11,64,800.00**
	Operation and maintenance for twelve months after successful commissioning of the plant and approval from the authorities including man power but excluding consumables					
	Sub Section 19 – Sewerage Treatment Plant					
19.1	Designing, Providing, installation testing and commissioning of sewer treatment plant (STP) including all electrical & mechanical Equipments, piping, sleeves, control panels, based on any approved technology like MBBR, FAB/Electronic Basis circulation pump wiring panel etc. complete in all respect including all equipment & consumable materials of STP including all civil work, RCC tanks as per design, consider to size of the treatment plant is as 150 Cum./day for 20 hours operation. (150KLD). The item includes recirculation pump of suitable capacity including wiring panel. The proposal should include, Bar screen chamber, Oil & Grease tank, Equalization tank, Chlorination tank, Salt dose tank, Packaged unit, Flocculation tank & mixer Filter unit, Underground treated water sump, Bypass unit etc. and all required for successful of commissioning of Plant ***(Alternate proposal will also be consider if found suitable)***	Set	1.00	190,58,206.73	Rupees One Crore Ninety Lac Fifty EightThousandTwo Hundred Six and Seventy Three Paisa Only	**1,90,58,206.73**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	Sub Section 20 – Road Works					
20.1	Providing & laying **Granular Sub-Base (GSB)** as per clause 401 of M.O.R.T.&H (2001) specifications of specified grading (Table 400-1 or 400-2) in specified thickness in layers. The item to include premixing the materials in plant, transportation to site, spreading in uniform layers with motor grader on a prepared subgrade, compacting with vibratory rollers till 98% of the maximum dry density (IS 2720 part-8) is achieved, etc. complete as directed by Engineer-in-charge.	Cum	729.90	1,300.00	Rupees One Thousand Three Hundred Only	**9,48,870.00**
20.2	Providing & laying **Wet Mix Macadam (WMM)** as per clause 406 of M.O.R.T.&H (2001) specifications of specified grading (Table 400-11) in specified thickness in layers. The item to include premixing the materials in plant, transportation to site, spreading in uniform layers with paver on a prepared sub-base, compacting with vibratory rollers till 98% of the maximum dry density (IS 2720 Part-8) is achieved, etc. complete as directed by Engineer-in-charge.	Cum	729.90	1,250.00	Rupees One Thousand Two Hundred Fifty Only	**9,12,375.00**
20.3	Providing and laying **Hot Mix Hot Laid Bituminous Macadam** of required thickness with required 3.4 % of bitumen of VG 30, by weight of total mix forBase / Profile Corrective course to remove irregularities, including all material and crushed aggregates of required grading , premixed with bituminous binder, including diversion of traffic, heating bitumen and chips in drum mix plant, laying bituminous macadam over a previously prepared surface by hydrostatic paver finisher with sensor control to the required grade level & alignment, including compacting with vibratory roller, transportation and cost of all materials, Cleaning etc. complete. (excluding tack	Cum	729.90	6,400.00	Rupees Six Thousand Four Hundred Only	**46,71,360.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	coat) Using DRUM MIX PLANT 60 to 90 TPH etc. complete.					
20.4	Providing and applying **Tack Coat** with Suitable low Viscosity paving Bitumen of VG 10 Grade confirming to IS -73 using Bitumen pressure distributor at the rate of 0.3 kg per Sqm on the prepared bituminous/granular surface cleaned with mechanical broom etc. complete.	Sqm	729.90	21.00	Rupees Twenty One Only	**15,327.90**
20.5	Providing and applying **Primer Coat** with Bitumen of V.G. 10 on prepared surface of granular Base including clearing of road surface and spraying primer at the rate of 0.60 kg / Sqm using mechanical means.	Sqm	729.90	46.00	Rupees Forty Six Only	**33,575.40**
20.6	Providing and laying **Dry Lean Concrete** base including providing coarse and fine aggregate to the specified gradation using minimum cement content 150 kg/cum of concrete with OPC 53 grade cement mixing of concrete as per approved design mix	Cum	3,288.70	4,206.00	Rupees Four Thousand Two Hundred Six Only	**138,32,272.20**
20.7	Providing and laying **Pavement Quality Concrete** of M 40 grade including providing 125 micron thick impermeable plastic sheet membrane over the surface to be covered, coarse and fine aggregates of specified gradation using minimum cement content 350 kg/cum.	Cum	9,866.10	6,402.00	Rupees Six Thousand Four Hundred Two Only	**631,62,772.20**
20.8	Providing, Laying and rolling of open graded **Premix Carpet Surfacing** 20 mm thickness composed of 13.2mm to 5.6mm aggregates either using 60/70 grade bulk bitumen to required line, grade and level to serve as wearing course on a previously prepared base, including mixing in 80-120 TPH Batch Mix Plant with SCADA and intelligent compactor, laying with hydrostatic paver finisher with sensor control to the required level and grades etc. Complete.	Sqm	4,866.00	163.00	Rupees One Hundred Sixty Three Only	**7,93,158.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	Sub Section 21 – Plumbing Works					
	Potable Water Supply Piping Work					
21.1	Heavy Class C GI pipes and fittings conforming to IS: 1239 and IS: 1879 with fittings, union and clamps, elbows, tee etc. paint pipes and fitting with two coat of anti-corrosive bitumastic paint and wrapping two layers of polyethylene tape, including external work of soil and restoration complete in all respects. **(embedded pipe / external)**					
	25 mm dia		375.00	530.00	Rupees Five Hundred Thirty Only	**1,98,750.00**
	40 mm dia		-	766.00	Rupees Seven Hundred Sixty Six Only	**-**
	50 mm dia		210.00	977.00	Rupees Nine Hundred Seventy Seven Only	**2,05,170.00**
21.2	Heavy Class C GI pipes conforming to IS: 1239 and IS: 1879 with specials, fittings, union and clamps internal working, painted exposed pipe with two coats of enamel of approved shade and make, including holes in walls, floors, R.C.C. slab/ beam and restoration of the same complete in all respects. (internal)					
	15 mm dia	RM	160.00	391.00	RupeesThree Hundred Ninety One Only	**62,560.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	20 mm dia	RM	435.00	407.00	RupeesFour Hundred Seven Only	**1,77,045.00**
	25 mm dia	RM	485.00	482.00	RupeesFour Hundred Eighty Two Only	**2,33,770.00**
	32 mm dia	RM	30.00	512.00	RupeesFive Hundred Twelve Only	**15,360.00**
	40 mm dia	RM	2,057.00	696.00	RupeesSix Hundred Ninety Six Only	**14,31,672.00**
21.3	Making connection from main potable water supply line including necessary excavation & making good the same including cutting, boring and taping the existing line by providing and installing ferrule connections with necessary fittings as required and making good the same.	LS	14.00	12,719.00	RupeesTwelve Thousand Seven Hundred Nineteen Only	**1,78,066.00**
21.4	G.I. pipe heavy class sleeve 450mm long, threaded on both sides upto 65 mm dia and flanged ends(both side) above 65 mm dia pipes with 6mm thick M.S. plate 100mm wide welded around in the centre of pipe as per detail complete in all respects.					
	50 mm dia	Nos	1.00	3,273.00	RupeesThree Thousand Two Hundred Seventy Three Only	**3,273.00**
	40 mm dia	Nos	16.00	2,334.00	RupeesTwo Thousand Three Hundred Thirty Four Only	**37,344.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
21.5	Supply, providing, installation, test and commissioning water meter. **Water meter** conforming to IS: 779 with direct reading dial in KL with all internal parts in gunmetal or brass, strainer, flanged distance piece for easy removal in future 100 mm dia, boulder type pressure gauge and isolated cock including necessary test certificate for the meter from municipal authority.					
	25 mm dia.	Set	6.00	8,873.00	Rupees Eight Thousand Eight Hundred Seventy Three Only	**53,238.00**
	40 mm dia.	Set	7.00	14,045.00	Rupees Fourteen Thousand Forty Five Only	**98,315.00**
	50 mm dia.	Set	1.00	15,622.00	Rupees Fifteen Thousand Six Hundred Twenty Two Only	**15,622.00**
	100 mm dia.	Set	1.00	31,554.00	Rupees Thirty One Thousand Five Hundred Fifty Four Only	**31,554.00**
21.6	Supply, providing, fixing and installation of valves and accessories, valves shall be the types or models, which are suitable for the working fluid in the system. The rated working pressure of the valve as specified for the working fluid shall be at least 1.5 times of the actual working pressure, but not less than 1,034 kPa (150 PSIG).					
	Lever **ball valve** P.N. 40 hotforged sand blasted nickel plated body and cap sealed with loctite chrome plated brass valve carbon steel handle PVC coated complete in all respects. (screw type)					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	for 25 mm nominal bore	Nos	12.00	1,791.00	Rupees One Thousand Seven Hundred Ninety One Only	**21,492.00**
	for 40 mm nominal bore	Nos	28.00	3,664.00	Rupees Three Thousand Six Hundred Sixty Four Only	**1,02,592.00**
	for 50 mm nominal bore	Nos	4.00	4,085.00	Rupees Four Thousand Eighty Five Only	**16,340.00**
21.7	Supply providing, fixing and installation of **pressure reducing valve** as indicated in the Drawings and at the location where pressure would be too high and cause the problem. The Pressure Reducing Valve is a hydraulically operated, single seated globe valve controlled by a direct acting spring and diaphragm pilot valve. It is available in globe or angle body. The main valve shall be operated by the downstream pressure passing through the pilot system. The body shall be cast iron. Seat and stem shall be stainless steel. The diaphragm shall be reinforced synthetic rubber.					
	It will reduce a high pressure of upstream to a predetermined lower pressure of downstream.					
	(a)Pressure ratings:1,034 kPa. (150 PSI.)					
	(b)Pressures adjust ranges: 170 to 550 kPa. (25 to 80 PSI.)					
	32 mm dia	Nos	6.00	6,935.00	Rupees Six Thousand Nine Hundred Thirty Five only	**41,610.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	40 mm dia	Nos	14.00	11,750.00	Rupees Eleven Thousand Seven Hundred Fifty Only	**1,64,500.00**
	50 mm dia	Nos	1.00	13,055.00	Rupees Thirteen Thousand Fifty Five Only	**13,055.00**
21.8	Supply, providing , fixing and installation of **strainer** as indicated in the Drawings and strainers shall be of the Y type. Strainers of 50 mm and smaller shall have bronze or iron bodies with screwed connections while 65 mm strainers and larger shall have iron bodies and flanged connections. They shall have the same rating as the piping system. A water strainer shall comply with the requirements of the ASTM standards.					
	32 mm dia	Nos	6.00	2,546.00	Rupees Two Thousand Five Hundred Fourty Six Only	**15,276.00**
	40 mm dia	Nos	14.00	3,696.00	Rupees Three Thousand Six Hundred Ninety Six Only	**51,744.00**
21.9	Supply, providing, fixing and installation of **Water Hammer Arrestors** as indicated in the Drawings. Water hammer arrestor shall be installed at discharge pipe of water pump It contains only one moving part; a spherical piston which floats inside the surge copper chamber, built in valve and gauge assembly simplifying charging and recharging procedure					
	25 mm dia	Nos	12.00	1,610.00	Rupees One Thousand Six Hundred Ten Only	**19,320.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	32 mm dia	Nos	6.00	2,108.00	Rupees Two Thousand One Hundred Eight Only	**12,648.00**
	40 mm. dia	Nos	14.00	2,990.00	Rupees Two Thousand Nine Hundred Ninety Only	**41,860.00**
21.10	Supply and installation of automatic air vent conforming to ASA Standards, shall be of cast-iron body furnished at the top of main water risers, supply and return pipes (AAV) Dia 25 mm.	Nos	26.00	898.00	Rupees Eight Hundred Ninety Eight Only	**23,348.00**
21.11	HDPE 3 layered insulated water storage tank including holes for inlet, outlet, overflow, drain & vent pipes, manhole cover, rested on R.C.C. plat form etc. complete on terrace.	Ltrs	50000	21.00	Rupees Twenty One Only	**10,50,000.00**
	Treated Water Supply Piping Work					
21.12	Heavy Class C GI pipes and fittings conforming to IS: 1239 and IS: 1879 with fittings, union and clamps, elbows, tee etc. paint pipes and fitting with two coat of anti-corrosive bitumastic paint and wrapping two layers of polyethylene tape, including external work of soil and restoration complete in all respects. **(embedded pipe / external)**					
	25 mm dia		375.00	530.00	Rupees Five Hundred Thirty Only	**1,98,750.00**
	40 mm dia		150.00	766.00	Rupees Seven Hundred Sixty Six Only	**1,14,900.00**
	50 mm dia		195.00	977.00	Rupees Nine Hundred Seventy Seven Only	**1,90,515.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	100 mm dia		25.00	1,949.00	Rupees One Thousand Nine Hundred Forty Nine Only	**48,725.00**
21.13	Heavy Class C GI pipes conforming to IS: 1239 and IS: 1879 with specials, fittings, union and clamps internal working, painted exposed pipe with two coats of enamel of approved shade and make, including holes in walls, floors, R.C.C. slab/ beam and restoration of the same complete in all respects. (internal)					
	15 mm dia	Rmt	93.00	391.00	Rupees Three Hundred Ninety One Only	**36,363.00**
	20 mm dia	Rmt	311.00	407.00	Rupees Four Hundred Seven Only	**1,26,577.00**
	25 mm dia	Rmt	462.00	482.00	Rupees Four Hundred Eighty Two Only	**2,22,684.00**
	32 mm dia	Rmt	30.00	512.00	Rupees Five Hundred Twelve Only	**15,360.00**
	40 mm dia	Rmt	2,125.00	696.00	Rupees Six Hundred Ninety Six Only	**14,79,000.00**
21.14	Making connection from main treated water supply line including necessary excavation & making good the same including cutting, boring and taping the existing line by providing and installing ferrule connections with necessary fittings as required and making good the same.	LS	14.00	12,719.00	Rupees Twelve Thousand Seven Hundred Nineteen Only	**1,78,066.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
21.15	G.I. pipe heavy class sleeve 450mm long, threaded on both sides upto 65 mm dia and flanged ends(both side) above 65 mm dia pipes with 6mm thick M.S. plate 100mm wide welded around in the centre of pipe as per detail complete in all respects.					
	50 mm dia	Nos	1.00	3,273.00	Rupees Three Thousand Two Hundred Seventy Three Only	**3,273.00**
	40 mm dia	Nos	16.00	2,334.00	Rupees Two Thousand Three Hundred Thirty Four Only	**37,344.00**
21.16	Supply , providing ,fixing and installation of valves and accessories, valves shall be the types or models, which are suitable for the working fluid in the system. The rated working pressure of the valve as specified for the working fluid shall be at least 1.5 times of the actual working pressure, but not less than 1,034 kPa (150 PSIG).					
	Lever **ball valve** P.N. 40 hotforged sand blasted nickel plated body and cap sealed with loctite chrome plated brass valve carbon steel handle PVC coated complete in all respects. (screw type)					
	15 mm dia	Nos	12.00	1200.00	Rupees One Thousand Two Hundred Only	**14,400.00**
	20 mm dia	Nos	8.00	1433.00	Rupees One Thousand Four Hundred Thirty Three Only	**11,464.00**
	25 mm dia	Nos	6.00	1791.00	Rupees One Thousand Seven Hundred Ninety One Only	**10,746.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	32 mm dia	Nos	6.00	3074.00	Rupees Three Thousand Seventy Four Only	**18,444.00**
	40 mm dia	Nos	7.00	3664.00	Rupees Three Thousand Six Hundred Sixty Four Only	**25,648.00**
	50 mm dia	Nos	1.00	4085.00	Rupees Four Thousand Eighty Five Only	**4,085.00**
21.17	Supply , providing ,fixing and installation of **pressure reducing valve** as indicated in the Drawings and at the location where pressure would be too high and cause the problem. The Pressure Reducing Valve is a hydraulically operated, single seated globe valve controlled by a direct acting spring and diaphragm pilot valve. It is available in globe or angle body. The main valve shall be operated by the downstream pressure passing through the pilot system. The body shall be cast iron. Seat and stem shall be stainless steel. The diaphragm shall be reinforced synthetic rubber.					
	It will reduce a high pressure of upstream to a predetermined lower pressure of downstream.					
	(a)Pressure ratings: 1,034 kPa. (150 PSI.)					
	(b)Pressures adjust ranges: 170 to 550 kPa. (25 to 80 PSI.)					
	40 mm dia	Nos	26.00	11,750	Rupees Eleven Thousand Seven Hundred Fifty Only	**3,05,500.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	50 mm dia	Nos	2.00	13,055.00	Rupees Thirteen Thousand Fifty Five Only	**26,110.00**
21.18	Supply, providing, fixing and installation of **Water Hammer Arrestors** as indicated in the Drawings. Water hammer arrestor shall be installed at discharge pipe of water pump It contains only one moving part; a spherical piston which floats inside the surge copper chamber, built in valve and gauge assembly simplifying charging and recharging procedure.					
	25 mm dia	Nos	12.00	1,610.00	Rupees One Thousand Six Hundred Ten Only	**19,320.00**
	32 mm dia	Nos	6.00	2,108.00	Rupees Two Thousand One Hundred Eight Only	**12,648.00**
	40 mm dia	Nos	14.00	2,990.00	Rupees Two Thousand Nine Hundred Ninety Only	**41,860.00**
21.19	Supply and installation of **Automatic Air Vent** conforming to ASA Standards, shall be of cast-iron body furnished at the top of main water risers, supply and return pipes (AAV) Dia 25 mm.	Nos	32.00	898.00	Rupees Eight Hundred Ninety Eight Only	**28,736.00**
21.20	HDPE 3 layered insulated water storage tank including holes for inlet, outlet, overflow, drain & vent pipes, manhole cover, rested on R.C.C. plat form etc. complete on terrace.	Ltrs	50000	21.00	Rupees Twenty One Only	**10,50,000.00**
	Sewer Line Piping Work					
21.21	**Centrifugal cast iron, soil, waste & vent pipes** including all fittings (plain or access door) e.g. bends, junctions, cowls, offsets, access pieces etc., jointed with lead joints, fixed with M.S. clamps in cement					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	concrete 1:2:4 blocks including supports, holes in wall/floors and restoration wherever required. (embedded pipes) as per IS 1729 / 2002					
	50 mm dia	Rmt	553.00	1,172.00	Rupees One Thousand One Hundred Seventy two Only	**6,48,116.00**
	65 mm dia	Rmt	155.00	1,438.00	Rupees One Thousand Four Hundred Thirty Eight Only	**2,22,890.00**
	80 mm dia	Rmt	105.00	1,638.00	Rupees One Thousand Six Hundred Thirty Eight Only	**1,71,990.00**
21.22	**Centrifugal cast (spun) iron pipes (Class LA)** conforming to IS-1536 : including lead joints including suppots fittings as per drawing.					
	80 mm dia	RM	75.00	1,405.00	Rupees One Thousand Four Hundred Five Only	**1,05,375.00**
	100 mm dia	RM	79.168	1,731.00	Rupees One Thousand Seven Hundred Thirty One Only	**1,37,040.00**
21.23	**G.I. (heavy class) waste pipes** and fittings conforming to IS: 1239 with M.S. clamp/hook including chases and holes in RCC/Brick wall/Ceilings and restoration of the same in cement mortar 1:3 (1 cement : 3 coarse sand) to match with the surroundings for waste from wash basins, urinals kitchen sink and sump, pump deliveries and suction etc as shown in drawings as required. (pipe connection between sanitary fixture and cast iron					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	pipe)					
	50 mm dia	RM	302.00	888.00	Rupees Eight Hundred Eighty Eight Only	**2,68,176.00**
	65 mm dia	RM	111.00	1,119.00	Rupees One Thousand One Hundred Nineteen Only	**1,24,209.00**
21.24	Two coats of bitumastic paint, two layers of polyethylene tape and final coat of bitumastic paint for embedded pipes and clamping with 16 Gauge SWG wire complete in all respects.					
	50 mm nominal bore	RM	302.00	89.00	Rupees Eighty Nine Only	**26,878.00**
	65 mm nominal bore	RM	111.00	112.00	Rupees One Hundred Twelve Only	**12,432.00**
21.25	Supplying, providing, fixing, installation, testing and commissioning of sewage pipe. **Gravity Sewage pipe shall be High Density Polyethylene (HDPE) pipe** SIDR 9- P.R. 160 PSI conforming to ASTM D2239 / IS 4984 with specials, fittings, union and clamps internal working painting exposed pipe as specified in tender specification including cutting chases, holes in walls, floors, R.C.C. slab/ beam, pipe sleeves and making good the same complete in all respects . Fitting for HDPE pipes shall be high density polyethylene as required or recommended by manufacturer. The unit rate to include the fittings, hanger, support & accessories.						

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	110 mm dia	RM	680.00	856.00	Rupees Eight Hundred Fifty Six Only	**5,82,080.00**
	160 mm dia	RM	4414.00	1,754.00	Rupees One Thousand Seven Hundred Fifty Four Only	**77,42,156.00**
21.26	Supply , providing , fixing and installation of valves and accessories, valves shall be the types or models, which are suitable for the working fluid in the system					
	Supplying, providing , fixing, installation, testing and commissioning of **floor drain** which shall be of the cast-iron type and provided with trap, chromium-plated brass inlet grating and round removable cast-brass strainer. They shall, furthermore, be threaded or have caulked connection with cutting chases, holes in walls, floors, R.C.C. slab/ beam , pipe sleeves and making good the same complete in all respects .					
a)	50 mm dia	Nos	137.00	646.00	Rupees Six Hundred Forty Six Only	**88,502.00**
21.27	Supplying, providing , fixing, installation, testing and commissioning of **floor cleanout,** which shall have an iron body, ferrule with raised head brass plug or with spanner wrench sockets with cutting chases, holes in walls, floors, R.C.C. slab/ beam , pipe sleeves and making good the same complete in all respects .					
	80 mm dia	Nos	92.00	1,440.00	Rupees One Thousand Four Hundred Forty Only	**1,32,480.00**
21.28	Square mouth SW gully trap grade 'A' complete CI grating brick masonry chamber and water tight CI cover with frame of 300 x 300 mm size (inside) the	Nos	8.00	3,850.00	Rupees Three Thousand Eight Hundred Fifty Only	**30,800.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	weight of cover to be not less than 4.50 kg and frame to be not less than 2.7 kg. as per standard design. 150x100mm size P type With FPS bricks of class designation 75					
	Rain Water Piping Work					
21.29	Supply, providing, fixing, fabricating, laying, testing, painting and commissioning of storm drain piping as using **hot dip galvanized steel pipes,** conforming to **BS 1387 Class H** with specials, fittings, union and clamps internal working painting exposed pipe as specified in tender specification including cutting chases, holes in walls, floors, R.C.C. slab/ beam , pipe sleeves and making good the same complete in all respects. All pipe shall be threaded joints and flange connection for equipment and part required maintenance. Small pipe if necessary threaded joints may be used with union connection for equipment. Pipe and fittings shall be rated kPa. (150 PSIG) working pressure including Fitting, Hanger, Support and Accessories for rain water drain pipe					
	150 mm dia	RM	1582.00	2,175.00	Rupees Two Thousand One Hundred Seventy Five Only	**34,40,850.00**
	200 mm dia	RM	405.00	2,821.00	Rupees Two Thousand Eight Hundred Twenty One Only	**11,42,505.00**
21.30	Supplying, providing , fixing ,installation, testing and commissioning of Roof Drain with floor trap and jali including with cutting chases, holes in walls, floors, R.C.C. slab/ beam , pipe sleeves and making good the same complete in all respects					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	150 mm dia	Each	228.00	2,098.00	Rupees Two Thousand Ninety Eight Only	**4,78,344.00**
21.31	Supplying, providing, fixing, installation, testing and commissioning of flexible connector which shall be suitable for the specified working fluid, and specified working pressure and temperature. The material shall be stainless steel.					
	150 mm dia	Each	13.00	2,073.00	Rupees Two Thousand Seventy Three Only	**26,949.00**
	200 mm dia	Each	13.00	2,874.00	Rupees Two Thousand Eight Hundred Seventy-four Only	**37,362.00**
	Sub Section 22 – Miscellaneous Works					
22.1	Providing, fabricating and erecting **M.S. welded steel work** using sections, tubes, flats, channels, sheets, plates including roller wheels, channels, hinges, locks, cutting, hoisting, fixing in position and applying a priming coat of approved steel primer and painting as per the specifications for ladder, gates, hand railings etc. complete as directed by Engineer-in-charge. – **Steel Railing**	MT	**10.96**	70,925.00	Rupees Seventy Thousand Nine Hundred Twenty Five Only	**777338.00**
22.2	Supplying and fixing 8mm thick toughened glass fixed in the panels of stainless framework of railing with suitable fixtures like S.S. patch fittings, bolts fasteners, et c. edges of the glass grinded and finished smooth to the satisfaction of Engineer-in-charge complete as shown on drawing and as directed by Architect,	Rmt	**70.00**	**28,000.00**	Rupees Twenty Eight Thousand Only	**19,60,000.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	including necessary scaffolding support etc.					
22.3	Providing and erecting chain link fencing l.6 Rmt. meter height with galvanized iron, chain link of size 50 mm x 50 mm, 8 gauge thick and fixed 75 mm above ground level on vertical mild steel angles of 40 x 40 x 6 mm size, embedded in cement concrete block of 1 :4:8 mix of size 45 x 45 x 60 cm 2 .5m centre to centre with iron bar 16 mm dia. as hold fast including welding link with angle frame at 30 cm centre to centre including pit excavation 45 x 45 x 60 cm, nuts and bolts and horizontal mild steel angles at top and bottom of 25 x 25 x 5 mm size and vertical mild steel flat 35 x 5 mm and 25 x 5 mm horizontal including cross support of 40 x 40 x 6 mm angles both sides at interval of 25'-0" and at every corner or bend embedded in concrete blocks of 1:4:8 mix of size 45 x 45 x 60 cm including three coats of oil painting etc. complete.	Rmt	**201.08**	1,329.00	Rupees One Thousand Three Hundred Twenty Nine Only	**2,67,235.32**
22.4	Providing and laying RMC M-35 grade for Ferrow Concrete Cover 100 mm thick as per IS 456:2000 including formwork, transportation, pouring the concrete, compaction, finishing with all contractors labour, machinery, material, lead, lift, etc. complete as directed by Engineer-in-charge.	Sqm	17,590.00	1,200.00	Rupees One Thousand Two Hundred Only	**2,11,08,000.00**
	Landscaping Works					
22.5	Supplying, stacking and spreading **of good earth** at site including royalty and all leads and lifts (earth measured in stacks will be reduced by 20% for payment) etc. complete or as directed by the Engineer-In-Charge.	Cum	20.00	700.00	Rupees Seven Hundred Only	**14,000.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
22.6	Supplying stacking and spreading at site **dump manure** for Badli or other approved source, including all leads and lifts (manure measured in stacks will be reduced by 8% for payment) etc. complete or as directed by the Engineer-In-Charge.	Cum	20.00	730.00	Rupees Seven Hundred Thirty Only	**14,600.00**
22.7	**Supply of Rectangular Pots with plant** Providing and supplying of cement pots of size 36" x 18" x 18" in terracotta colour including two plants 4 ft.-5ft height, health Tall Areca pams/Bamboos etc. with transportation/loading unloading etc. complete or as directed by the Engineer-In-Charge.	Nos	25.00	1,600.00	Rupees One Thousand Six Hundred Only	**40,000.00**
22.8	**Supply of Rectangular Pots with plant** Providing and supplying of cement pots of size 36" x 18" x 18" in terracotta colour including two plants health Bougainvella (of different colour variety) with transportation/loading unloading etc. complete or as directed by the Engineer-In-Charge.	Nos	25.00	1,500.00	Rupees One Thousand Five Hundred Only	**37,500.00**
22.9	**Tall Plants:** Providing of Tall Plants like Palms/Ficus/Bamboos of 4 ft. -5ft height health in polythene bags etc. complete or as directed by the Engineer-In-Charge.	Nos	25.00	700.00	Rupees Seven Hundred Only	**17,500.00**
22.10	**Creepers:** Providing of creepers like thumbergia/allamanda etc. of 9 inches - 1 ft height in polythene bags for giving a curtain effect etc. complete or as directed by the Engineer-In-Charge.	Nos	25.00	55.00	Rupees Fifty Five Only	**1,375.00**
22.11	**Indoor Potted Plants:** Providing of indoor potted plants in plastic pots of 9" / 11" of any kind of species like money plants, areca palms, ficus etc. complete or as directed by the Engineer-In-Charge.	Nos	20.00	600.00	Rupees Six Hundred Only	**12,000.00**
22.12	**Supply of Rectangular Pots** Providing and supplying of cement pots of size 36" x 18" x 18" in terracotta colourincluding transportation/loading unloading etc. complete or as directed by the Engineer-In-Charge.	Nos	20.00	800.00	Rupees Eight Hundred Only	**16,000.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
22.13	**Supply of Rectangular Pots** Providing and supplying of cement pots of size 24" x 18" x 18" in terracotta colour including transportation/loading unloading etc. complete or as directed by the Engineer-In-Charge.	Nos	20.00	700.00	Rupees Seven Hundred Only	**14,000.00**
22.14	**Supply of Rectangular Pots** Providing and supplying of cement pots of size 18" x 18" x 18" in terracotta colour including transportation/loading unloading etc. complete or as directed by the Engineer- In-Charge.	Nos	20.00	500.00	Rupees Five Hundred Only	**10,000.00**
	Annual Maintenance of Trees					
22.15	Maintenance of newly planted / transplanted trees including labours, watering, preparation of tree basins, fixation of tree guard, support to the trees, removing tree branches, vermicomposting, pesticides, replacement of red earth and manure as and when required including associated costs required for maintenance of trees initially for the period of 3 years, etc complete as directed by Engineer-in-charge	Per Tree Per Month	500.00	238.5π	Rupees Two Hundred thirty Eight and Fifty Paisa Only	**1,19,265.00**
22.16	Supply of mali for manuring, removing side branches, proper fixation of tree guard & support to the tree, etc. complete as directed by Engineer-in-charge	Per Day	5.00	450.00	Rupees Four Hundred Fifty Only	**2,250.00**
22.17	Supply of unskilled labour for day to day watering, weeding, preparation of tree basins, etc. complete as directed by Engineer-in-charge	Per Day	5.00	300.00	Rupees Three Hundred Only	**1,500.00**
22.18	Supply of vermicomposting, etc. complete as directed by Engineer-in-charge	1 Kg	125.00	6.00	Rupees Six Only	**750.00**
22.19	Supply of red earth, etc. complete as directed by Engineer-in-charge	Cum	25.00	700.00	Rupees Seven Hundred Only	**17,500.00**
	Signages & Logos					

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
22.20	Providing & fixing Emergency **escape route plan/map**. The printed route plan/mapshould of Auto Glow sign in 2mm thick. The route plan/map should be sand witched in between two clear acrylic sheet of 3 mm thick with edges to be chamfered/rounded. The route plan/map shall be fixed with SS 304 grade studs. The floor plan with showing fire escape route should be got approve before printing. etc. complete or as directed by the Engineer-In-Charge.					
A	Size 600 X 450mm ('A-2' size)	Nos	20.00	2,484.00	Rupees Two Thousand Four Hundred Eighty Four Only	**49,680.00**
B	Size 450 X 300mm ('A-3' size)	Nos	15.00	1,242.00	Rupees One Thousand Two Hundred Forty Two Only	**18,630.00**
22.21	Providing & fixing Exit Signage of size 300 X 100mm on foam board of 3mm thick approved make. The signage should of Auto Glow sign. It should be pasted with good quality double sided glue tape on wall or wherever instructed. The signage should be got approve before printing. etc. complete or as directed by the Engineer-In-Charge.					
A	Size 450 X 150 mm for Floor numbered informative signs, Arrows.	Nos	60.00	496.80	Rupees Four Hundred Ninety Six and Eighty Paisa Only	**29,808.00**
B	Size 300 X 100 mm for informative signs like Fire Exit, Staircase, CCTV, Pantry, First Aid, etc.	Nos	50.00	220.80	Rupees Two Hundred Twenty and Eighty Paisa Only	**11,040.00**
C	Size 200 X 200mm for informative signs like Lift Instruction, Danger, Handicap, Parking numbers, etc.	Nos	25.00	294.40	Rupees Two Hundred Ninety four and forty paisa Only	**7,360.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
D	Size 150 X 50mm for informative signs like Push, Pull etc.	Nos	30.00	55.20	Rupees Fifty five and Twenty Paisa Only	**1,656.00**
E	Size 100 X 100mm for informative signs like Fire Alarm Call Point etc.	Nos	50.00	92.00	Rupees Ninety two Only	**4,600.00**
22.22	Providing & fixing **Fire Exist Back to Back Directional Signage** of size 300 X 100mm on foam board of 3mm thick approved make. The signage should of Auto Glow sign. It should be hanged with good quality SS chain from ceiling or wherever instructed. The signage should be got approve before printing. etc. complete or as directed by the Engineer-In-Charge.	Nos	30.00	402.50	Rupees Four Hundred Two and Fifty Paisa Only	**12,075.00**
22.23	Providing & fixing 40 mm wide **Arrow Tapes/ Green** Diagonal Tapes for way finding or escape directions of 2mm thick approved make. The signage should of Auto Glow sign. The signage should be got approve before printing. etc. complete or as directed by the Engineer-In-Charge.	Nos	12.00	2,645.00	Rupees Two Thousand Six Hundred and Forty Five Only	**31,740.00**
22.24	Providing & fixing 40 mm wide **Antiskid Tapes** for staircase of 2mm thick approved make. The signage should of Auto Glow sign. The signage should be got approve before printing. etc. complete or as directed by the Engineer-In-Charge.	Nos	3.00	6,900.00	Rupees Six Thousand Nine Hundred Only	**20,700.00**
22.25	Providing and installing **Name Plate** to be made of 6 mm thick and 100 mm high letters in good quality Brass for each letter in matt or glossy finish as per requirement. Item also includes Aluminium base plate made of 3mm thick approved powder coating of required size to be mounted on wall or hanging or as instructed including all accessories required. etc. complete or as directed by the Engineer.	Nos	500.00	74.75	Rupees Seventy Four and Seventy Five paisa Only	**37,375.00**
22.26	**LOGO**- providing and installing Departmental LOGO in stainless steel base with laser cut vinyl as per the Artwork and content supplying by MMRDA. Size of the base sheet (SS) shall be 750mm x 900mm, with the	Nos	8.00	24,840.00	Rupees Twenty Four Thousand Eight Hundred Forty Only	**1,98,720.00**

Sr. No	Item Description	Unit	Quantity	Rate (INR)		Amount in INR
	size of the letter of Approximate 150mm height, etc. complete as per specifications or as directed by Engineer In charge.					
22.27	**Cabin/Room Wise Signage** - Providing and fixing room wise signage of 4'' height x 10'' width in 6 mm satin finish aluminium with polished return edges. All the letters shall be in English and Marathi in Gravoryply as per the art work. Etc. complete as per specifications or as directed by Engineer in charge.	Nos	50.00	977.50	Rupees Nine Hundred Seventy Seven and Fifty Paisa Only	**48,875.00**

	Total Amount **(Rupees Three Hundred Forty Crore Thirty Four Lac Fifty EightThousandOnly)**	**INR**	**340,34,58,000.00**

EMPLOYER'S REQUIREMENTS

APPENDIX 2B

(Revised)

The Contractor shall prepare and submit his Detailed Works Programme so as to achieve key dates of various activities on time. The Contractor shall complete the work in a phased manner by fixing priorities to different stretches of work to give access to the other interfacing contractors as per the requirement of project from time to time and as per the key dates (mile stones) indicated below:

(i) FOR METRO TRAIN DEPOT AT AAREY COLONY

Key Date Reference	Description of Works Completion	Number of Days from Date of Works Commencement	Liquidity Damages for Not Achieving Key Dates
KD1	Completion of Site Formation Works in Area 1 for Access to Track and Other Interfacing Contractors	288	0.01% of total contract value per week of delay for the key date
KD2	Completion of at least 50% Boundary Retaining Walls	288	0.01% of total contract value per week of delay for the key date
KD3	Completion of all Perimeter Storm Water Box Drains	295	.01% of total contract value per week of delay for the key date
KD4	Completion of Diversion of Existing 1200mm Diameter Water Main	295	.01% of total contract value per week of delay for the key date
KD5	Completion of Site Formation Works in Area 2 for Access to Track and Other Interfacing Contractors	396	0.01% of total contract the key date
KD6	Completion of Site Formation Works in Area 3 for Access to Track and Other Interfacing Contractors	457	0.01% of total contract value per week of delay for the key date
KD7	Completion of Vehicular Underpass	457	0.01% of total contract value per week of delay for the key date
KD8	Completion of all Boundary Retaining Walls	457	0.01% of total contract value per week of delay for the key date
KD9	Completion of Site Formation Works in Area 4 for Access to Track and Other Interfacing Contractors	518	0.01% of total contract value per week of delay for the key date

KD10	Completion of Site Formation Works in Area 5 for Access to Track and Other Interfacing Contractors	518	0.01% of total contract value per week of delay for the key date
KD11	Completion and Commissioning of Entire Storm Water Drainage System	518	0.01% of total contract value per week of delay for the key date
KD12	Completion of Works for Stabling Lines (Zone 1) for Access to Interfacing Contractors	518	0.01% of total contract value per week of delay for the key date
KD13	Completion of OCC/OCC Theater, and All Equipment Rooms of Administration and PTR Building and Provide Shared Access to Interfacing Contractors (with shared access to Depot E&M at least 3 months earlier for associated E&M works)	608	0.01% of total contract value per week of delay for the key date
KD14	Completion of Depot Traction Switching Station for Access to Interfacing Contractors	608	0.01% of total contract value per week of delay for the key date
KD15	Completion of Auxiliary Sub-station Buildings ASS-1 and ASS-2 for Access to Interfacing Contractors	608	0.01% of total contract value per week of delay for the key date
KD16	Completion of All Underground Cable Boxes/Ducts for Access to Interfacing Contractors	608	0.01% of total contract value per week of delay for the key date
KD17	Completion of Under Floor Wheel Lathe Shed Structure for Access to Interfacing Contractors	608	0.01% of total contract value per week of delay for the key date
KD18	Completion of Maintenance and Inspection Workshop Shed, Maintenance Workshop and Central Store Building including DCC for Access to Interfacing Contractors (with shared access to Depot E&M at least 3 months earlier for associated E&M works)	608	0.01% of total contract value per week of delay for the key date
KD19	Completion of Works for Stabling Lines (Zone 2) for Access to Interfacing Contractors	699	0.01% of total contract value per week of delay for the key date
KD20	Completion of All Works of Administration and PTR Building	699	0.01% of total contract

			value per week of delay for the key date
KD21	Completion & Pre-Commissioning of Effluent Treatment Plant Facilities	730	0.01% of total contract value per week of delay for the key date
KD22	Completion & Pre-Commissioning of Permanent Water Supply and Plumbing Services	730	0.01% of total contract value per week of delay for the key date
KD23	Completion of All Aarey Station Rooms, Platform Track Areas and Other Station Areas for Access to Interfacing Contractors (with shared access to Depot E&M at least 3 months earlier for associated E&M works)	638	0.01% of total contract value per week of delay for the key date
KD24	Completion of All Works of Aarey Station Including Access Ramps to Basement	730	0.01% of total contract value per week of delay for the key date
KD25	Completion of all Remaining Works for all Buildings/Structures for Access to Interfacing Contractors	730	0.01% of total contract value per week of delay for the key date
KD26	Completion of All Works of the Contract for Issue of Completion Certificate	912	0.01% of total contract value per week of delay for the key date

Note- 1- For each room or area, the civil contractor shall finalise with respective designated system contractors the level of finishes required to be completed before the room/area is acceptable to the respective contractor and the key date will be considered achieved only when the room/area is completed as per the requirement. The requirement finalised with system contractor duly signed by them shall be submitted to Engineer at least two months before the respective key dates.

Note- 2- Liquidity Damage, mentioned in this appendix is per week. Penalty per day, can be obtained on dividing the penalty (in week) by seven.

BIDDING DOCUMENTS

MUMBAI METRO LINE 3

EMPLOYER'S REQUIREMENTS

GENERAL SPECIFICATIONS

Section VII-D

Appendix 19 (Revised)

SYSTEM INTERFACE MANAGEMENT

January 2017

MUMBAI METRO RAIL CORPORATION LIMITED
MMRDA BUILDING,
Bandra Kurla Complex,Bandra (East),
Mumbai – 400 051, India.

TABLE OF CONTENTS

EMPLOYER'S REQUIREMENTS

DESIGN AND CONSTRUCTION INTERFACE MANAGEMENT

1. DEFINITIONS AND ABBREVIATIONS

1.1 Chief Interface Coordinator(CIC) means a suitably qualified person, assigned by a Contractor, who is the Team Leader responsible for administerating, monitoring, managing, supervising and resolving all interface issues between Interfacing Contractors for the Mumbai Metro Line 3 Project.

1.2 General Consultant Interface Manager (GCIM) means the responsible person, assigned by the PM who is the main coordinatorof all project interfaces with **RE** and contractors **CIC**. He shall coordinate the overall technical point of the project from the point of view of proper integration of a System and Civil Work in all technical and operational areas to ensure delivery of safe and coherant metro system. He shall attend coordination meetings with all project contractor's**CIC**, and communicate issues & concerns relating to coordination, approvals and systems & Civil interfaces.

1.3 Combined Services Drawings (CSD)means the drawings produced by the Civil Work Contractor, showing the locations, sizes and details of all of the Contractor's equipment, cable containment, pipes, etc. These drawings are to be used to enable all equipment, pipes, cables, etc. to be installed without conflict and to enable future changes or modifications to be performed without impacting the existing installation.

1.4 Interface means the region of interaction across the common boundary between two adjacent but separately managed and controlled parts of the Project. The coordination and management of the interaction regions is necessary to ensure that the overall scope and definition of the Project works is complete and seamless across all such boundaries.

1.5 Interfacing Contractors means any of the following whose activities or the works they are engaged to carry out in any way or at any time affect or are affected by the Works:

a. Project Contractors and design or specialist consultants engaged on the Project from time to time by the Employer, the Government of Republic of India, the Government of Maharashtra or the utility providers;
b. utility providers;
c. developers or franchisees appointed on the Project from time to time by the Employer;
d. subcontractors of any tier of the contractors within category (a) above, and contractors and subcontractors of any tier of utility providers, developers and franchisees within categories (b) and (c) above;
e. provided that the definition shall exclude the Contractor and his subcontractors of any tier in relation to the Works and in any other capacity which would otherwise fall within categories (a) to (d) above in relation to other works.

1.6 Interface Coordination Sheet (ICS) means a document produced by the Contractor which defines the integration and interfaces between his contract and the Interfacing Contractors employed on the Project.

1.7 Interface Management Programme (IMPG) means the programme produced by the Contractor, developed and updated on a quarterly basis, which describes the sequence and timing of each of the Interfacing Contractor's scope of work, and clearly describes dependencies between his Works and the work of the Interfacing Contractors.

1.8 Interface Management Plan (IMP) means the Report prepared by the Contractor, developed and updated on a quarterly basis that provides a clear description of his interfaces both sequentially and technically as specified in the Contract. The report will be reviewed in accordance with this procedure and is a pre-requisite to the PM's Notice of No Objection.

1.9 Interface Specification (IS)means the specification document developed by the Lead Contractor for the interfacing part of his project on the basis of, and by integrating into his design, the information provided by the Interfacing Contractors in accordance with the interface agreements as contained in the **ICS**. The Interface specification needs to be agreed upon by both the Lead Contractor and the Interfacing Contractor's before it is submitted to the**PM** for Notice of No Objection.

1.10 Master Interface Log (MIL) is an electronic Log of identified interfaces maintained by the Interface SupportingTeam (**IST**) in the format given in **Attachement D**, showing (among others) updated status and priority rating of each interface agreement, by its unique serial number, for the purpose of monitoring the progress of Interface agreements from inception to close-out.

1.11 Master Interface Matrix (MIM) means the document developed by the **PM**, which may be updated, and/or expanded to include additional Interfacing Contractors, by the PM as the Project progresses. The purpose of the Master Interface Matrix is to allocate which Interfacing Contractors are the lead party(s) for each contract.

1.12 Resident Engineer (RE)means the General Consultant Discipline Key Chief Resident Engineer, who is incharge of the monitor progress in interface agreements of his contractor with other interfacing contractors, on site in accordance with the IMP/IMPG and resolve interface issues which the interfacing contractors are unable to resolve among themselves. He shall identify interface issues that cannot be resolved at his level and alert the GCIM about them in the course of his day-to-day interactions with the GCIM for taking further action.He shall pursue the matter till the required information is exchanged in time.

1.13 Structural, Electrical and Mechanical Drawings (SEM) means those drawings produced by the Civil Work Contractor, showing the locations, sizes and details for all structural openings, plinths, embedments, sumps, floor chases, etc. required for the installation of all equipment, cable trays, pipes, etc.

1.14 Zone of Interface means where two or more components of the railway provided by two or more Interfacing Contractors combine to provide a single element.

1.14 Acronymsand abbreviation will appear immediately after the first time the words are used. Thereafter, only the acronyme or abbreviation will be used in the **Appendix 19** .

Acronym	Description
CIC	Chief Interface Coordinator (of the Contractor)
CSD	Combined Services Drawing
GC	General Consultant for MML3
GCIM	General Consultant Interface Manager
ICS	Interface Coordination Sheet – Monthly report
IS	Interface Specification
IST	Interface Support Team

IST TL	Interface Support Team Team Leader (Project Rail Systems Manager, a Member of the Project Management Team, discharges this function.)
IMP	Interface Management Plan
IMPG	Interface Management Programme
MIM	Master Interface Matrix
MIL	Master Interface Log
MMRC	Mumbai Metro Rail Corporation
MOM	Minute Of Meeting
PM	Project Manager as Employer's Representative
RE	Resident Engineer as Project Manager's Representative
SEM	SructuralElectical and Mechanical Drawings

2. INTRODUCTION

2.1 Interface and co-ordination of the Works will include the co-ordination of all design,technical and programming matters with the various Interfacing Contractors to achieve fully co-ordinated construction and installation of the facilities.

2.2 This **Appendix 19** describes the Contractor's responsibilities with regard to interface management and coordination with those Interfacing Contractors and who are responsible for undertaking work, which interfaces with the Contract. The Contractor's responsibility for interface coordination shall include currently defined Interfacing Contractors and those whoshall be identified in the future. This responsibility is not limited to a particular number of Interfacing Contractors.

2.3 The Contractor's responsibility for interface co-ordination shall include identification of Interfacing Contractors, subcontractors, including subcontractors within his own Contract.and those who shall be subsequently identified during the course of the Contract for whom the Contractor will need to interface and coordinate the Works. This in no way detracts from the fact that the Contractor remains solely responsible for identifying, liaising, and co-ordinating with all Interfacing Contractors in relation to the Works.

2.4 The **PM**will monitor and oversee the interface Management activities by the contractor and will specifically provide direction or information in the following circumstances.

a) When the interfacing contract has not yet been awarded

b) When common agreement cannot reached between the interfacing parties

c) When it is in the interest of the project programme, quality or safety to issue direction.

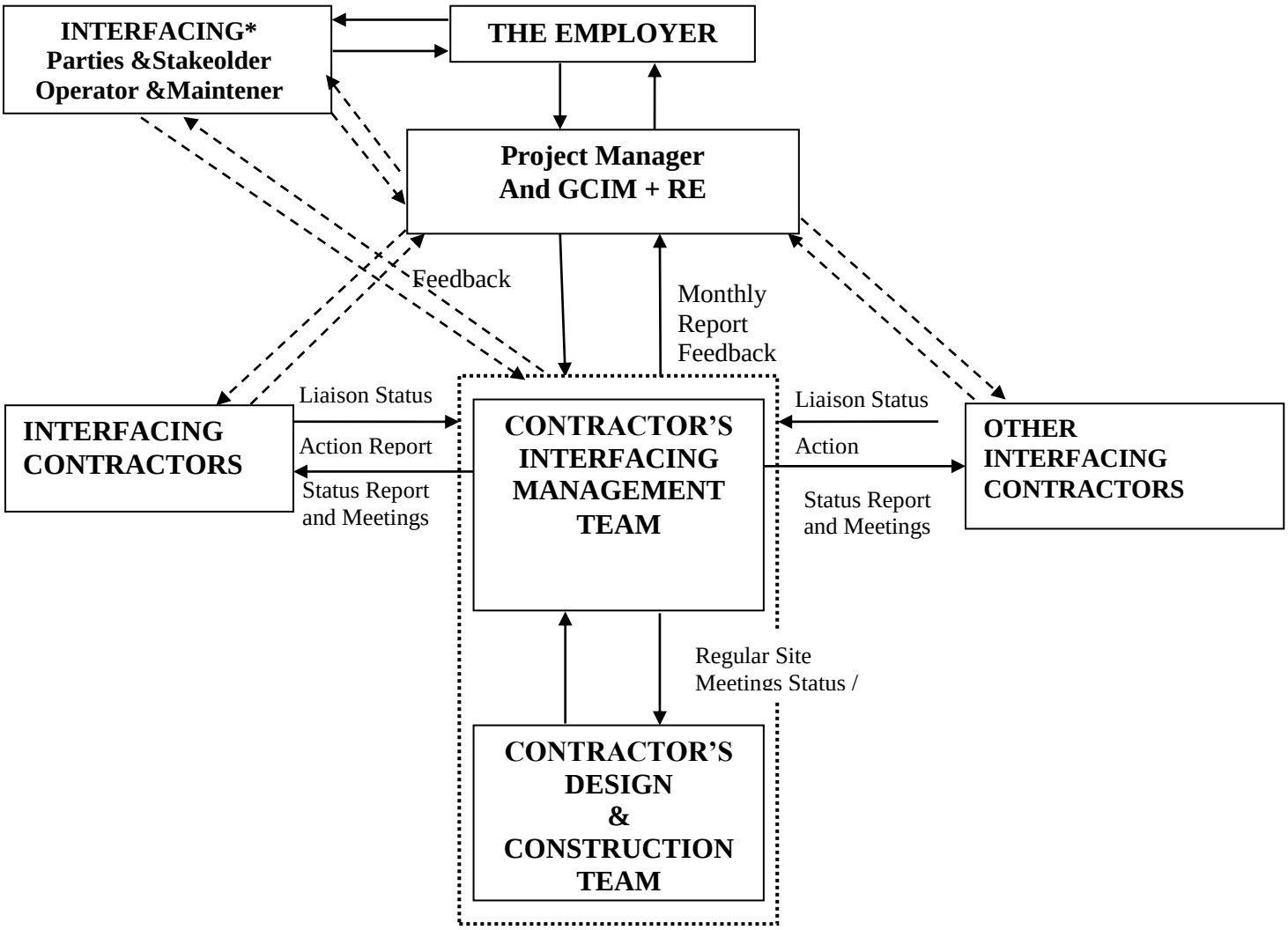
Direction or information provided by the employer representative where ever necessary, shall not in any way relieve the contractor of his full responsibility to ensure the correctness, accuracy and suitability of the interface implementation and required specification.

2.5 The Contractor shall at all times use his best endeavours to resolve all interfaces applicable to the Contract and shall be proactive in seeking out interface issues and their solutions.

2.6 The Contractor shall ensure that all of the above Interface requirements are included in his Interface Management Plan, refer to Clause 6 of this **Appendix 19**. Flow charts illustrating the process of entering into an Interface agreement/desagreement and Monitoring its progress with the help of the Interface Coordination Sheet are provided as **Attachment A**(Flowchartcreation /elaboration of theInterface Coordination Sheet) and**Attachment B** (Flowchart for Progress

Monitoring of Interface Agreement)of this **Appendix 19**. And Figure 1 gives a schematic presentation of the Interface Communication and Coordination processes between the various role-players in the Project.

2.7 The Contractor's internal sub-contractors' and suppliers' interfaces are the sole responsibility of the Contractor and are not covered in this **Appendix 19**. However, the Contractor shall co-ordinate and manage these interfaces in such a way as to identify and cater for the requirements of the Interfacing Contractors and domestic interfaces, including but not limited to, the avoidance of clashes and sequencing of Works. The Contractor shall compile an internal **IMP** for his own use, a copy of which shall be furnished to the **PM**on request at any time.



Contractor's Organisation

Figure 1 – Interface Communication and Coordination Model

INTERFACING *
Interfacing Parties could be: Utility,Telephone Operator, Water, Electricity….
Interfacing Stakeholder could be: Safety Autority, ISA, RDSO,CMRS, Fire, Police, EIG.

3. CO-ORDINATION

3.1 Contractor's Co-Ordination Responsibilities

The Contractor shall co-ordinate with the **PM** (**GCIM** and/or **RE**) and shall be required to attend meetings on issues appertaining to Government authorities and utility agencies regarding the services/facilities to be provided by them for the project.

The Contractor shall ensure that the work of all Interfacing Contractors can be carried out in accordance with the Interface Management Plan prepared by the Contractor.

3.2 Site Co-Ordination & Attendance

This Chapter 3.2 describes what the Civil Work Contractor shall do.

3.2.1. The Civil Work Contractor shall, at his own cost, provide all attendance on and co-ordination with Interfacing Contractor. The following items are not a comprehensive or exhaustive list of the co-ordination or interface attendance items to be provided for the Interfacing Contractor's use, but are intended to provide an outline of the content of amenities, services and facilities for which the Civil Work Contractor is responsible:

a) Single point of contact for meetings, actions, planning, scheduling and co-ordinating.

b) Site access

The Civil Work Contractor shall co-ordinate with the Interfacing Contractor and provide access and use of temporary access roads to and from and within the Site. The Civil Work Contractor shall co-ordinate all vehicle movements, deliveries and other activities with the Interfacing Contractor so as to ensure conflicts of use will be controlled on and around the Site.

c) Storage and Accommodation area

The Interfacing Contractor will require limited temporary site accommodation and storage areas. The Civil Work Contractor shall agree with the Interfacing Contractor access and areas for storage and temporary site accommodation prior to their commencing work on Site.

d) Work space requirement and sequence of Works

e) Shared use of Civil Work Contractor's scaffold

The Civil Work Contractor shall co-ordinate with the Interfacing Contractor and provide free use and shared access of his erected scaffolding, ladders and hoists should they be available at the time the Interfacing Contractor requires to use them. Not withstanding this requirement, the Civil Work Contractor shall at all times remain responsible for the management of safety and the maintenance of such scaffolding, ladders and landings. The Civil Work Contractor will not be required to adapt or erect access scaffolds specifically for the use of Interfacing Contractor.

If the Interfacing Contractor erects and uses his own scaffold he will be required to adhere to the Civil Work Contractor's safety rules and access routing for equipment and materials. The Civil Work Contractor shall ensure that all scaffolds of Interfacing Contractor are erected in a safe manner and are subject to permits for use issued by the Contractor.

f) Setting out control points

g) Access Openings

The Civil Work Contractor will form all penetrations and delivery openings and subsequently close them(either temporary or permanent) for access to rooms or areas for the delivery of equipment and materials.

h) The Civil Work Contractor will be required to install all temporary and permanent lifting hooks and beams shown Temporary lighting requirements 100 lux minimum.
i) Temporary power and water supplies have to be provided at agreed locations around the Site for the Interfacing Contractor's use.
j) Water tightness. All rooms and areas handed over to Interfacing Contractor shall be in a watertight condition and maintained as such.
k) Ensure all electrical supplies both temporary and permanent have the correct testing and commissioning certification.
l) Waste management and disposal
m) Appropriate protection to finishes, walls, floors, ceilings and equipment using polythene, hardboard, steel plates etc.
n) Programme agreement for mobilizing and demobilizing
o) Fire fighting and supply and maintenance of fire extinguishing equipment and devices pursuant to the Civil Work Contractor's obligations .
p) Construction interface co-ordination management of penetrations in structures, embedded and cast-in items, etc.
q) Temporary Drainage
   The Civil Work Contractor shall provide, operate and maintain all necessary temporary drainage, sumps, silt traps and sump pumps to collect and dispose of wastewater from Interfacing Contractor construction processes including installation, testing and commissioning activities.
r) Sanitation facilities
   The Civil Work Contractor shall provide all sanitation facilities and the disposal of waste. No unauthorised sanitation facility will be allowed on the Site.
s) Making good and fire stopping of penetrations
t) Lifting apparatus and hoists
   The Civil Work Contractor will be required to install all temporary and permanent lifting hooks and beams shown on the drawings and the Specification required for installation and/or maintenance purposes. The Civil Work Contractor will be responsible for the testing and labeling of all apparatus. The Civil Work Contractor will be required to make available any lifting or hoist apparatus on Site as required by the Interfacing Civil Work Contractor at agreed times and duration for their use. The Civil Work Contractor shall be responsible for the maintenance testing and operational management of hoists. The Civil Work Contractor shall make available his cranes for lifting equipment or materials for Interfacing Contractor.
u) Health and Welfare Facilities
   The Civil Work Contractor shall allow Interfacing Contractor use of his health, welfare and mess facilities, and temporary background lighting. He shall liaise with the Interfacing Contractor to determine their planned and actual manning levels and ensure that sufficient facilities are provided prior to them commencing work on Site. The facilities shall be maintained on Site until the Interfacing Contractor has completed its Works and demobilised or such earlier time as the **PM** may direct.

3.2.2. The Civil Work Contractor is deemed to have ascertained for himself the full scope of his responsibilities and obligations under the Contract in terms of attendance on and co-ordination with Interfacing Contractor and shall not be entitled to any additional payment, Cost or extension of time for completion should he have failed to do so.

3.2.3. The Civil Work Contractor shall make due allowance for providing Attendance, including power and other utilities supplies, throughout all phases of the Interfacing Contractor work including testing and commissioning and where supplies to various Interfacing Contractors need special consideration during testing and performance trials under peak load conditions.

4 INTERFACE

4.1 Co-Ordination of Contractor's Scope of Work

In accordance with the requirements of the Conditions of Contract and other specified requirements**,** the Contractor shall co-ordinate his own work with that of all Interfacing Contractors and ensure that the design, construction, installation and testing requirements of the Interfacing Contractors are incorporated into the Civil Work Contractor's co-ordinated plans, programmes and Works. The Contractor shall proactively seek out interface issues and solutions.

In addition to the Civil Work Contractor's obligations to the Interfacing Contractors contained elsewhere in the Contract, the Civil Work Contractor shall provide / handover occupation or access as required, to the Interfacing Contractors to those parts of the Works which are subject to Key Dates by the required Key Dates.

The Civil Work Contractor shall complete those parts of the Works, which are subject to Key Dates, by the required Key Dates thatare specified in the Appendix to Tender and/or **Appendix 3**of Part 2 – Employer's Requirements of this Contract. Those parts of the Works subject to Key Dates shall be completed to a state whereby any Interfacing Contractor can immediately commence his works without the need to make any change, addition or modification to the Contractor's Works.

4.2 Interfacing Contractors

4.2.1 The Interfacing Contractors will require interface and co-ordination for information, programming, drawings acceptance, handover etc. as shown on the Interface Coordination Sheet enclosed in **Attachment F** of this **Appendix 19**.

However, the Contractor should note the Interface Coordination Sheet shown herein has been compiled by the **PM**(and **GCIM**/**RE**), and is therefore given as example only.

The Contractor's responsibilities in this respect are in no means restricted by the details listed in such sheets and no warranty is given by the Employer or the **PM**that all interfaces and Interfacing Contractors have been included in such. The Contractor is to confirm and verify all of the details included in the Interface Coordination Sheets, and his review should ensure that all interfaces have been included.

The Contractor shall take overall responsibility for the Interface Coordination Sheets, which must be submitted to the **PM**(and **GCIM**/**RE**) for a notice of no objection.

4.2.2 The Master Interface Matrix (**MIM**), enclosed in **Attachment E**, assigns the Contractor which has been designated as the Lead party(s) for each interfacing contractor. The **MIM**has been developed by the **PM**(and **GCIM**), which he may update and/or expand at any time to include additional Interfacing Contractors, and the Contractors lump sum price

for Interface Management shall be deemed to include any such additional works related to interfacing.

4.2.3 The Contractor shall expand the **MIM** and the **ICS** for additional subcontractor system interfaces. Those additional subcontractors system Interfaces should include interaction areas between different systems in the same project contractor scope. In that case the Contractor shall take overall responsibility for its own **MIM** and **ICS** and shall submit the expandable **MIM** and **ICS** to the **PM** (and **GCIM**/**RE**) for approval.

4.2.4 The leading Interfacing Contractor shall be responsible for administrating, monitoring, managing, supervising and resolving all interface issues between all Interfacing Contractors. Any expansion during the course of the works should be done by the Lead Interfacing Party

4.2.5 In a situation when the Lead Contract has not yet been awarded and the Interfacing contractor has commenced work, the **PM**(and **GCIM**) will perform the coordination activities including preparation of tentative **ICS**/**IS**, with the express understanding that they may undergo changes as and when the Lead Contractor commences his work on being awarded the Contract etc.

4.2.6 Where an interfacing contract has yet to be awarded, the Lead Contractor shall proceed with the coordination activities (including preparation of **ICS** and Interface specification) as instructed by the **PM** until such time when the Interfacing Contractor is available.

4.3 Interfacing Contractors - Communications and Information Exchange

4.3.1 GENERAL

a) The Contractor shall communicate, co-ordinate and exchange information directly with the Interfacing Contractors and the Contractor shall keep the **PM**(and **GCIM**/**RE**) advised at all times. Information necessary to fulfil the Contractor's interface obligations shall be directly requested and obtained from the Interfacing Parties, and receipt acknowledged. Conversely, the Contractor shall provide directly to the Interfacing Contractors information within the Contractor's scope that is required by them.

b) All requests for information, acknowledgement of receipt of information, and any official communication between the Contractor and the Interfacing Contractors shall be made in writing, with a copy to the **PM**for his information. The **PM**(and **GCIM**/**RE**) shall be invited to attend all interface meetings between the Contractor and the Interfacing Contractors. Irrespective of whether these meetings were attended by the**PM**or not, the contractor's monthly progress report to**PM**shall invariably include the details of all interface meetings held and decisions arrived.

c) The Contractor's programme shall allow time for the availability of necessary interface information from the Interfacing Contractors and in this regard the Contractor shall, where required, proceed on a late start basis to allow adequate time for others to provide required information and thereby achieve design process compatibility.

d) The Contractor shall allow for the fact that many of the design and construction activities for the different contracts will be proceeding concurrently. In the event that certain interface information is not forthcoming at the time targeted, the Contractor shall be responsible to resolve the matter with the relevant Interfacing Contractor without recourse to the **PM**, and where necessary develop alternative interim arrangements such that the interface informationis accommodated at a later date.

e) Definitive dates for transfer of information and particular interface actions shall be confirmed between the Contractor and the Interfacing Contractors.

4.3.2 INTERFACING FUNCTIONS

The Interfacing Contractors are responsible for, but not limited to, the following;

a) the management of Contract to Contract Interfaces as required;
b) preparing the Interface Management Plan and subsequent procedures;
c) preparing their Interface Management Programmes in accordance with this procedure and submitting these to the Interfacing Contractors for concurrence;
d) preparing the Interface Management Programmes and submitting these to the **PM**for a Notice of No Objection;
e) preparing their Interface Coordination Sheets and Interface Specifications and issuing same to the relevant Interface Contractors and **PM**;
f) Co-ordinating with the relevant Interface Contractors to establish coordinated **CSD**&**SEM** Drawings;
g) Maintaining their **ICS** updated continuously and attaching it to their Monthly Progress Report submitted to the **PM**in accordance with the requirements of the Contract and this **Appendix 19**

4.3.3 DOCUMENTATION REVIEW

The Contractor shall, as a minimum:

a) review those portions of the Specification and Drawings relevant to the interface and transmit such information to the Interfacing Contractors;
b) co-ordinate and co-operate with Interfacing Contractors on all Site related matters including, but not limited to, Site access and occupation, attendance, safety, verification of work compatibility, survey control, etc...;
c) review the interface information received and agree in writing with the Interfacing Contractors that the interface information is adequate for that stage of that activity.

4.3.4 DESIGN STAGE

The design interface is an iterative process, thus throughout the design process, the Contractor shall be responsible for coordinating his own design with Interfacing Contractors to develop interface designs in conjunction and co-operation with the designers of Interfacing Contractors. These interface designs will be monitored and have to be given Notice of no objection by the **PM**, but the Contractor shall work directly with the Interfacing Contractors to develop designs which are mutually acceptable to all parties.

The Contractor shall, immediately upon Contract Award, gather all necessary information and develop his design to a level where meaningful interaction can take place as soon as the Interfacing Contractors are available.

4.3.5 INTERFACE DESIGN CHANGE PROCESS

The Contractor shall establish an interface design change process to ensure that:

a) All proposed changes for a specific interface are reported, recorded and resolved;

b) Proposed changes are fully evaluated;
c) Internal/External communications and distribution paths are properly defined

4.3.6 CONSTRUCTION / INSTALLATION SATGE

During construction the Contractor shall, when a construction item is ready for field inspection, advise the Interfacing Contractor in advance to verify compatibility with the Interfacing Contractor's needs.

The Contractor shall:

a) advise the Interfacing Contractors in writing when the as-constructed interface-related work can be inspected, and provide the necessary Site access and occupation;
b) request in writing and obtain from the Interfacing Contractors, interface information required for that stage of the Contract;
c) agree in writing with the Interfacing Contractors on the adoption of any applicable comments on the constructed work;
d) agree that any testing and commissioning for works can be carried out in accordance with the Interface Management Plan;
e) conduct on-Site inspections of the work elements, and give comments in writing to the Interfacing Contractors;
f) agree in writing with the Interfacing Contractors that the as-constructed work meets the interface requirements.
g) Where the execution of work by Interfacing Contractors depends upon the Contractor's site management or upon information to be given by the Contractor, the Contractor shall provide the Interfacing Contractors with the required services or the correct and accurate information required to enable the Interfacing Contractors to meet thier programme for the construction or installation of their works.

4.3.7 TEST &COMMISSIONING STAGE

The Contractor shall co-ordinate all of his testing and commissioning activities with the Interfacing Contractors. Interface commissioning shall demonstrate that the delivered interface, part A of the interface, is ready and meets the interface requirements of the interface part B, and vice versa.

Successful completion of all interface commissioning shall prove its readiness for commissioning of the overall contract scope and completion of the overall Metro-rail Project, prior to handover to the Employer for their commercial operation.

4.3.8MAINTENANCE STAGE

The Contractor shall co-ordinate all of his maintenance activities with the interfacing contractors. Important interface issues, daily maintenance should be jointly identified with interfacing contractor.

4.4 Resolution of Co-Ordination Difficulties

When the Contractor identifies interface co-ordination difficulties, the Contractor shall review the pertinent points of each Interfacing Contractor to determine possible compatible solutions in terms of sequence, timing and technical details. The Contractor shall then meet with the relevant Interfacing Contractor(s) to determine solutions, which are mutually acceptable to each Interfacing Contractor and advise the **PM**.

Where an acceptable solution has not been identified, the Contractor shall advise the **PM** in writing of the problems encountered. If, in the opinion of the PM, an interface is not proceeding satisfactorily, then the **PM**will review the matter, and establish a co-ordinated plan directing the Contractor and the Interfacing Contractor(s) on the required action. In the event that no agreement can be made between the Contractor and the Interfacing Contractor(s), the **PM**shall determine the requirements to the best of his knowledge, and his determination shall be final and binding on the Contractor and the Interfacing Contractor(s).

4.5 Interface Performance

The Contractor's performance in relation to his compliance with the interface requirements under the Contract shall be assessed by the **PM**three months after the Commencement Date and thereafter at three monthly intervals. The assessment will be in the form of an audit of the Contractor's interface management system. This audit will assess the Contractor's compliance with the responsibilities delineated in this **Appendix 19**and elsewhere as related to interface management and the preparation of the Interface Management Plan (**IMP**) and Programme and other documentation and procedures associated with Interface Management and Coordination.

The Contractor will be notified of non-conformances from the audit, which will require rectification. Where, in the opinion of the **PM**, the Contractor has failed to rectify a non-conformance within a reasonable period from the date of notification, this may lead to non-payment of any lump sums, until such time as the non-conformance has been rectified to the satisfaction of the **PM**, refer sub-clause below.

The Contract allows for continuous audits of the Contractor's compliance with his Interface Management Plan and the requirements of this **Appendix 19** of Part 2 Employer's Requirements, and any extreme or continuing failures shall result in a negative audit report, which may lead to non-payment of the relevant payment item in the Preliminaries section of the Pricing Document. The decision of the **PM**in this regard shall be final.

5. CONTRACTOR'S INTERFACE MANAGEMENT SYSTEM

5.1 Interface Management System

The Contractor shall establish and maintain an Interface Management System to identify, control and monitor the interfaces of the Contract, which shall include, but not be restricted to, the following:

a) Establishment and maintenance of an Interface Management Team suitably qualified and experienced in co-ordination and interface management in relationship with the **GCIM**.

b) Provision, as one of his Key Personnel, of a Chief Interface Co-ordinator, to head the Interface Management Team, suitably qualified and experienced as noted in **Section A** of this Part 2 Employer's Requirements, with the responsibility, experience and authority to resolve interface matters in accordance with the Contract. The Chief Interface Co-ordinator (**CIC**) will develop a monitoring and reporting procedure to be implemented by his team for the duration of the Contract.
c) Implement and maintain a strict monitored control of information transfer to the Interfacing Contractors, the Employer and the **PM**utilising the official channels of communication.
d) Provide a comprehensive interface schedule of Interfacing Contractors, including specialist domestic interfaces (i.e. specialist testing and commissioning engineers) identifying all interfacing activities and timetables of events.
e) Arrange all internal and external interface meetings. The **PM**may arrange regular meetings to monitor the status of interfaces, and may require special meetings asthat are necessary to resolve specific issues. The Contractor's Interface Management Team will be required to attend such meetings. The Contractor may request assistance from the **PM**(and **GCIM/RE**) to arrange meetings on particular subjects.
f) Providing the **PM**(and **GCIM/RE**) with all information and/or details of interfaces, including copies of all correspondence and material.
g) Providing the **PM**(and **GCIM/RE**) with access to information for the purpose of conducting audits on the interface system and for confirming that interface co-ordination is proceeding consistently with the Project requirements.
h) Establish interface dates for information, documentation, access or works completion requirements.

5.2 Interface Management Team

The Contractor's Interface Management Team will undertake and fulfil the following tasks:

a) Provide timely interface information when requested, anticipating the information needs of the Interfacing Contractors and transmitting such information as soon as it is available.
b) Pro-actively keep the Interfacing Contractors informed of any development of the Works related to the interfaces. Communicating and co-operating with the Interfacing Contractors to identify and resolve potential interface problems.
c) Advise the Interfacing Contractors on potential problems related to the interfaces, together with proposed solutions likely to be acceptable to Interfacing Contractors and which meet the needs of the Project.
d) Arrange and/or attend meetings with the Interfacing Contractors as necessary to resolve interface issues.
e) During each stage of the Contract, the Contractor shall directly communicate and co-ordinate with Interfacing Contractors as necessary to achieve a fully co-ordinated construction/installation.
f) Contractor shall issue true records of all interface meetings, with appropriate actions and attendance lists, to all Interfacing Contractors, whether in attendance or not, and to the **PM**(and **GCIM/RE**), within 3 days of the meeting. Minutes of meetings shall

be signed by all parties in attendance, signifying their agreement to the contents thereof, before being formally issued by the Contractor.

The authority and responsibilities of all personnel involved in the Interface Management Team must be clearly defined in the **IMP**.

6 .INTERFACE MANAGEMENT PLAN & INTERFACEMANAGEMENT PROGRAMME

6.1 General

The Contractor shall prepare the proposed Interface Management Plan and proposed Interface Management Programme, in accordance with **Part 2 Section VI-A clause 3.4**, this clause 6 and based on the formats noted in **Attachments H ~~and I~~**, to which the PMissues a notice of no objection. The Interface Management Plan (**IMP**) and Interface Management Programme shall completely define the Contractor's programme and methodology for interface co-ordination and management, whilst complying with all Key Dates stated in the Appendix to Tender and/or **Appendix 3**of this Part 2 Employer's Requirements.

Subsequently they shall be kept up to date and submitted on a quarterly basis to the PMfor scrutiny and notice of no objection, and a summary of the principal issues shall be included in each Monthly Progress Report. The Contractor shall note that each submission of these documents is subject to regular audits and the issue of a notice of no objection by the PM.

6.2 Interface Management Programme (IMPG)

The Interface Management Programme describes the sequencing and timing of each of the Interfacing Contractor's scope of work, clearly describing the interdependencies for all stages of the work between the Contractor's works and that of the Interfacing Contractors and complementing the Interface Management Plan, whilst complying with all Key Dates stated in the Appendix to Tender and/or **Appendix 3**of this Part 2 Employer's Requirements.

The programme shall be structured to detail each of the primary zones of interface and the principal elements of the design and of the works requiring interfacing contribution from others. This Interface Management Programme shall also be related to the Contractor's Works Programme and shall show the sequences and timing agreed with the Interfacing Contractors to the necessary degree of detail to clearly illustrate each of the interfaces to be undertaken.

Targets to receive or supply information shall also be shown, with due allowance being given for the design process of others. Information relating to Contractual Key Dates and information exchange dates shall be shown for both the Contractor and the Interfacing Contractors to demonstrate a matching of design processes.

A record of these interfaces, with current status and agreed dates for information transfer, site inspections, access, occupation, handover, etc..shall be maintained and also identified on the**ICS**, refer Clause 7 below.

Refer to **Attachment K** - Guidance Notes for the Preparation of **IMPG**

6.3 Interface Management Plan (IMP)

The Interface Management Plan is that document which describes the Contractor's interface management in terms of providing a clear description of each of the interfaces, both technically and sequentially, and represents an account of how the Contractor proposes to achieve co-ordination of the Works. The description shall completely detail the Contractor's

work scope and interface with each of the Interfacing Contractors in terms of technical description, sequence and timing for each of the elements required to achieve a coordinated design. The Contractor shall demonstrate how potential interface conflicts can be eliminated by design simplification. This document is also required to demonstrate that the co-ordinated design and construction details described therein fully comply with the needs of others, and agreement in writing of these details by the Interfacing Contractors will be a pre-requisite to the **PM**issuing a notice of no objection. In this step, the **IMP** shall be submitted to the **PM** for approval with this Notice of No Objection.

Refer to **Attachment L** – Guidance Notes for the Preparation of **IMP**.

6.4 Requirements For The Interface Management Programme &Interface Management Plan

The Interface Management Programme (**IMPG**) shall be a process-driven programme in a format to be agreed with the **PM**. The **IMPG** shall incorporate the key activities from both the Interfacing Contractors' and Contractor's Works programmes that will enable the Contractor to demonstrate that any Interface is being correctly managed and will result in fully co-ordinated construction / installation of works.

The Interface Management Plan and Interface Management Programme shall:

a) Follow the outline structure, numbering system, and related procedures in a format to be agreed with the **PM**(and **GCIM/RE**).
b) Be co-ordinated with the Interfacing Contractors to ensure compatibility of interface identification and definition.
c) Comply with the Key Dates stated in the Appendix to Tender and/**or Appendix 3**of this Part 2 Section VI-A Employer's Requirements.
d) Be transmitted to the Interfacing Contractors concurrently with submittals to the PM.
e) Support the Works Programme to which the PM has given a notice of no-objection.
f) Address each zone of interface i.e. ancillary buildings, train stabling, trackwork external, trackwork internal, substations, signalling and telecommunications facilities, operation and control rooms, staff accommodation, external works etc. related to each design submission and stage of design or construction / installation.
g) List all relevant interfaces in detail, their status, and the corresponding source(s) of information.
h) Include interface information transfer dates which have been agreed by the Interfacing Contractors.
i) Accommodate comments and input required by the PM.
j) Include an account of how the interfaces are being managed.
k) Identify the latest information regarding agreements with the Interfacing Contractors and transfers of information.
l) Review and address the design, supply, installation, testing & commissioning programme of the Interfacing Contractors to ensure that the Key Dates of each contract can be achieved, and highlight any programme risks requiring management attention.
m) Identify any problems related to co-ordination with Interfacing Contractors.

6.5 Interface Specification.

6.5.1 The Interface Specification form enclosed in **Attachment C**, and associated drawings shall specify the proposed method and schedule for verifying the interface integrity, the individual equipment/system performance and the combined system performance.

The Interface Specification shall include a programme of tests to demonstrate the performance and integrity of the integrated system. The interface sheets developed by the **PM**(**GCIM**) are attached in**Appendix-19 – Attachment N**.Theattached interface sheetsare not final.They are indicative in natureanddo not relieve the Contractor's obligation to identify any new interface to meet contract requirements. The interface sheets, which the Contractor develops, shall be used as a basis to establish the Interface Specification. Any revision to the Interface Specification shall be mutually agreed between the Contractor and Interfacing Contractors, with submission to the **PM**, and shall specifically -

a) Understand the design requirements of each party and associated constraints;
b) Determine the detailed interface works to be performed during the various stages and
c) Agree on the interface works in reference to respective scope, with any agreements reached to be formally documented in InterfaceMinutes of Meetings , including an actions item list.

6.5.2 The Interface Contractors shall mutually identify and agree the Interfaces that will exist between them using theInterface Coordination Sheets, the format of which is contained in **AttachmentF part 1**. These interfacesshall be expanded, if required, to include all, and any other, interfaces that develop during the execution of the Project.

6.5.3 The Interfacing Contractors shall mutually agree upon the information to be exchanged and shall develop a unique Interface Specification for each interface identified. A sample Interface Specificationproforma is provided in **Attachment C**.

The **ICS**s will be tracked and monitored using an **ICS** Register to be compiled by the Contractor. This register will track the progress of the **ICS** from inception through to closure and final processing by the Contractor, prior to transmittal to the PMas a complete Integrated Design.

Each interface shall have a unique reference number to enable the Interface to be readily identified and tracked and monitored.

6.6 Contractor's Submissions

6.6.1 On commencement of the contract, Master Interface Matrix (MIM) and the Interface sheets in the Contract Documents shall be used as the reference documents from which the Contractor develop its Interface Management Plans (**IMP**) and its Interface Management Programmes (**IMPG**). The Contractor has to provide to the **PM** the following, as per the due date(s) mentioned below.

a) **CV** of **CIC** subject to Notice of No Objection (BDE1) by **PM**(30 days)
b) Interface Management Plan (**IMP**) (45 days)
c) Interface Management Programme (**IMPG**) 3 month rolling program updated monthly (45 days)
d) Interface Coordination Sheets (**ICS**) – monthly progress report pertaining to interface matters (45 days)
e) Confirmation of Coordination form (45 days)
f) Interface specification (45 days)

6.6.2 The **PM** shall review the Contractor's interface submissions and issue Notice of No Objection for those sections that comply with the contractual requirements of Interface Management and recommend changes to any sections that do not meet Employer's Requirements. The Master Interface Log (**MIL**) is updated by **PM**/**GCIM** (**IST)** with the

sections of the Contractor's **IMPG** that receive a Notice of No Objection. A sample Master Interface Log example is provided in **Attachment D**.

6.6.3 To receive a Notice of No Objection, the Contractor's Interface Management Programme (**IMPG**) and Interface Management Plan (**IMP**) shall meet the Employer's requirements on Interface Management - **Appendix 19** of Part 2 Section VI A.

6.6.4 The **PM**/**GCIM**is responsible for the overall implementation and maintenance of the interface management process throughout the project life cycle by developing and implementing interface management work processes, capturing the necessary interface agreements, monitoring progress, ensuring that schedule requirements are maintained and pointing out any change requests that may arise out of interface requirements.

6.7 Monitoring the Progress of Interface Agreements

6.7.1 The Chief Interface Coordinator (**CIC**) of the Lead Contractor convenes regular Interface Meeting with the Interfacing Contractor to progress the Interface issues by keeping track of activities required to be performed towards facilitating the needed exchange of information. The Lead Contractor writes the Minutes of Meeting, actions oriented and systematically review the last Minutes of Meeting to confirm agreement, check progress, prior to examining new items.

6.7.2 The **PM**/**GCIM** (**IST TL**) and his delegates monitor the status of the interface agreements on a regular basis by having periodical (weekly or monthly) meetings with the concerned persons. The Interface Agreements with a `Critical' rating are prioritized and rigorously monitored.

6.7.3 When the Interfacing Contractor receives the requested information by the required date and considers it acceptable, to close a particular interface item/location Lead Contractor will record in the confirmation of coordination form for the interfacing element and send it to the Interfacing Contractor/s for agreement. The mutually agreed Interface Specification is then submitted to **PM** for Notice of No Objection.

6.7.4 To close a particular significant phase or portion, Lead Contractor will record in the Interface Specification document and send it to the Interfacing Contractor's for agreement. The mutually agreed Interface Specification is then submitted to **PM** for Notice of No Objection. If **PM**raises any objection, the Lead Contractor re-works the Interface Specification document, in consultation with the Interfacing Contractor, and re-submits to **PM** for Notice of No Objection. After issue of Notice of No Objection, the Interface Agreement is recorded as `closed' in the Interface Databases of both the Contractors as well as in the **MIL**. The closed interfaces are omitted from future interface agreement reporting.

6.7.5 The **PM**/**GCIM** shall prepare Status Reports from the Master Interface Log (**MIL**) on the progress of the Interface Agreements as part of the Monthly Progress Reports to the **Employer**.

6.7.6 **PM/GCIM** shall check the physical interfaces on site as necessary to make sure that they are progressing according to the agreements made by the Interfacing Contractors and report to the **PM/GCIM**.

7 .INTERFACE COORDINATION SHEET (ICS)

7.1 The Contractor's Interface Coordination sheet, the format of which is shown in **Attachment F** – Part 1, is required to be used by each of the Interfacing Contractors to record all of the Contract Interfaces. The Contractor shall ensure that each Interfacing Contractor provides input and maintains the **ICS** continually updated as required in this **Appendix 19** .

7.2 The Contractor shall ensure that the Interfacing Contractors demonstrate their co-ordination efforts as required by the Contract. To achieve this, the Contractor and the Interfacing Contractors shall identify their interface requirements which shall be input into the interface documents i.e. **IMP**, **IMPG**, **ICS** etc. by the Contractor.

7.3 The Contractor shall monitor the **ICS** to ensure that, as the Interface progresses, the records show the appropriate Status (refer status codes indicated in Part 3 of **Attachment F**) as agreed with the Interfacing Contractors. The Contractor will be responsible for confirming the "Closing Out" of each **ICS**record, whilst ensuring that throughout the interface process all Interfacing Contractors have agreed to the following:

a) The receiving Interfacing Contractor has received and accepted the Interface being recorded.
b) All InterfacingContractors have recorded the interface record as "Proposed Close Out".
c) The Confirmation of Co-ordination form in **Attachment G** has been updated and signed by the relevant Interfacing Contractors, refer clause 7.4 below.

7.4 When documents are exchanged for review/comment with Interfacing Contractors, the originator preparing these documents should ensure that they are accompanied by the Confirmation of Coordination form in **Attachment G**. When the Interfacing Contractor returns these documents with comments to the originator, they should be returned with the Confirmation of Coordination form duly completed, confirming coordination and agreement or comment as appropriate, as a record of them having coordinated the interface item. This Confirmation of Co-ordination is to be transmitted to the **PM,**upon signing by the Interfacing Contractor(s), for Notice of No Ojection with the appropriate Template **Attachment H**- Review and Comment on all Design / Interface Submittals. The Rank (B, Ma, Mi) iscatgoriesd into blocked, major & minor catagories.

7.5 The **PM** will obtain approval from **MMRC** on every Main Features of the final designs / drawings with respect of the following "Approval for Notice of No Objection".

8. COORDINATION DRAWINGS

8.1 General

For the purpose of achieving a Project which is fully co-ordinated with respect to civil, structural, architectural, building services, electrical, mechanical works and interface elements, and to ensure compatibility between different facilities and services, and adequate space requirements, all drawings are to be reviewed and co-ordinated by the Civil Work Contractor.

The Civil Work Contractor will provide and issue detailed Interface Working Drawings in terms of items such as; special arrangements, space allocation, cast in items, primary and secondary fixings, grouting of equipment/plinths, drill and fix brackets, embedded and cast-in items and the like.

The drawings shall be prepared by the Civil Work Contractor, reviewed and validated by the Contractor for its own Interface in accordance with the ICS.. The Civil Work Contractor

shall also include composite cross-sections and layouts, which show the spatial requirements of all Interfacing Contractors and identify items to be finalised, defined, or resolved.

8.2 Combined Services Drawing (CSDs) And Structural E&M Drawings (SEMs)

The Civil Work Contractor's **CSD**s and **SEM**s must be clear and sufficiently detailed to unambiguously show the intent of the subject services and the corresponding structure / facility allowances. While these drawings do not have to duplicate all of the details of the Drawings, they must include plans sections and elevations as required to clearly illustrate the compatible relationship between the different disciplines. Specifically, the drawings will include wall elevation drawings at 1:50 scale (or larger where required) indicating all openings, access panels, reinforcement zones, embedded and cast-in items and the like, and shall be submitted to the **PM**for a Notice of No Objection.

The **CSD**s shall show the intended locations, routes and spatial relationships of the individual **E&M** services, Building Services systems, and installations, Depot Equipment, Core Systems installations and other installations, fully co-ordinated with each other and the civil structural and architectural work. The **CSD**s shall also clearly indicate that effective cable co-ordination has been achieved in terms of cable location or cable trays and the trunking and cable routing.

The **SEM**s shall show all civil, structural, and architectural requirements for the **E&M** services, Building Services systems and installations, Builder's works and the Core Systems and other installations.

Where Builder's works are required by the Interfacing Contractors, the drawings, details, specification notes and catalogue information and the like shall be obtained by the Civil Work Contractor from these Interfacing Contractors indicating the builder's work to be incorporated into the Works. The Civil Work Contractor shall include details of such Builder's works in the **SEM**s and Method Statements as appropriate.

Builder's work comprises, but is not limited to, the following:

a) construction of plinths, bases, builders bund walls and the like.
b) placing and fixing of holding down bolts, lifting beams and hooks and other supporting items;
c) supply, fabrication installation, protection, fixing and finishing of supporting steelwork, for equipment and associated accessories;
d) casting in of edgings, angles in recesses, ducts, conduit, pipes etc;
e) fixing equipment and associated, brackets, cable containment and fixtures;
f) forming of penetrations, sleeves, access panels, holes, chases, recesses, openings;

all in accordance with the Civil Work Contract.

The **CSD**/**SEM**s shall also be used for the purpose of co-ordinating with the Interfacing Contractors and shall be continuously updated to reflect the latest interface co-ordination. Copies of the **CSD**/**SEM** drawings shall be included in submittals to the **PM**(and **GCIM**/**RE**).

Where the **CSD**s or **SEM**s do not fully co-ordinate with the Site conditions the Civil CoontractorContractor shall co-ordinate and propose a solution to the problem. All proposed solutions shall be issued to the PMas Project Manager.

8.3 Interface Drawings

For the Interface Drawings, the Contractor shall prepare in diagrammatic format for each interface the demarcation of scope of responsibilities between the Contractor and each of the Interfacing Contractors. The Contractor shall submit all Drawings with interface requirements for a notice of no objection from the PM. Any proposed deviation to the Construction Specification or Drawings shall be identified and justified with design documentation, details and drawings. The submission shall also identify all interface requirements. The contractor should develop own interface drawings with detailed design and dimensions and submit the same to other interfacing contractor.

8.4 As Constructed Drawings

Upon completion of the Works the Civil Work Contractor shall submit all Combined Services Drawings, Structural **E&M** Drawings, and Interface Demarcation Drawings showing the final "As Constructed" status of the Works related to these drawings.

9. ATTACHMENTS

Attachment A - Flow Chart for creation / elaboration of Interface Coordination Sheet

Attachment B - Flow Chart for Progress Monitoring of Interface Agreements

Attachment C - Interface Specification Form

Attachment D - Master Interface Log (MIL) – Example

Attachment E - Master Interface Matrix (MIM)

Attachment F Part 1 - Interface Coordination sheet - Example

Attachment F Part 2 - Interface Coordination Sheet – Contract Codes

Attachment F Part 3 - Interface Coordination Sheet – Status Codes

Attachment G - Confirmation of Coordination Form

Attachment H - Review and Comment on all Design / Interface Submittals Template

Attachment K - Guidance Notes for the Preparation of Interface Management Programme.

Attachment L - Guidance Notes for the Preparation of Interface Management Plan.

Attachment M – Interface Sheet (Template)

Attachment N –Indicative Interface Sheet List for Contract MM3-CBS-CWD

N1- Indicative Interface Sheet of Track Works and Depot Civil works station.

N2- Indicative Interface Sheet of Track Works and Depot Civil works.

N3- Indicative Interface Sheet of Depot Civil works and Rolling Stock

N4- Indicative Interface Sheet of OCS and Depot Civil works

N5- Indicative Interface Sheet of Signalling, Train Control, PSD & Telecom & Detailed Design Consultant

N6- Indicative Interface Sheet of Signalling, Train Control, PSD & Telecom & Depot Civil works

N7- Indicative Interface Sheet of UG Tunnel (UGC-07) and Depot Civil Works.

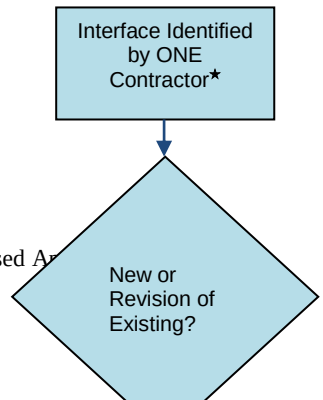
N8- Indicative Interface Sheet of Depot Civil Works and Depot E&M.

N9- Indicative Interface Sheet of Depot Civil Works and Pylon termination Contractor

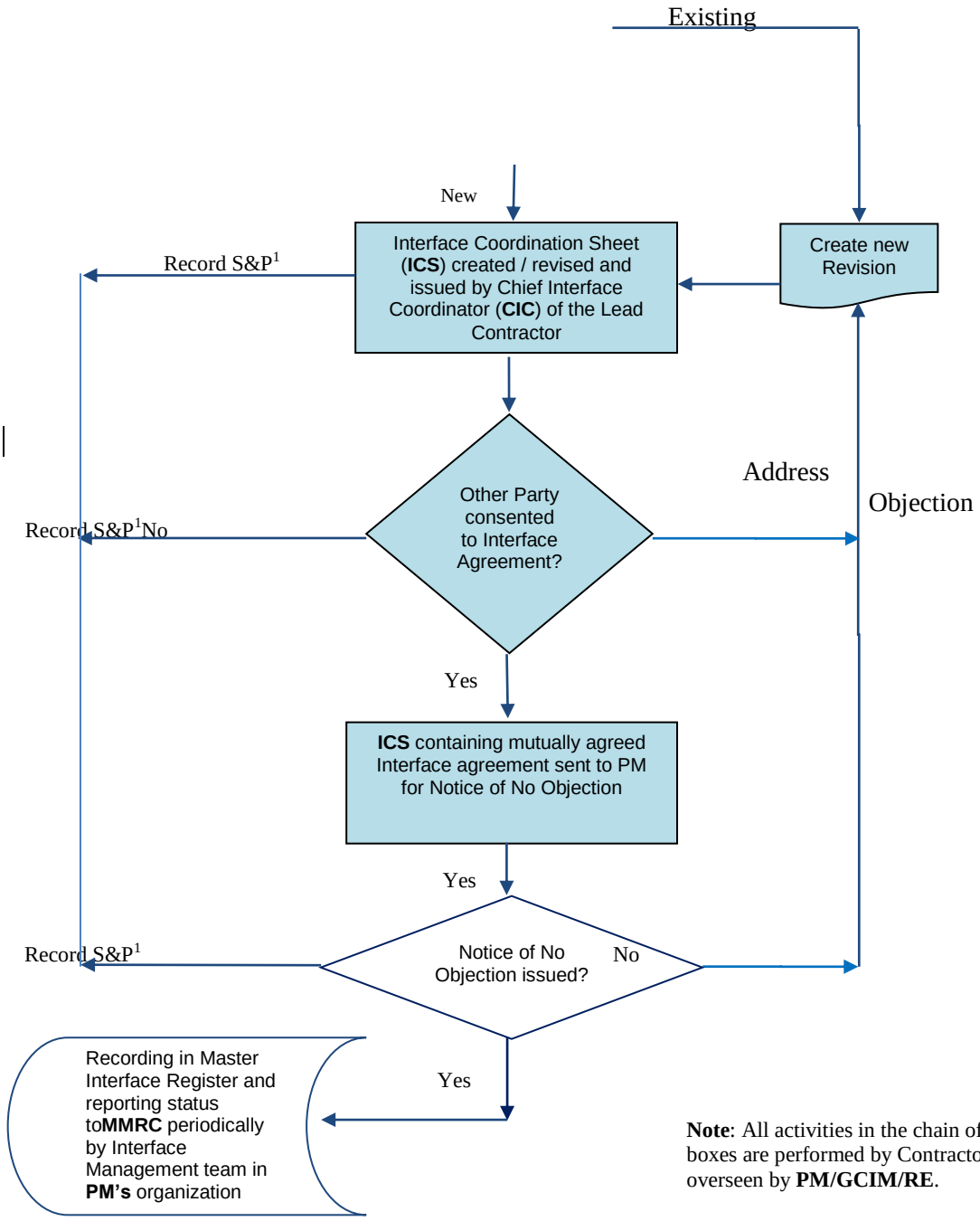
N10- Indicative Interface Sheet of Depot equipment Contractor and Detailed Design Consultant

N11- Indicative Interface Sheet of Detailed Design Consultant and Depot Civil Works.

Attachment A - Flow Chart for creation / elaboration of Interface Coordination Sheet



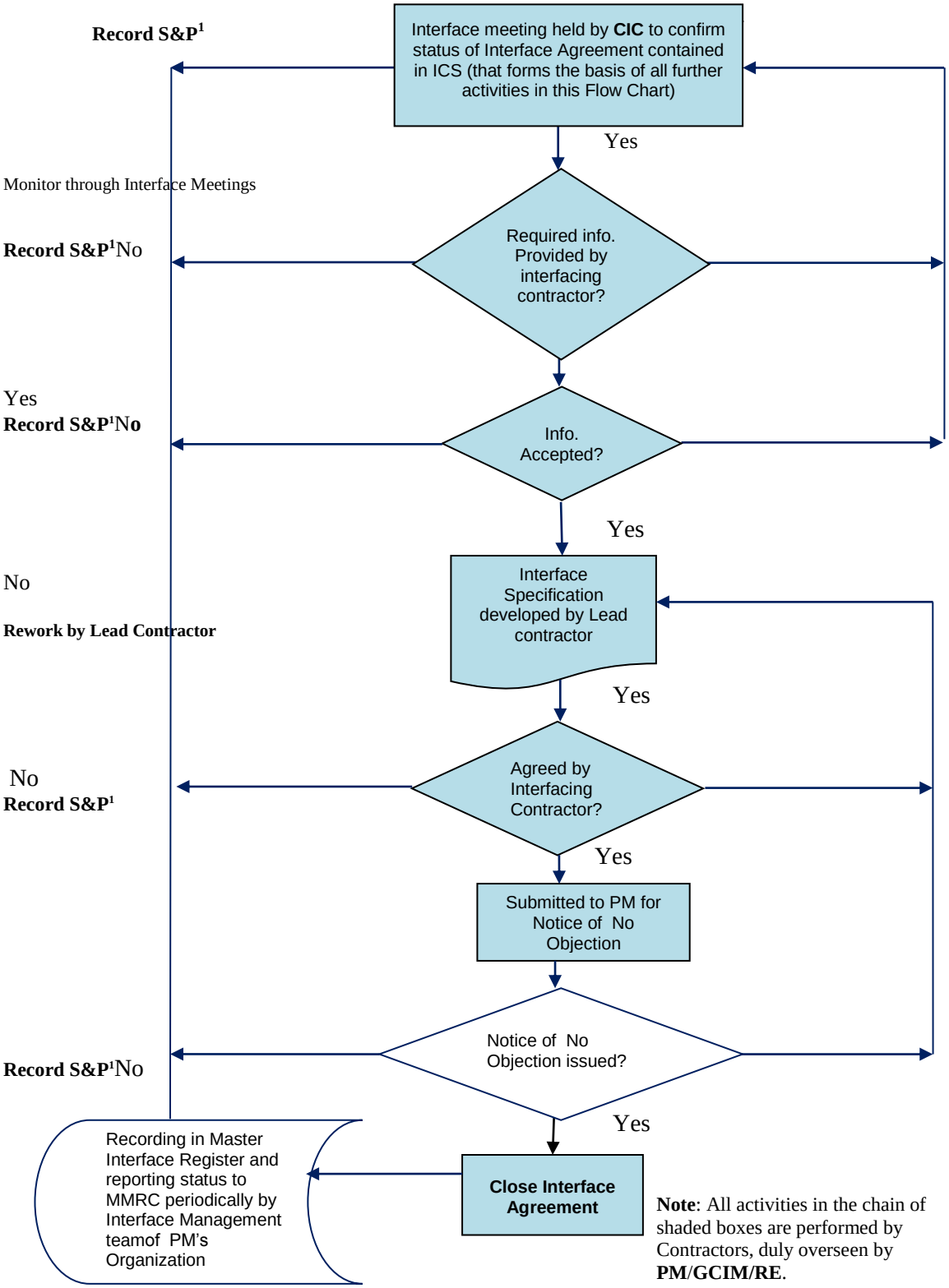
★From either Interface Sheet/Matrix given in the Contract or through other sources



Note: All activities in the chain of shaded boxes are performed by Contractors, duly overseen by **PM/GCIM/RE**.

1 = Status and Priority
Ref Attachment F Part 3

Attachment B - Flow Chart for Progress Monitoring of Interface Agreements



1 = Status and Priority
Ref Attachment F Part 3

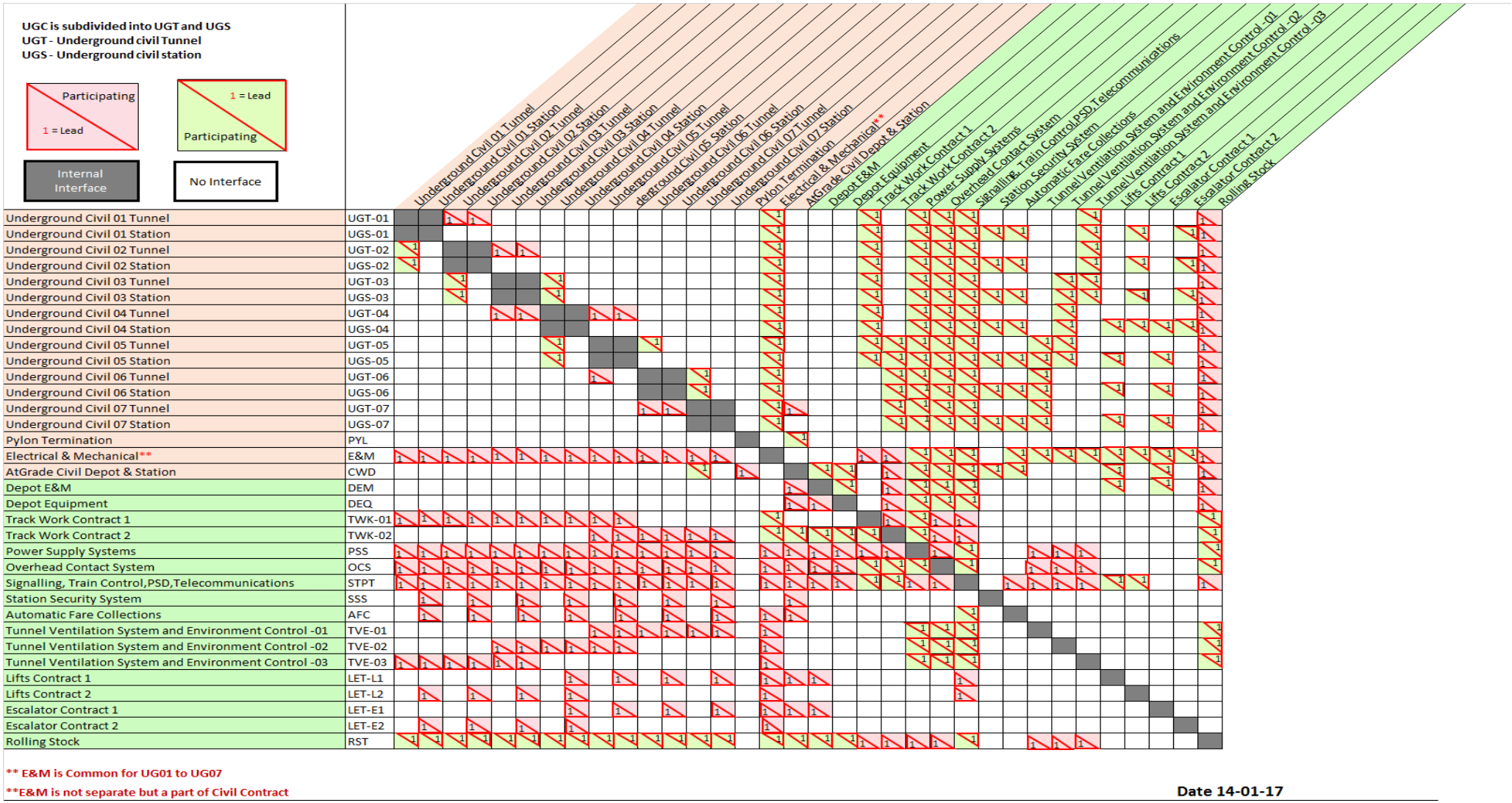
Attachment C - Interface Specification Form

INTERFACE SPECIFICATION			**Ref:** *to creat*	
	Contract Designation	**Contractors Sequence Number**	**Date of Issue**	
Initiating Contractor			**Interface Manager Signature**	
Responding Contractor			**Interface Manager Signature**	
Interface Specification Required for;			**Response Required by;**	
Reviewed by;				
Design Sections			**Station Arch. / Building Services**	
Description of the Interface				
Specific Details of the Interface				**Location**
Drawings / Specifications Attached				
Title		**Drawing / Specification Ref.**		**Drg. Issue**
Document	**Name**	**Date**	**Document References (if any)**	
Prepared by:				

Attachment D - Master Interface Log (MIL) - Example

PM Ref. No.	Revision No.	Interface Item No.	Stage	Location	Contract A	Name	Contract B	Name	Status	Remarks
10	A0	UT/US-05	Construction / Installation	Mahalaxmi	Contract UAA-02 shall install cable containment for HV, LV, Signal & telecom and emergency lighting cable routing	UAA-02	Contract UAA-0 shall lay power cable for emergency light and control cable for telephone system from station (controllers will be from Mumbai Central station up to May Day Park shaft)	UAA-01	Pending	
10	A0	UT/US-06	Construction / Installation	Mahalaxmi	Contract UAA-02 shall construct temporary and permanent drainage system and interlink with contract UAA-01 drainage system	UAA-02	Contract UAA-01 shall construct temporary and permanent drainage system and interlink with contract UAA-02 drainage system	UAA-01		
10	A0	UT/US-07	Construction / Installation	BKC	Completion of contract UAA2-02 handover shaft back to UAA-01	UAA-02	Contract UAA-01 shall Jointly inspect and accept the shaft handed over by UAA-02	UAA-01	Completed	
10	A0	UT/US-08	Test & Commissioning	SEEPZ	Alignment of the tunnels, 1st stage concrete in the tunnels to match with the shaft base slab	UAA-02	Agree and accept	UAA-01	Completed	
10	A0	UT/US-09	Maintenance	Santacruz	Stop water leakage between the Shaft wall & tunnels	UAA-02	Joint inspection and accept	UAA-01	Pending	

Attachment E - Master Interface Matrix (MIM)



Underground Civil 01 Tunnel	UGT-01
Underground Civil 01 Station	UGS-01
Underground Civil 02 Tunnel	UGT-02
Underground Civil 02 Station	UGS-02
Underground Civil 03 Tunnel	UGT-03
Underground Civil 03 Station	UGS-03
Underground Civil 04 Tunnel	UGT-04
Underground Civil 04 Station	UGS-04
Underground Civil 05 Tunnel	UGT-05
Underground Civil 05 Station	UGS-05
Underground Civil 06 Tunnel	UGT-06
Underground Civil 06 Station	UGS-06
Underground Civil 07 Tunnel	UGT-07
Underground Civil 07 Station	UGS-07
Pylon Termination	PYL
Electrical & Mechanical**	E&M
AtGrade Civil Depot & Station	CWD
Depot E&M	DEM
Depot Equipment	DEQ
Track Work Contract 1	TWK-01
Track Work Contract 2	TWK-02
Power Supply Systems	PSS
Overhead Contact System	OCS
Signalling, Train Control,PSD,Telecommunications	STPT
Station Security System	SSS
Automatic Fare Collections	AFC
Tunnel Ventilation System and Environment Control -01	TVE-01
Tunnel Ventilation System and Environment Control -02	TVE-02
Tunnel Ventilation System and Environment Control -03	TVE-03
Lifts Contract 1	LET-L1
Lifts Contract 2	LET-L2
Escalator Contract 1	LET-E1
Escalator Contract 2	LET-E2
Rolling Stock	RST

** E&M is Common for UG01 to UG07

**E&M is not separate but a part of Civil Contract

Date 14-01-17

Attachment F Part 1 - Interface Coordination sheet- Example

Interface Co-ordination Sheet:EAS-05 / AC 01			**Elevated stations contractor A Viaduct Corridor - 1 Contractor B**		
PROVISIONS AS PER THE INTERFACE SHEET				**INTERFACE IMPLEMENTATION**	
NO	**Project Stage**	**Interface point-Lead**	**Interface Point- Participating**	**Status**	**Action/Progress records &Folllow-ups**
Sheet 2 – MMRC Station					
2	Design Stage	Contractor A (Lead Contract) shall furnish the details of Viaduct Lighting mast locations and loading details to Contractor-B (Lead Contract)	Contract B(Participating Contract) shall collect the loading particulars of Viaduct lighting mast of various locations. Shall design and provide the details of foundations	Pending	**Past Activity** **Activity during the Month** 1 meeting during the Month **Major Decisions** A. Contract A shall fix cable trays by anchor fasteners B. Contract A to submit mutually agreeable method statement by 15th Dec 2010 **Open Issue**
3	Design Stage	Contractor-A(Lead Contract)shall request fitting/mounting arrangements to install cable containment for signal, telecom and LV & Lighting cables	Contractor-B(Participating Contract) shall include in viaduct design	Pending	**Past Activity** 3 Minutes of Meeting **Activity during the Month** 1 meeting 10th December **Major Decisions** A. Contract A shall fix cable trays by anchor fasteners B. Contract A to submit mutually agreeable method Statementby 15th Dec 2010 **Open Issue**

Attachment F Part 2 - Interface Coordination Sheet-Contract Codes

The following table provides the Interfacing Party Contract codes to be used whenpreparing / updating the Contractors Interface Coordination Sheet, which should be prepared on thebasis of a separate Excel spreadsheet for each Interfacing Party.

Interface Party Codes	
AFC	Automatic Fare Collection
CWD	AtGrade Civil Depot& Station
DEM	Depot E&M
DEQ	Depot Equipment
LET-E	Escalator
LET-L	Lift
OCS	Overhead Contact System
PSS	Power Supply System
PYL	Pylon Termination
RST	Rolling Stock
SSS	Station Security System
STPT	Signalling ,Train control, PSD and Telecom
TVE	Tunnel Ventilation System / Environment Control System
TWK	Track work
UGC	Underground Civil (UGC-01 to UGC-07)

Notes :

1 Depot Equipment may be subdivided into individual items of equipment in which case Contractorswill be notified of designated interfacing codes.
2 Other document coding should be in accordance with the requirements of the Contract and as agreed with **PM**.

Attachment F Part 3 - Interface Coordination Sheet- Status Codes

The following table describes the Interface Status with codes to be used in preparing / updating the Interface Coordination sheet.

Interface Status Codes & Meanings		
Interface Status	**Code for Log**	**Description of Status**
To be coordinated	TBC	Both Contractor's have not agreed the conditions for this interface
Coordinated	COR	Both Contractor's have agreed that the interface is valid
Not coordinated	NCOR	One Contractor does not agree the conditions for this interface
Received	REC	The Contractor responsible for the design/construction element has received the information/documents required
Provided	PRO	The Contractor responsible for providing the information/documents to progress the design/construction element has provided the documents to the Interfacing Party
Accepted	ACP	The Contractor has accepted the proposed Interface Design or Construction element
Not Accepted	NACP	Either of the Contractors have not accepted the proposed Design/Construction element
Propose closeout	PCO	Both Contractor's have accepted the proposed Interface Design or Construction element and no other requirements are outstanding. Both Parties can agreed to sign the Confirmation of Coordination Form
Closed out	CO	The final Interface Documentation together with Confirmation of Coordination Form has been sent to the Interface Coordination Manager for closing the interface
Superseded	SUP	The Interface design or construction element has been superseded

Attachment G – Confirmation of Coordination Form

Mumbai Metro Rail Project		
Ref No.		
CONFIRMATION OF COORDINATION		
CONTRACT:		**TRANSMITTAL No.:**
TITLE:		
ACTIVITY NO.:		
GENERAL DESCRIPTION:		
SIGNATURE OF INTERFACING CONTRACTORS:		

	Interfacing Contractor	**Authorized Name**	**Signature**	**Date Reviewed**	**Comment**
1					
2					

Signatures above confirm that this design document has been reviewed as part of the coordination process.

NOTE: Where Contractors are not in agreement with the details on this submission, they are to comment above and advise the interfacing party in question requesting accommodation of the requirement and advise the PMunder separate cover and report progress in Monthly Report / Coordination Meetings.

Attachment H-Review and Comment on all Design / Interface Submittals Template

SUBMISSION REVIEW REQUEST No.

SRR of Ref Document

CONTRACT- MM3-CBS-CWD

Column**"Commentstatus"**contains **(Open/closed with date) + Rank(B, Ma ,mi)** and is filled in by PM

Interface Reference No.			**Date of submission**	
Type of Reference			**Revision:**	
Subject / Title			**Date of Review**	
	GC Review Status			
Review without objection ☐		**Review without objection, subject to** ☐	**Rejected** ☐	
Reviewer: Date: Signature:			Checker: Date: Signature:	

Column**"Commentstatus"**contains **(Open/closed with date) + Rank(B, Ma ,mi)** and is filled in by GC

Page No. / Paragraph No.	**GC comments**	**Contractor Reply**	**Comment status**

Ranks :

1 B – Blocked
2 Ma – Major

3 Mi – Minor

Attachment K - Guidance Notes for the Preparation of Interface Management Programme.

1. The programme shall be prepared and submitted in bar chart format.
2. The bar chart shall be formed by activities grouped by major Zones of Interface.
3. The detail of each bar chart activity shall demonstrate the Contractor's understanding of the scope of work of any Interfacing Contractor who is to supply input to the Contractor, in order for him to achieve an integrated coordinated design.
4. The bars shown on the bar chart shall be annotated with details of the information expected from the Interfacing Contractors, and highlight any target dates to receive or produce information.
5. Information relating to contractual milestone dates shall be shown on both the Contractor's and Interfacing Contractors schedules.
6. The prime purpose of the document is to assist with ensuring that a coordinated design, construction, testing and commissioning is achieved. This document shall be forwarded to Interfacing Contractors for comment and agreement on a regular basis.
7. A complementary table of activities and dates should be prepared for ease of reference.

Attachment L - Guidance Notes for the Preparation of Interface Management Plan.

The purpose of this Plan is to demonstrate how the Contractor proposes to achieve a fully coordinated design, which is compatible with that design carried out by Interfacing Contractors.

This document shall describe each of the component parts, within Zones of Interface, of the design, which require input from Interfacing Contractors. The descriptions should include details relating to the inputs required from both the Contractor and Interfacing Contractor, to achieve a fully coordinated design. The document should also be complementary to the IMPG, which details the proposed schedule and timings of each of the interfacing activities.

This document shall also detail the proposed interfacing requirements to be met by all Interfacing Contractors. The Contractor shall ensure that this document is acceptable to the Interfacing Contractors and that they are able to comply with all of its requirements. This is to be achieved by document exchanges and discussions to achieve agreement of documents.

The Plan shall therefore:

i) Detail each of the component parts of the Project, which require the input of Interfacing Contractors to achieve a coordinated design. It shall describe the various disciplines and detail the technical input from others that will be required to achieve a coordinated design.
ii) Cover the whole duration of the Works and be complementary to the **IMPG**, which details the proposed/agreed schedule and timings.
iii) Be given by the Contractor to other Interfacing Contractors for their information and agreement.
iv) Be developed in association with the process of increasing knowledge of the design and shall reflect the agreements reached by the Contractor and the Interfacing Contractors as the Project progresses. The Plan shall be updated on a quarterly basis to reflect this developing status.

The Status of any interface at any point in time shall be identified by one of the following conditions;

(i) to be coordinated
(ii) coordinated
(iii) not coordinated
(iv) received
(v) provided
(vi) accepted
(vii) not accepted
(viii) propose close-out
(ix) superseded
(x) closed out

Attachment M–Interface Sheet (Template)

Mumbai Metro Interface Sheet	**Contract A (Lead Contract)**	**Name of Contract**	**Contract B(Participating Contract)**	**Name of Contract**	***Sheet # : Number/max***	***Rev : A1*** ***Date :***
Approved by : ((name(s) and signature(s))	*Discipline A*		*Discipline B*		*Last changes :*	
PM issued by :	*Name of writer, position, signature for discipline A*		*Name of writer, position, signature for discipline B*			
PM Checked by :	*Name of checker, DCL, signature for discipline A*		*Name of checker, DCL, signature for discipline B*			
Interface description brief / Key elements (time schedule, physical, functional,…):						
Contract A(Lead Contract)		**DESIGN STAGE**		Contract B(Participating Contract)		
Title ***Interface A Name/Interface B-Number***: detail ***Interface A Name/Interface B-Number=Number+1***: detail			**Title** ***Interface A Name/Interface B-Number***: detail ***Interface A Name/Interface B-Number=Number+1***: detail			
Reference documents:			*Reference documents:*			
Contract A(Lead Contract)		**CONSTRUCTION / INSTALLATION STAGE**		Contract B(Participating Contract)		
Interface A Name/Interface B-Number=Number+1: detail			***Interface A Name/Interface B-Number=Number+1***: detai			
Reference documents:			*Reference documents:*			
Contract A(Lead Contract)		**TEST & COMMISIONNING STAGE**		Contract B(Participating Contract)		
Interface A Name/Interface B-Number=Number+1: detail			***Interface A Name/Interface B-Number=Number+1***: detail			
Reference documents:			*Reference documents :*			
Contract A(Lead Contract)		**MAINTENANCE STAGE**		Contract B(Participating Contract)		
Interface A Name/Interface B-Number=Number+1: detail			***Interface A Name/Interface B-Number=Number+1***: detail			
Reference documents:			*Reference documents :*			

Attachment N –Indicative Interface Sheet List for Contract MML3-CBS-CWD

Sr. No.	DESCRIPTION
N1	Indicative Interface Sheet of Track Works and Depot Civil works station.
N2	Indicative Interface Sheet of Track Works and Depot Civil works.
N3	Indicative Interface Sheet of Depot Civil works and Rolling Stock
N4	Indicative Interface Sheet of OCS and Depot Civil works
N5	Indicative Interface Sheet of Signalling, Train Control, PSD & Telecom & Detailed Design Consultant
N6	Indicative Interface Sheet of Signalling, Train Control, PSD & Telecom & Depot Civil works
N7	Indicative Interface Sheet of UG Tunnel (UGC-07) and Depot Civil Works.
N8	Indicative Interface Sheet of Depot Civil Works and Depot E&M.
N9	Indicative Interface Sheet of Depot Civil Works and Pylon termination Contractor
N10	Indicative Interface Sheet of Depot equipment Contractor and Detailed Design Consultant
N11	Indicative Interface Sheet of Detailed Design Consultant and Depot Civil Works.

Note- The "Design stage " Interface mentioned in Interface Sheets no. N1 to N8 are only for information of the depot civil contractor.The design part mention in interface sheets will be performed by the DDC civil employed by the employer. The DDC civil contractor will be responsible to confirm site check.

N1. INDICATIVE INTERFACE SHEET OF TRACK WORKS(TWK) and DEPOT CIVIL WORKS STATION (CWD)

Mumbai Metro Interface Sheet	**Contract A**	**TWK**	**Contract B**	**CWD**	***Rev # :***	***A1***
					Date:	***09/01/17***
Approved by *:*	**TWK (Track Works)** Lead Contract		**CWD (Depot Civil Works station)** Participating Contract		First issue:	
GC issued by :						
Checked by :						

Interface description brief / Key elements (time schedule, physical, functional, ...) :

1.General Interface details between the TWK (Track Works)vs CWD (Civil work depot station)

Contract A(TWK)	**DESIGN STAGE**	Contract B(CWD-DDC)
TWK/CWD-01: Shall fix chainages of the turnouts / crossover based on the chainage of station centre line furnished by the station building contract.		**TWK/CWD-01**: Shall furnish correct chainage of station centre line.
TWK/CWD-02: Shall provide the rail level		**TWK/CWD-02**: Shall Check the rail level.
TWK/CWD-03: Shall check the same.		**TWK/CWD-03:** Shall ensure that pillars / columns supporting in station structure are located clear of the minimum infringement clearance from centre of track stipulated in the S.O.D.

Mumbai Metro Interface Sheet	Contract A	TWK	Contract B	CWD	*Rev # :*	*A1*
					Date:	*09/01/17*
			wherever such pillars / column are beyond the platform length.			
TWK/CWD-04: Shall provide track drainage consistent with the general drainage arrangement in station area.			**TWK/CWD-04:** Shall design the general drainage system in the station area taking into account track drainage catchment area.			
TWK/CWD-05: Contract B shall verify with contract A.			**TWK/CWD-05:** Contract A shall ensure that all components of the structure at intersection with ramp/ At Grade are clear of the structure gauge of the S.O.D. with respect to the project rail level.			
Contract A(TWK)		**CONSTRUCTION / INSTALLATION STAGE**		Contract B(CWD)		
TWK/CWD-06: Shall jointly check before taking over.			**TWK/CWD-06:** Shall hand over the track installation area in the vicinity of pillars / columns and such obstructions clear of the infringement distances stipulated in the S.O.D.			
TWK/CWD-07: Shall ensure proper drainage compatible to Civil Contract design of drainage.			**TWK/CWD-07:** Shall furnish levels and location of the general drainage system in the station area and ensure track drainage is compatible with general drainage system.			
TWK/CWD-08: Track work contract shall jointly decide the storage space and access for track work as per key Dates of access.			**TWK/CWD-08:** Shall provide storage space for track materials in consultation with track contract and shall permit access to track contract for construction of track as per agreed schedule of access periods.			
TWK/CWD -09: Track contract shall furnish requirement of temporary water supply. But for track construction work the water supply and electricity will be arranged by track contract.			**TWK/CWD-09:** Shall provide temporary water for construction of track on term of mutual agreement to design & construct the water supply scheme in consultation with track contract.			

Mumbai Metro Interface Sheet	Contract A	TWK	Contract B	CWD	*Rev # :*	*A1*
					Date:	*09/01/17*
TWK/CWD 10: Shall provide survey Data of Track for completion (level and horizontal) of platform			**TWK/CWD 10:** level completes the platform (level and horizontal) according to track.			
Reference documents:			Reference documents:			
Contract A(TWK)		**TEST & COMMISSIONING STAGE**		Contract B(CWD)		
NIL			**NIL**			
Reference documents :			Reference documents*:*			
Contract A(TWK)		**MAINTENANCE STAGE**		Contract B(CWD)		
NIL			**NIL**			
Reference documents:			Reference documents:			

N2. INDICATIVE INTERFACE SHEET OF TRACK WORKS(TWK) and DEPOT CIVIL WORKS (CWD)

Mumbai Metro Interface Sheet	**Contract A**	**TWK**	**Contract B**	**CWD**	***Rev # :***	***A1***
					Date:	***09/01/17***
Approved by *:*	**TWK (Track Works)** Lead Contract		**CWD (Depot Civil Works)** Participating Contract		First issue:	
GC issued by :						
Checked by :						

Main interfaces between Civil Work Depot contract and Track Works contract are the following:

- X, Y, Z track co-ordinates
- Floor finishing
- In pit track supporting posts + embedded track + washing track
- Track drainage
- Temporary water supply during construction
- Time schedule

Contract A(TWK)	**DESIGN STAGE**	Contract B(CWD-DDC)
TWK/CWD-01: Shall take into account the depot drawings and pieces of information from contract B and shall design accordingly the track layout within the whole depot.		**TWK/CWD-01**: Shall provide to Contract A the general depot layout, relevant detailed drawings and any pieces of information allowing contract B carrying out the track design within the depot.

Mumbai Metro Interface Sheet	Contract A	TWK	Contract B	CWD	*Rev # :*	*A1*
					Date:	*09/01/17*
TWK/CWD-02: Shall provide to contract B the track depot layout, the drawings of the different types of track laying (outdoor, indoor, on pit, in the washing shed etc.), and principles for track drainage, compacted soil requirements etc., and any track requirements.			**TWK/CWD-02**: Shall take into account track drawings, track requirements, track drainage principles, compacted soil requirements ,pit drawings, including washable apron etc. from contract A for designing the depot.The design of the general drainage system for the depot, including the final formation levels, gradients, cross slopes, longitudinal cross drainage pipes culverts crossings. Etc. shall be decided by contract B in consultation with contract A.			
TWK/CWD-03: Shall co-ordinate with contract B, shall furnish any track updates, shall take into account observations from Contactor B and shall update the changes, if needed.			**TWK/CWD-03:** Shall co-ordinate with contract A, shall furnish any depot updates, shall take into account observations from Contactor A and shall update the changes, if needed.			
Contract A(TWK)		**CONSTRUCTION / INSTALLATION STAGE**		Contract B(CWD)		
TWK/CWD-04: Shall plan and co-ordinate the track works in the depot with the progress of depot works based on mutually accepted programme of works.			**TWK/CWD-04:** Shall plan and co-ordinate the depot works with the progress of track works in the depot based on mutually accepted programmed of works and ensure key dates for access.			
TWK/CWD-04(A) Shall ensure with contract B for gaining access to various location of in depot for executing track work and also for storing the required track material.			**TWK/CWD-04(A)** Shall provide suitable roads for gaining access to various location of in depot for executing track work and also for storing the required track materials.			

Mumbai Metro Interface Sheet	Contract A	TWK	Contract B	CWD	*Rev # :*	*A1*
					Date:	*09/01/17*
TWK/CWD-05: Contract A shall ensure in respect of track in locations like washing lines, inspection bay, working lines, etc. contract A shall check and ensure the concrete base to the required levels providing suitably dowels for track base plates, shear connectors, etc. as required before taking over from contract B for installing the track work. **TWK/CWD-05(A):** Before commencing the ballasted/slab track work in an area, contactor A shall verify with contract B that the longitudinal and cross drains are completed in that area. Before laying the track, contract B shall provide designed cross slopes on the track formation.			**TWK/CWD-05:** In respect of track in locations like washing lines, inspection bay, working lines, etc. contract B shall complete the concrete base to the required levels providing suitably dowels for track base plates, shear connectors, etc. as required. **TWK/CWD-05(A):** Before handing over the finished formation of depot to contract A for installing slab/ballasted track, contract B shall construct and complete the longitudinal and cross drains forming the drainage network designed by him including up to out flow and any sump etc Contactor B shall excavate the finished formation to the required dimensions and install the drains to proper design levels and with appropriate perforated drain cover on top for entire drainage.			
TWK/CWD-06: Contract A shall request temporary water supply from contract B, However contract A shall make own arrangement of water supply for concreting.			**TWK/CWD-06:** Shall provide temporary water supply during the track works			
TWK/CWD -07: *Shall conduct tests and commissioning of track works..*			**TWK/CWD-07:** Shall provide necessary support to contract A to ensure testing and commissioning of track works..			
Reference documents:			Reference documents:			

Mumbai Metro Interface Sheet	**Contract A**	**TWK**	**Contract B**	**CWD**	***Rev # :***	***A1***
					Date:	***09/01/17***
Contract A(TWK)		**TEST & COMMISSIONING STAGE**		Contract B(CWD)		
TWK/CWD-08: Shall conduct tests and commissioning of track works.			**TWK/CWD-08:** Shall provide necessary support to Contractor a to ensure testing and commissioning of track works.			
Reference documents :			Reference documents*:*			
Contract A(TWK)		**MAINTENANCE STAGE**		Contract B(CWD)		
NIL			**NIL**			
Reference documents:			Reference documents:			

N3. INDICATIVE INTERFACE SHEET OF CIVIL DEPOT WORKS (CWD) And ROLLING STOCK (RST)

Mumbai Metro Interface Sheet	**Contract A**	**CWD**	**Contract B**	**RST**	***Sheet # : 1/2***	***Rev # : A1***
Approved by *:*	**Depot Civil Works** (Interface Lead)		**Rolling stock** (Interface Follower)		Last changes : Special machines foundations included	
GC issued by :						
Checked by :						

General Interface details between the Rolling stock & Civil Depot.

Contract A(Civil Depot-DDC*)*	**DESIGN STAGE**	Contract B(Rolling stock*)*
CW/RS-01: Shall prepare the Civil works accordingly to parameters of Rolling Stock		**CW/RS-01:** Shall provide parameters of Rolling Stock to Depot Civil Contractor
CW/RS-02: Shall require details from Contractor B about Rolling Stock technical characteristics, and depot facilities requirements and recommendations. Shall follow requirements through regular review meetings and associated actions items managed by means of a data base.		**CW/RS-02:** Shall provide at time to Contractor A any relevant Rolling Stock technical characteristics (static/dynamic gauges, subassemblies detailed drawings, weights,) and depot facilities requirements and recommendations.
CW/RS-03: Shall design the Depot maintenance facilities for accommodating special tools, testing and diagnostic equipment, special jigs, fixtures and gauges, spare parts to be delivered by Contractor B.		**CW/RS-03:** Shall provide lists of special tools, testing and diagnostic equipment, special jigs, fixtures and gauges, spare parts to be delivered in the depot.
CW/RS-04: Shall take into account Rolling Stock Manufacturer requirements and recommendations.		**CW/RS-04:** Shall furnish to Contractor A, all along the design stage, any updates, accurate details and pieces of information allowing Contractor A to Finalize the Depot maintenance facilities design.

CW/RS-05: Shall design the Depot maintenance facilities to suit Rolling Stock Manufacturer requirements and recommendations. **CW/RS-05A:** Shall design and provide Base foundation and pedestal, Electrical power required for special machines installation	**CW/RS-05**: Shall help to contract-A to ensure that Depot maintenance facilities design fit Rolling Stock requirements and recommendations. **CW/RS-05A**: Shall provide details of Base foundation and pedestal, Electrical power required for special purpose machines installation for those machines supplied by contractor-B
CW/RS-06:Structure Gauge and Dynamic Envelope (KE) - To ensure Civil Constructions are as per the SOD.	**CW/RS-06:** Rolling Stock shall ensure compliance as per stipulations of Contract and SOD in respect of Static gauge, KE, Structure gauge and other clearances.
CW/RS-07:Building and Foundation work for Driving Simulator and its components -Shall prepare the civil works accordingly. Shall do the foundation work as per the design & drawing.	**CW/RS-07:** Supply General Arrangement drawing of the Simulator room, other facilities required. Supply of detailed interface drawings including detail foundations, showing load points and other Civil works, etc. Supply of any special grouting material that goes into foundation.
CW/RS-08: Finishing requirements for Simulator room. - Shall provide finishing as per the requirements	**CW/RS-08:**Shall provide details of roof, floor and room finishes; Furnish equipments layouts within the rooms
Reference documents*:*	Reference documents:
Contract A(Civil Depot***)***	**CONSTRUCTION / INSTALLATION STAGE** Contract B(Rolling stock***)***
CW/RS-05: Shall ensure conformance to design parameters during Depot Maintenance facilities construction.	**CW/RS-05:** Shall co-ordinate with contract-A
CW/RS-06: Shall inform Contractor B with any Depot maintenance facilities Evolution and updating. Shall find an agreement with Contractor B for the resolution of any Design change. **CW/RS-06A:**Shall provide base foundation and electrical power cable and compressed air line required for special purpose machine installation	**CW/RS-06**: Shall inform Contractor A with any Rolling Stock requirements and Recommendations updating. Shall find an agreement with Contractor A for the resolution of any design change **CW/RS-06A**:Shall install special purpose machines

Reference documents*:*	Reference documents:
Contract A(Civil Depot***)***	**TEST & COMMISIONNING STAGE** Contract B(Rolling stock***)***
CW/RS-07: Shall conduct tests demonstrating that Depot maintenance facilities suit Rolling Stock needs.	**CW/RS-07:** Shall provide necessary support to Contractor A during Depot maintenance facilities tests and commissioning.
Reference documents :	Reference documents:
Contract A(Civil Depot***)***	**MAINTENANCE STAGE** Contract B(Rolling stock***)***
NIL	**NIL**
Reference documents:	Reference documents*:*

N4. INDICATIVE INTERFACE SHEET OF OVERHEAD CONTACT SYSTEM (OCS) and DEPOT CIVIL WORKS (CWD)

Mumbai Metro Interface Sheet	**Contract A**	**OCS**	**Contract B**	**CWD**	***Rev # :***	***A1***
					Date:	***10/01/17***
Approved by *:*	**OCS (Overhead Contact System)** Lead Contract		**Depot Civil Works** Participating Contract		First issue:	
GC issued by :						
Checked by :						

Interface description brief / Key elements (time schedule, physical, functional, ...) :

1.General Interface details between the Overhead Contact System (OCS) vs Depot Civil

Contract A(OCS)	**DESIGN STAGE**	Contract B(Depot Civil-DDC)
OCS/Depot-01: Shall provide the locations and load details of Drop Arms with fixing arrangement for OCS support in Sheds.		**OCS/Depot-01**: Shall design the Shed structures in depot considering the requirements of Contract A.
OCS/Depot-02: Shall provide location and load for anchoring of OCS tension lengths in wheel lathe and workshop sheds.		**OCS/Depot-02**: Shall design the shed structures and keep provision for holes for fixing arrangement as per the requirements of Contract A.
OCS/Depot-03: Shall provide the requirements of Duct banks for 33 kV Cables, 25 KV Cables, Traction Return Cables, Control Cables, and BEC in at grade section to Contract B.		**OCS/Depot-03**: Shall design the combined services drawings for at grade section considering the requirements of Contract A.

Mumbai Metro Interface Sheet	Contract A	OCS	Contract B	CWD	*Rev # :*	*A1*
					Date:	*10/01/17*
OCS/Depot-04: Shall provide the requirements of Duct banks for 25 KV Cables, Traction Return Cables, Control Cables and BEC in Depot to Contract B.			**OCS/Depot-04**: Shall design the combined services drawings for Depot considering the requirements of Contract A.			
OCS/Depot-05: Shall design safety interlocking system between Retractable Rigid OCS and Inspection Bay platform access doors.			**OCS/Depot-05**: Shall provide details of Access Door of Inspection Bay Platform.			
OCS/Depot-06: Shall design safety interlocking system between flexible OCS and heavy washing shed platform access door.			**OCS/Depot-06**: Shall provide details of Access Door of washing shed platform			
Reference documents*:*			Reference documents*:*			
Contract A(OCS)		**CONSTRUCTION / INSTALLATION STAGE**		Contract B(Depot Civil)		
OCS/Depot-07: Shall install fixing arrangements for Retractable OCS in inspection bay structural columns.			**OCS/Depot-07**: Shall drill holes for fixing Retractable OCS in inspection bay structural columns as per the requirements of Contract-A.			
OCS/Depot-08: Shall Install OCS drop arms in heavy washing shed.			**OCS/Depot-08:** Shall provide vertical steel supports with suitable fastenrs for fixing OCS drop arms in heavy washing shed.			
OCS/Depot-09: Shall supply and install 33 kV cables, 25 KV cables, traction return			**OCS/Depot-09:** Shall provide ductbanks / conduits for 33 kV cables, 25 KV cables, traction return cables, control cables, and BEC cables in at grade			

Mumbai Metro Interface Sheet	Contract A	OCS	Contract B	CWD	*Rev # :*	*A1*
					Date:	*10/01/17*
cables, control cables, and BEC cables in at grade section.			section.			
OCS/Depot-10: Shall supply and install 25 KV cables, traction return cables, control cables, and BEC cables in Depot.			**OCS/Depot-10:** Shall provide ductbanks / conduits for 25 KV cables, traction return cables, control cables, and BEC cables in Depot.			
OCS/Depot-11: Shall provide a safety interlocking arrangement between the OCS and inspection bay and heavy washing shed platform access doors.			**OCS/Depot-11:** Shall install the interlocking arrangement in inspection bay and heavy washing shed platform access doors.			
OCS/Depot-12: Shall Install anchoring plates in wheel lathe and workshop sheds.			**OCS/Depot-12:** Shall provide fixing points for anchoring plates.			
Reference documents:			Reference documents:			
Contract A(OCS)		**TEST & COMMISSIONING STAGE**		Contract B(Depot Civil)		
OCS/Depot-13: Shall test the interlocking arrangement of inspection bay and heavy washing shed platform access door with Contract B.			**OCS/Depot-13**: Shall witness the testing of interlocking arrangement for inspection bay and heavy washing shed platform access door.			
Reference documents :			Reference documents*:*			

Mumbai Metro Interface Sheet	**Contract A**	**OCS**	**Contract B**	**CWD**	***Rev # :***	***A1***
					Date:	***10/01/17***
Contract A(OCS)		**MAINTENANCE STAGE**		Contract B(Depot Civil)		
NIL			**NIL**			
Reference documents:			Reference documents:			

N5 . INDICATIVE INTERFACE SHEET OF SIGNALLING, TRAIN CONTROL, PSD & TELECOMMUNICATION (STPT) & DETAILED DESIGN CONSULTANT(DDC)

Mumbai Metro Interface Sheet	**Contract A**	**STPT**	**Contract B**	**DDC**	***Rev # :***	***A1***
					Date:	***3/02/2017***
Approved by *:*	**ST (Signalling Train Control, PSD &Telecommunication**) Lead Contract		**DDC (Detailed Design Consultant)** Participating Contract		First issue:	
GC issued by :						
Checked by :						

Interface description brief / Key elements (time schedule, physical, functional, ...) :

1.General Interface details between the Signalling Train control, PSD & Telecommunication vs. Detailed Design Consultant (DDC)

Contract A(Signalling Train Control, PSD & Telecommunication)	**DESIGN STAGE**	**Contract B (DDC)**
ST/DDC-01: a) Shall furnish detailed requirements (space, doors, mechanical load, lighting, false flooring, cable raceways (routing), vertical risers, cutouts, slab openings, air conditioning & ventilation arrangements, for etc.) for concerned rooms. b) Shall furnish the design details of radio masts on buildings, area and arrangement of fixtures, routing requirements for antenna cable, aviation warning lights and Earthing arrangements of the mast. Shall also check the adequacy of maintenance access for the radio mast, antenna etc c) shall furnish detailed drawings and load requirements of PSD at Aarey station Platform		**ST/DDC-01:** a) Shall integrate S&T detailed requirements and shall provide detailed design drawings of concerned rooms. b) Shall check the mast design details from the angle of structural safety including its fixtures in the structural design and also integrate cable routing arrangements for antenna cables, aviation warning lights and Earthing arrangements in the structural design. Plan for adequate maintenance access for radio mast, antenna etc. c) Shall incorporate in civil design

ST/DDC-02: a) Shall integrate the requirements of contractor B in the design of access control and intrusion detection system.	**ST/DDC-02: a)** Shall advise the access control and intrusion detection requirement., as well as monitoring requirements, for various locations in the OCC, DCC, Depot perimeter fence and gate sensors and for access control vehicle barrier. Shall design the doors so as to be suitable for access control system.
ST/DDC-03 Shall furnish the detailed drawings and requirements (dimensions, cable weight, cable minimum bending radius, cable supporting and mounting details) of cable routing arrangements and containments.	**ST/DDC-03:** Shall incorporate all cable routings in and shall design the cable routing and containments within the yard, buildings and sheds. Combined Service Drawing
ST/DDC-04: Shall provide detailed drawings and requirements with the locations, loads, type of fixing / mounting arrangements, etc. of all heavy S & T equipment like CCTV cameras, TDS clocks, PA speakers, CCTV monitors, etc. to be installed in concerned rooms and areas.	**ST/DDC-04:** Shall validate the locations and fixing arrangements in structural and detailed design.
ST/DDC-05: Shall furnish the requirements of lightning protection for different S&T systems to be installed	**ST/DDC-05:** Shall validate the location and installing procedure of lightning protection system .
ST/DDC-06: a) Shall Design the power cable requirement from OCC S&T UPS room to CER, OCC, DCC and all depot area. **b)** Shall design the S&T power cable requirement from Aarey station S&T UPS rooms to SER, TER SCR, and station area.	**ST/DDC-06: a)** Shall co-ordinate with Contractor A to finalise the route for the power cable from UPS room to CER, OCC, DCC and all Depot area. **b)** the Same as above for S&T power cable route from Aarey station (S&T UPS room) to SER, TER SCR, station area at same station.
ST/DDC-07: Shall furnish the locations and sizes of foundations of all track side Signalling equipments like Signals,Masts, cable termination boxes, Point machines, impedance bonds etc., in the depot.	**ST/DDC-07:** Shall design the expansion joints for all track side signalling equipments accordingly.

ST/DDC-08: Shall furnish the detailed layout drawings of line side equipments to be installed like signals, Masts, point machines, cable termination boxes, telephones, ATP / ATO equipments, Train stoppage beacons and location boxes etc. along the ramp.	**ST/DDC-08:** Shall suitably incorporate the detailed drawing prepared by contractor A.
Contract A(Signalling Train Control, PSD & Telecommunication)	**CONSTRUCTION / INSTALLATION STAGE** **Contract B (DDC)**
NIL	**NIL**
Contract A(Signalling Train Control, PSD & Telecommunication)	**TEST & COMMISSIONING STAGE** **Contract B (DDC)**
NIL	**NIL**
Contract A(Signalling Train Control, PSD & Telecommunication)	**MAINTENANCE STAGE** **Contract B (DDC)**
NIL	**NIL**

N6 . INDICATIVE INTERFACE SHEET OF SIGNALLING, TRAIN CONTROL, PSD & TELECOMMUNICATION (STPT) & DEPOT CIVIL WORKS (CWD)

Mumbai Metro Interface Sheet	**Contract A**	**STPT**	**Contract B**	**CWD**	***Rev # :***	***A2***
					Date:	***03/02/17***
Approved by *:*	**ST (Signalling Train Control, PSD &Telecommunication**) Lead Contract		**CWD (Civil Work Depot)** Participating Contract		First issue:	
GC issued by :						
Checked by :						

Interface description brief / Key elements (time schedule, physical, functional, ...) :

1.General Interface details between the Signalling Train control, PSD & Telecommunication vs. Civil Work Depot (CWD)

Contract A(Signalling Train Control, PSD & Telecommunication*)*	**CONSTRUCTION / INSTALLATION STAGE**	**Contract B(CWD*)***
		This is to be in DDC Interface
ST/CWD-02: a) Shall specify technical room sizes and other details like false floor, false ceiling etc. b) Arrange and Instal radio mast, antenna,antenna connections,aviation warning and Mast earthing.		**ST/CWD-02:** Shall provide the a) Concerned rooms and other facilities mentioned here. b) Cable routing arrangements to enable Contractor A and the E&M Contractor to fix containments and lay the Cables. c) Fixing arrangements as needed for heavy equipments, cutouts, etc. for all S & T equipments, provide and assist in fixturesfor the radio mast and arrangements for maintenance access to the radio masts. d) Radio Mast fixing arrangement on buildings and ensure mast erection is done duly keeping in view the structural safety and aesthetics

ST/CWD-03: Shall provide, install and fix all Telecommunication equipment, including cables with connections to individual devices.	**ST/CWD-03:** Shall provide the heavy foundations.Shall provide the necessary support to contractor A during the installation of S & T equipment. Cable containment shall be provided by E&M Contractor. To be in E&M Interface
ST/CWD-04: Shall plan and coordinate the installation of S & T equipment with the progress of depot works, in accordance with the global depot coordination.	**ST/CWD-04:** Shall plan and coordinate the progress of depot works with the progress of S & T equipment installation in the depot.
ST/CWD-05: Shall install S&T UPS power cables from the distribution panel to all concerned rooms. Shall also arrange for distribution of power supply to all field S&T Equipments.	**ST/CWD-05:** Shall provide necessary cutouts for routing and mounting of cables.
ST/CWD-06: Shall install the PA system, Access control & intrusion detection system, CCTV system and telephones for the OCC / DCC areas as well as the depot area.	**ST/CWD-06:** Shall Co-ordinate with S&T Contractor particularly for Access Control and Intrusion detection. For other systems general assistance as needed by S&T Contractor shall be extended that the requirements are fully met.
ST/CWD-07: Shall prepare foundations and install all track side signalling equipments like Signals, cable termination boxes, Point machines, axle counters, etc., in the depot	**ST/CWD-07:** Shall provide expansion joints before track slab is laid as per interface drawing
ST/CWD-08: Shall install the line side S & T equipments like signals, Masts, ATP/ATO equipments, train stoppage beacons, location boxes, point machines, cable termination boxes, telephones, axle counters, along the ramp.	**ST/CWD-08:** Shall provide the necessary assistance to install line side S & T equipments like signals, Masts, ATP / ATO equipments, train stoppage beacons, location boxes, point machines, cable termination boxes, telephones, axle counters, etc. along the ramp.
ST/CWD-09: a) Shall install the MML3 LAN in the Depot all buildings in Depot, Aarey station to cover all the locations indicated by contractor B.	**ST/CWD-09:** a) Shall provide necessary cutouts for routing and mounting of LAN cables.

b) Shall extend the FOTS-FO, FOTS-IP to all buildings in the depot area and terminate at a central distribution point in each building.	b) shall facilitate
ST/CWD-10: Shall install the Access control system and intrusion detection system	**ST/CWD-10:** Shall provide necessary assistance to install the Access control system and intrusion detection system
ST/CWD-11: Shall supply mountings and fixtures to Depot contractor	**ST/CWD-11:** Shall install and assist in mounting and fixing arrangements for heavy equipments like CCTV monitors, display boards, clocks etc during the construction as per ST requirements **keeping the structure strength in mind.**
ST/CWD-12: Shall install the equipments at OCC Depot and station like staff protection keys locks, emergency stop plungers, PIDS, PA System, Clocks, CCTV cameras and TV equipment etc	**ST/CWD-12:** Shall facilitate
ST/CWD-13: Shall lay all necessary cables in Depot, station and other areas	**ST/CWD-13:** Shall arrange track crossings as per requirements. The materials like pipes etc. will be supplied by the S&T Department.
ST/CWD-14: Shall furnish cable routing plan to Contractor B for PSD	**ST/CWD-14:** Shall construct cable ducts/containment for PSD cable
ST/CWD-15: Shall install PSD at platforms of station	**ST/CWD-15:** Shall assist in installation
Contract A(Signalling Train Control, PSD & Telecommunication)	**TEST & COMMISSIONING STAGE** **Contract B(CWD)**
NIL	**NIL**
Contract A(Signalling Train Control, PSD & Telecommunication)	**MAINTENANCE STAGE** **Contract B(CWD)**
NIL	**NIL**

N7 . INDICATIVE INTERFACE SHEET OF UG TUNNEL (UGC-07) & DEPOT CIVIL WORKS (CWD)

Mumbai Metro Interface Sheet	**Contract A**	**UGC-07**	**Contract B**	**CWD**	***Rev # :***	***A1***
					Date:	***09/01/17***
Approved by *:*	**UG Tunnel (UGC-07)** Lead Contract		**Depot Civil Works(CWD)** Participating Contract		First issue:	
GC issued by :						
Checked by :						

General Interface details between Underground Tunnels and Depot Civil Works.

Contract A(UGC-07)	**DESIGN STAGE**	Contract B(CWD-DDC)
UG/CWD-01: Contractor-A shall design the cut &cover portion including the ramp leading to the Depot connection . The Contractor-A shall interface and coordinate with the Contractor-B on the following issues/requirements : **a)** Longitudinal profile at the Contract boundary and its approaches ; **b)** Formation /Rail level on depot connection (to be compatible with the base of ramp structure). **c)** Design parameters and the provisions required in the ramp structure for accommodating the approach slab(to be designed and provided by the Contractor-B) to be provided at the junction of RCC ramp structure with the at-grade formation(for the smooth transition from ballastless track on the ramp to the ballasted track on the formation).		**UG/CWD-01:** Contractor-B Shall exchange the required details with the Contractor-A to ensure the compatability of works to be done by the two contractors at the contract boundary and its approaches.
UG/CWD-02: Contractor-A shall Agree and incorporate Survey and Alignment details given by Contract-B		**UG/CWD-02:** Contractor-B Shall give particulars of Survey and Alignment details like Vertical and horizontal profile, rail level,gradient,radius and transition of curve at the junction point(contract boundary).

Mumbai Metro Interface Sheet	Contract A	UGC-07	Contract B	CWD	*Rev # :*	*A1*
					Date:	*09/01/17*
UG/CWD-03: Contractor-A shall Agree with the drainage scheme duly ensuring the compatibility and incorporate the drainage system/measures in the beginning of ramp given by Contractor-B.			**UG/CWD-03:** Contractor-B Shall design the drainage arrangements in depot at the junction of RCC ramp structure with the at-grade formation and its approaches to prevent (to the maximum extent possible) water entering from depot to the ramp/tunnels etc. and furnish the details of drainage System/measures required to be incorporated in the ramp structure.			
Reference documents:			Reference documents:			
Contract A(UGC-07)		**CONSTRUCTION / INSTALLATION STAGE**		Contract B(CWD)		
UG/CWD-04: Shall review the measures and agree for their adequacy			**UG/CWD-04**: Take measures and ensure that water doesn't enter from depot to the ramp/tunnels .			
UG/ CWD -05: Accept survey details of Depot connecting section			**UG/CWD-05**: Accept survey details of cut & cover portion including the ramp.			
Reference documents:			Reference documents:			
Contract A(UGC-07)		**TEST & COMMISSIONING STAGE**		Contract B(CWD)		
UG/CWD -*06*:Contractor-A shall co-ordinate with contractor-B and rolling stock contractor while conducting trial tests regarding kinematic and structural gauge checking and undertake corrective works in the profile wherever necessary.			**UG/CWD-06**: Contractor-B should attend for testing and commissioning work and do Corrective works in the profile where ever necessary			
Reference documents :			Reference documents*:*			

Mumbai Metro Interface Sheet	**Contract A**	**UGC-07**	**Contract B**	**CWD**	***Rev # :***	***A1***
					Date:	***09/01/17***
Contract A(CWD)		**MAINTENANCE STAGE**		Contract B(RST)		
NIL			**NIL**			
Reference documents:			Reference documents:			

N8. INDICATIVE INTERFACE SHEET OF DEPOT CIVILWORKS (CWD) & DEPOT E & M STATION(DEM)

Mumbai Metro Interface Sheet	**Contract A**	**CWD**	**Contract B**	**DEM**	***Rev # :***	***A1***
					Date:	***09/01/17***
Approved by *:*	**Depot Civil Works(CWD)** Lead Contract		**DEM (DEM Stations)** Participating Contract		First issue:	
GC issued by :						
Checked by :						
General Interface details between Civil work Depot(CWD) and DEM Stations(DEM)						
Contract A(CWD-DDC)	**DESIGN STAGE**			Contract B(DEM)		
CW/DEM-01:Shall provide the E&M requirement in the architectural drawings.			**CW/DEM-01**: Shall advice to Contract "A" regarding E&M requirement such as required cutout, sleeves, wall opening for all MEP services to be provided in architectural and structural design at Depot and Array Station.			
CW/DEM-02: Shall coordinate and provide requirement of Contract "B" in drawings			**CW/DEM-02**: Ensure all the required cut outs, sleeves and other provisions for E&M services as VAC, Fire Fighting, cable trays, etc. are in place as per the drawing and requirement.			
CW/DEM-03: Shall include Contract "B" requirement in the civil drawings.			**CW/DEM-03**: Shall advice the required trench layout for electrical cables with three types of trenches, one for HT cables, one for LT cables, and one combined for both LT & HT cables (required number of trenches will be designed considering minimum 750mm horizontal sufficient space for installation and maintenance works) pipe lines, etc. for various E&M services to be provided in the civil drawings.			

Mumbai Metro Interface Sheet	Contract A	CWD	Contract B	DEM	*Rev # :*	*A1*
					Date:	*09/01/17*
CW/DEM-04: Shall incorporate Contract "B" requirement in his false ceiling design. (Reflected Ceiling Plan).			***CW/DEM-04***: Shall provide required drawings to Contract "A" of lighting fixture mouting/fixing details, layout & design, fire alarm &fire fighting equipment's location, VAC equipments etc.			
CW/DEM-05: Shall incorporate Contract "B" E&M equipment loads in Structural design.			**CW/DEM-05:** Shall submit the E&M equipment's loads (weight) details and GAD to Contract "A".			
CW/DEM-06: Shall incorporate and provide the lifting hooks / chain pulley with rail arrangement for other E&M services as required.			**CW/DEM-06**: Shall submit the lifting hook, chain pulley with rail arrangement details / load requirements for all MEP services to Contract "A".			
CW/DEM-07: Shall incorporate foundation for Transformers, DG's, Compressor, VAC equipment, Firefighting pumps and other E&M equipment as required.			**CW/DEM-07**: Shall provide the Dimensional and load (in kgs / ton) details of E&M to Contract "A".			
CW/DEM-08: Shall design and construct the fire water tank, raw water tank and treated water tank.			**CW/DEM-08**: Shall coordinate and provide water requirement for fire fighting system, raw water and treated water to Contract "A".			
CW/DEM-09: Cable trench and manholes with top cover should be provided by civil. (RCC for External Trenches and Steel for Internal Trenches).			**CW/DEM-09**: Shall advice Contract "A" the E&M requirement with trench and manhole layout plan, etc. details and drawings.			
CW/DEM-10: Shall coordinate & provide Contractor "B" requirement			**CW/DEM-10**: Closing and sealing of cable trench at entry / exit point of trench / manholes to the building from external trench.			

Mumbai Metro Interface Sheet	Contract A	CWD	Contract B	DEM	*Rev # :*	*A1*
					Date:	*09/01/17*
CW/DEM-11: Shall provide the I/O points on open protocol for plumbing pumps, STP & ETP equipments, control panels, etc to Contract "B".			**CW/DEM-11**: Shall integrate with Depot E&M SCADA or BMS System.			
CW/DEM-12: Shall provide electrical power requirement for ETP, STP to Contract "B" for designing power distribution.			**CW/DEM-12**: Shall design and incorporate in the electrical distribution the requirements of Contract "A".(only power cables)			
CW/DEM-13: Shall co-ordinate & provide area required for earthing, the Soil resistivity report, etc. for Earth Mat Design.			**CW/DEM-13**: Shall advice to Contract "A" Earth mat area and shall design the Earth Mat in coordination with Civil Contractor.			
CW/DEM-14: Shall provide the Earthing and Bonding Details for Civil and Steel Structures.			**CW/DEM-14**: Shall advice to Contract "A" E&M Earthing design details requirements.			
CW/DEM-15: Shall provide to Contract "B" wall partition, glass glazing, roof sheeting, etc. specification and other details for designing of VAC works (In room wise matrix form).			**CW/DEM-15**: Shall detail VAC designs as per room detail inputs from Contract "A". (Shall detail A/c, Non A/c rooms etc).			
CW/DEM-16: Over head crane weight shall be incorporated in workshop's structural design as per requirement of contract "B".			**CW/DEM-16**: Shall advice to contact "A" the Overhead Crane details like types, Quantity, Capacity, weight, etc.for incorporation in structural design.			
CW/DEM-17: Shall design pump sizing, rating and head for the water supply pumps, sump pumps, horticulture pupms etc.			**CW/DEM-17**: Shall incorporate and design Control panel and electrical distribution system accordingly.			

Mumbai Metro Interface Sheet	**Contract A**	**CWD**	**Contract B**	**DEM**	***Rev # :***	***A1***
					Date:	***09/01/17***
Contract A(CWD)		**CONSTRUCTION / INSTALLATION STAGE**		Contract B(DEM)		
CW/DEM-18:Shall provide the Contract "B" requirements / details as mentioned under Design Stage above.			**CW/DEM-18**: Shall coordinate, verify and submit acceptance to Contract "A" works.			
CW/DEM-19:Shall share and incorporate the E&M requirements in the architectural false ceiling drawings			**CW/DEM-19**:Shall coordinate and advice with Contract "A" for requirement.			
CW/DEM-20:Shall provide the space for installation of raceways before finished flooring works.			**CW/DEM-20**:Shall install the required raceways before flooring works.			
CW/DEM-21:Shall install aligned Steel Girders for Overhead crane long travel movement.			**CW/DEM-21**:Shall verify the requiremets provided by contract "A".			
CW/DEM-22:Shall advice to Contract "B" the installation instructions for welding rails and all other peripheral accessories for Overhead Crane operations.			**CW/DEM-22**:Shall follow the advice of Contract "A" for completion of welding works for Crane operations.			
CW/DEM-23:Fixing work of Supporting arrangement for High Bay/Medium Bay Lighting to be provided.			**CW/DEM-23**:Shall arrange Lighting luminaires etc. with fixing arrangement.			
CW/DEM-24:Excavation and closing of area identified for earth mat will be done by Contract "A" in coordination with Contract "B".			**CW/DEM-24**:Shall share the design details of earth mat for excavation and cloaing of pits to Contract "A".			

Mumbai Metro Interface Sheet	**Contract A**	**CWD**	**Contract B**	**DEM**	***Rev # :***	***A1***
					Date:	***09/01/17***
CW/DEM-25:Contract "A" shall provide three types of cable trench with cover for electrical cables (first for onlyLT cables, second for only HT cables and third for both HT & LT combined), pipe lines, and Drainage lines for various MEP services in Depot to be provided in the civil drawings.			**CW/DEM-25**:Shall coordinate and advice to Contract "A"the requirements			
CW/DEM-26: Shall provide piping network for water supply system, strom water drainage system, horticulture sypply system and coordinate with contract "B" in installation of pumps.			**CW/DEM-26**:Shall provide water supply pumps, sump pumps, horticulture pupms etc. as requirement of Contract "A".			
Reference documents:			Reference documents:			
Contract A(CWD)		**TEST & COMMISSIONING STAGE**		Contract B(DEM)		
CW/DEM-27: Contract "A" shall conduct test run jointly with Contract "B" corrective works in the profile wherever necessary.			**CW/DEM-27**: Contract "A" shall conduct test run jointly with Contract "B"			
Reference documents :			Reference documents:			
Contract A(CWD)		**MAINTENANCE STAGE**		Contract B(DEM)		
NIL			**NIL**			
Reference documents:			Reference documents:			

N9. INDICATIVE INTERFACE SHEET OF DEPOT CIVIL WORKS (CWD) AND PYLON TERMINATION CONTRACTOR (PYL)

Mumbai Metro Interface Sheet	**Contract A**	**CWD**	**Contract B**	**PYL**	***Rev # :***	***A1***
					Date:	***09/01/17***
Approved by *:*	**Depot Civil Works(CWD)** Lead Contract		**Pylon Termination Contractor (PYL)** Participating Contract		First issue:	
GC issued by :						
Checked by :						
General Interface details between Depot Civil Works and Pylon Termination Contractor						
Contract A(CWD)	**CONSTRUCTION / INSTALLATION STAGE**			Contract B(PYL)		
CW/PY-01: Shall construct diversion road based on Termination yard layout			**CW/PY-01:**Shall mark termination yard layout on ground including working space required for construction of termination yard.			
CW/PY-02: Shall evolve construction methodology for underpass so that already constructed cable duct not damaged.			**CW/PY-02:**Shall complete cable duct nearer to underpass on priority and vacate the area for Contract A.			
CW/PY-03: Shall undertake construction work at existing pylons(4 nos) location only after Termination yard is commissioned and existing pylons including foundations dismantled.			**CW/PY-03:**Shall dismantle existing pylons including foundation without disturbing adjacent construction work carried out by Contract A.l			
Reference documents:			Reference documents:			
Contract A(CWD)	**TEST & COMMISSIONING STAGE**			Contract B(PYL)		

Mumbai Metro Interface Sheet	**Contract A**	**CWD**	**Contract B**	**PYL**	***Rev # :***	***A1***
					Date:	***09/01/17***
Reference documents :			Reference documents*:*			
Contract A(CWD)		**MAINTENANCE STAGE**		Contract B(PYL)		
NIL			**NIL**			
Reference documents:			Reference documents:			

N10 . INDICATIVE INTERFACE SHEET OF DEPOT EQUIPMENT(DEQ) AND DETAILED DESIGN CONSULTANT(DDC)

Mumbai Metro Interface Sheet	**Contract A**	**DEQ**	**Contract B**	**DDC**	***Rev # :***	**A0**
					Date:	**03-02-2017**
Approved by :	**Depot Equipment Contractor** (Interface Lead)		**Detailed Designed Consultant** (Interface Follower)		Last changes :	
GC issued by :						
GC Checked by :						

General Interface details between Depot Contractor and Detailed Designed Consultant

Contract A (Depot Equipment)	**DESIGN STAGE**	Contract B (Detailed Designed Consultant)
DE/DDC-01: Under-floor wheel lathe along-with Chip crusher, conveyor and Train Shunter – Shall provide details of civil requirements for building, Machine foundation, flooring, pit, drainage, etc.		**DE/DDC-01**: Shall prepare the civil construction drawings along with interfaces.
DE/DDC-02: **Railcar lifting system for 4 cars (Pit jacks)** – Shall provide requirements for foundation of equipment, Pits etc.		**DE/DDC-02**: Shall prepare the civil construction drawings along with interfaces.
DE/DDC-03: **Mobile lifting jacks for 8 cars** – Shall give requirements for Floor Surface, markings etc.		**DE/CW-03**: Shall prepare the civil construction drawings along with interfaces.
DE/DDC-04: **Bogie Turn Table** -Shall define the requirements for mounting foundation etc. for Bogie Turntables		**DE/DDC-04**: Shall prepare the civil construction drawings along with interfaces.
DE/DDC-05: **Automatic Train Wash Plant** - Shall define the floor and other foundations including the pipeline ducts, drainage, tanks etc. for the train wash plant. To lay the cables/conduit etc. to provide the Control of the Train Wash plant in DCC and shall co-ordinate the job with Depot Civil Works		**DE/DDC-05**: Shall prepare the civil construction drawings along with interfaces.

Contractor.	
DE/DDC-06: **Bogie Testing Bench** - Shall define the structure and foundation of the testing bench and to define the Civil require the testing bench	**DE/DDC-06**: Shall prepare the civil construction drawings along with interfaces.
DE/DDC-07: **Air Compressor for shop air supply with Piping Network –** Shall provide details for mounting, mounting elements, flooring, openings, trenches and other requirements. To define and lay the piping network for the compressed air from compressor room to workshop, etc.	**DE/DDC-07**: Shall prepare the civil construction drawings along with interfaces.
DE/DDC-08: **Pendant Type Travelling EOT cranes (for inspection bay & workshop) -** Shall define requirements for crane installation in inspection bay and workshop. To clear of the ceiling or roof of the building.	**DE/DDC-08**: Shall prepare the civil construction drawings along with interfaces.
DE/DDC-09: Any other Depot Equipment - Shall define the requirements for civil construction.	**DE/DDC-09**: Shall prepare the civil construction drawings along with interfaces.
Reference documents:	**Reference documents:**

N11 - INDICATIVE INTERFACE SHEET OF DETAILED DESIGN CONSULTANT(DDC) AND DEPOT CIVIL WORKS (CWD)

Mumbai Metro Interface Sheet	**Contract A**	**DDC**	**Contract B**	**CWD**	***Rev # :***	**A0**
					Date:	**03-02-2017**
Approved by :	**Detailed Design Consultant** (Interface Lead)		**Depot Civil Works Contractor** (Interface Follower)		Last changes :	
GC issued by :						
GC Checked by :						

General Interface details between Detailed Design Consultant Works and Depot Civil Works

Contract A (Detailed Design Consultant)	**CONSTRUCTION STAGE**	Contract B (Depot Civil Works)
DDC/CW-01: Under-floor wheel lathe along-with Chip crusher, conveyor and Train Shunter - Shall prepare the civil construction drawings along with interfaces.		**DDC/CW-01**: Shall construct Building, Pit, Floor, and Foundation for lathe, gantry for crane, drainage and electrical conduits for the Pit and opening in the Wall for Chip conveyor and all other civil requirements.
DDC/CW-02: **Railcar lifting system for 4 cars (Pit jacks)** - Shall prepare the civil construction drawings along with interfaces.		**DDC/CW-02**:Shall construct to build according to the requirements. The Depot Civil Works Contractor to provide the drainage for the Pit.
DDC/CW-03: **Mobile lifting jacks for 8 cars** - Shall prepare the civil construction drawings along with interfaces.		**DDC/CW-03**: Shall construct according to the requirements
DDC/CW-04: **Bogie Turn Table** - Shall prepare the civil construction drawings along with interfaces.		**DDC/CW-04**: Shall construct according to the requirements
DDC/CW-05: **Automatic Train Wash Plant** - Shall prepare the civil construction drawings along with interfaces.		**DDC/CW-05**: Shall construct according to the requirements. Provide the epoxy painting at the Train Wash Plant floor area if necessary. Depot Civil Works Contractor to conceal the Conduits etc. as defined and laid by the Depot Equipment Supplier.

DDC/CW-06: **Bogie Testing Bench** - Shall prepare the civil construction drawings along with interfaces.	**DDC/CW-06**: Shall construct according to the requirements.
DDC/CW-07: **Air Compressor for shop air supply with Piping Network** - : Shall prepare the civil construction drawings along with interfaces.	**DDC/CW-07:** Shall construct according to the requirements. To provide the passageway I trenches, etc. for the compressor piping network as defined by the Depot Equipment supplier.
DDC/CW-08: **Pendant Type Travelling EOT cranes (for inspection bay & workshop) -** Shall prepare the civil construction drawings along with interfaces.	**DDC/CW-08**: Shall construct according to the requirements. Build the columns, install girders, corbels/trusses, etc. to accommodate the mounting of the cranes.
DDC/CW-09: Any other Depot Equipment - Shall prepare the civil construction drawings along with interfaces.	**DDC/CW-09**: Shall construct according to the requirements.
Reference documents:	**Reference documents:**

APPENDIX 20 (Revised)

SCHEDULE OF DIMENSIONS

FOR

STANDARD GAUGE
(1435 MM)

(FOR 3200 MM WIDE STOCK)

JANUARY 2017

MUMBAI METRO RAIL CORPORATION LTD

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PREAMBLE

The schedule of dimensions for Standard Gauge Mumbai Metro Line 3 Corridor has been prepared based on following factors:

1. The Kinematic Envelope has been adopted for the 3200 mm wide rolling stock and 4048 mm (pantograph in locked down condition) high rolling stock. The track and vehicle maintenance shall conform to the clearances indicated therein during the period these stocks are in operation.

2. The clearances are based on the assumption that windows are sealed and doors are closed during movement/operation.

3. Track shall be maintained to the tolerances taken for calculation of kinematic envelope.

4. The Structure Gauge indicated in SOD shall not be violated under any circumstances except for platform coping, Platform Screen Doors (PSD) and hand railing in back of house of platform edge.

5. The Kinematic Envelope(s) indicated in SOD shall not be violated under any circumstances.

6. The vehicle Kinematic Envelope at a speed of 70 kmph for the platform area shall be applied within confines of stations. At all other locations, the kinematic envelope corresponding at 85 kmph operation speed shall be used for determining the Structure Gauge. The Design speed is set with 95 Kmph.

7. The maximum operating speed through station platforms shall be limited to 70 kmph and at all other locations 85 kmph ,subject to speed restriction .

8. No vertical curve shall be provided in platform area.

9. The SOD is applicable for ballast less track on main line and Ballasted/Ballastless track in the Depots.

10. No work/work men are allowed during operations of trains.

MUMBAI METRO LINE 3

SCHEDULE OF DIMENSIONS

STANDARD GAUGE (1435 MM GAUGE)

(FOR 3200 MM WIDE STOCK)

INTRODUCTION

The dimensions given in this are to be observed in all new works and alterations to existing works on 1435 mm gauge (STANDARD GAUGE) and 3200 mm wide Rolling Stock, unless prior sanction has been obtained from the Railway Board through the Commissioner of Railway Safety to execute works which infringe this Schedule Of Dimensions.

This Schedule of Dimensions is applicable to Underground , At-grade and Elevated Sections of Mumbai Metro Line 3 (MML3) which shall be with 25 kV, AC Traction system and Over Head current collection. The rolling stock shall be 3200 mm wide with sealed windows and doors closed while in motion.

The Underground system may be with a Circular Tunnel or Rectangular Box or of any other suitable shape while elevated system may be with suitable over ground structure such as viaducts .Both Underground and Elevated system shall have suitably designed ballastless track .For Depot tracks may be ballasted track /ballastless track .

The Schedule of Dimensions (SOD) has been divided into five chapters as under

CHAPTER-1----------	GENERAL
CHAPTER-2 ----------	STATION
CHAPTER-3----------	ROLLING STOCK
CHAPTER-4----------	ELECTRIC TRACTION
CHAPTER-5 ----------	PLATFORM SCREEN DOORS

CHAPTER – 1
GENERAL

1.1. SPACING OF TRACKS

1.1.1. Minimum distance, centre to centre of tracks without any structure between tracks for tangent (straight) track for:

(a) Under Ground sections……. 3800 mm
(b) Elevated sections……3900 mm
(c) At-grade sections……3900 mm

Note:
See Appendix-1 for minimum track centres on curves.

1.2. CURVES

1.2.1. Minimum radius of curves (horizontal)

On main running lines:	
a) Underground sections	200 m
b) Elevated and at-grade sections	120 m
Depot and other lines	100 m
At passenger platforms	1000 m

1.2.2. Check rail / Restraining rail

Check rail /Restraining rail shall be provided on curves on main line in the case that the radius is 190 m or less duly considering the limits given in 1.2.1. Check rail/ Restraining rail shall not be mandatory for curves in depots, yards and non-passenger lines where speed is less than 25 kmph. The clearance between the check/restraining rail and running rail shall be suitably decided by the Metro Authority.

1.2.3. Minimum radius of vertical curve

Minimum radius of vertical curve:	1500 m

1.3. GRADIENT

1.3.1 Maximum gradient shall be 4%. This maximum value has to be compensated according to Notes (ii) below .

Notes:

(i) There will be no change of gradient in transition portion of curves.

(ii) The gradient will be compensated for curvature at the rate of 0.04% per degree of curve.

1.3.2 Maximum permissible gradient on turnouts

i) On ballasted track	0.25%
ii) On ballastless track	2.5 %

Notes:

(i) There shall be no change of grade on and within 15 meters of any turnout on ballastless track. Similarly, there shall be no change of grade on and within 30 meters of any turnout on ballasted track.

(ii) In case of turnouts on gradient, there shall be no horizontal curve on and within 15 meters of any turnout on ballastless track and 30 meters of any turnout on ballasted track.

1.4. BUILDINGS AND STRUCTURES

1.4.1 Minimum horizontal distance from centre of track to any structure for heights above rail level on level/constant grade tangent track shall be as below:

(a) AT-GRADE

Height from rail level		Horizontal distance from centre line of track
(i)	Up to 305 mm	1771 mm
(ii)	305 mm to 880 mm	1771 mm increasing to 1903 mm
(iii)	880 mm to 1095 mm	1903 mm
(iv)	1095 mm to 1130 mm	1903 mm increasing to 1938 mm
(v)	1130 mm to 2030 mm	1938 mm
(vi)	2030 mm to 3300 mm	1938 mm decreasing to 1875 mm
(vii)	3300 mm to 3736 mm	1875 mm decreasing to 1540 mm
(viii)	3736 mm to 6250 mm	1540 mm

Also refer to FIG. no. MMRC-2

(b) UNDER GROUND SECTIONS

(i) CIRCULAR TUNNELS

Height from rail level		Horizontal distance from centre line of track
(i)	Up to 305 mm	1720 mm
(ii)	305 mm to 880 mm	1720 mm increasing to 1849 mm
(iii)	880 mm to 1095 mm	1849 mm
(iv)	1095 mm to 1130 mm	1849 increasing to 1875 mm
(v)	1130 mm to 2030 mm	1875 mm
(vi)	2030 mm to 3346 mm	1875 mm decreasing to 1815 mm
(vii)	3346 mm to 3738 mm	1815 mm decreasing to 1390 mm
(viii)	3738 mm to 4620 mm	1390 mm
(ix)	4620 mm to 4970mm	1390 mm decreasing to zero along an arc of radius 2800mm

Also refer to FIG. no. MMRC-2 (Circular Tunnel)

(ii) RECTANGULAR BOX TUNNELS

Height from rail level		Horizontal distance from centre line of track
(i)	Up to 305 mm	1720 mm
(ii)	305 mm to 880 mm	1720 mm increasing to 1849 mm
(iii)	880 mm to 1095 mm	1849 mm
(iv)	1095 mm to 1130 mm	1849 increasing to 1875 mm
(v)	1130 mm to 2030 mm	1875 mm
(vi)	2030 mm to 3346 mm	1875 mm decreasing to 1815 mm
(vii)	3346 mm to 3738 mm	1815 mm decreasing to 1390 mm
(viii)	3738 mm to 4838 mm	1390 mm

Also refer to FIG. no.MMRC-2 (BOX TNL)

Notes for (a) and (b) above:

i) Extra allowance shall be provided for curves as laid down at Para1.7.
ii) The term 'structure' covers any item including light ones like ladders, isolated posts, cables etc. erected alongside the track.
iii) Minimum lateral clearance for OHE masts for tangent track shall be 2150 mm from centre line of nearest track.
iv) For passenger platform & PSD refer to Para 2.2.1 to 2.2.3 of chapter 2.

1.5. KINEMATIC ENVELOPE

The kinematic envelope for level or constant grade tangent track, refer to:
a) FIG. no. MMRC-1 for At-grade and Elevated Sections
b) FIG. no. MMRC-1(TNL) for Underground Sections

1.6. STRUCTURE GAUGE

1.6.1 Underground Sections

The Structure Gauge (Fixed Structure Line) has been arrived at by allowing a minimum clearance of 100 mm to kinematic envelope and minimum electrical clearance of 270 mm from 25 kV live parts conforming to the stipulations in Chapter 4 of this SOD.

Refer to FIG. no. MMRC-2(BOX TNL) and FIG. no. MMRC-2(CIRCULAR TNL) for structure gauge for underground sections (outside station) with ballast less track for level or constant grade tangent track.

Note:

Extra allowance shall be provided for curves as laid down at para 1.7.

1.6.2 Elevated Sections

The Structure Gauge (fixed structure line) has been arrived at by allowing minimum clearance of 150 mm to kinematic envelope and minimum electrical clearance of 270mm from 25 KV live parts conforming to the stipulations in Chapter -4 of this SOD.

For Structure Gauge on Elevated sections (outside station) with ballast less track for level or constant grade tangent track, refer to FIG. no.MMRC-2.

Note:

Extra allowance shall be provided for curves as laid down at Para 1.7.

1.6.3 At-Grade Sections

The Structure Gauge (Fixed Structure Line) has been arrived at by allowing minimum clearance of 150 mm to kinematic envelope and minimum electrical clearance of 270mm from 25 kV live parts, conforming to stipulations in Chapter 4 of this SOD.

For Structure Gauge on At-grade sections (outside stations) on level or constant grade tangent track, refer to FIG. no. MMRC-2.

Note:

Extra allowance shall be provided for curves as laid down at Para 1.7.

1.7. EXTRA CLEARANCES ON CURVES

Following are the extra allowances considered for curves.

Abbreviations used in para 1.7:

C is the distance between centres of bogies in meters,
$\mathbf{C_1}$ is the coach (vehicle) length in meters,
R is the radius of curve in meters,
$\mathbf{C_a}$ is the cant applied in mm,
h is the height from rail level in mm and
G is the distance between centres of rails in mm

1.7.1 INSIDE OF CURVE

(A) CURVATURE EFFECT

i. Mid throw at the centre of the vehicle = V (in mm) = 125 x C^2/R
ii. Allowance due to gauge widening on curves

For values of items i. and ii. above, refer to Appendix 2.

Note:

Lateral shift of 32 mm due to nosing is included in kinematic envelope for tangent track (and as a result included in Structure Gauge also) shall be subtracted from the total extra allowance worked out as at para 1.7.1(A) i. & ii. above for inside of a curve in case the value of mid throw (V) is equal to or greater than 32 mm. In case the value of mid throw (V) is less than 32 mm, the curvature effect shall be due to widening of the gauge only. (The Mid throw minus 32.0 mm shall be taken as zero). Refer please also to Appendix 2.

(B) ALLOWANCE FOR SUPER ELEVATION

(a) Under Ground (Box Structures), At-Grade and Elevated Sections

The lean 'L' due to cant at any point at height 'h' above rail level is given by:

$L = C_a \times h/g$ (all in mm)

For values of structure gauge (E_1) for inside of a curve with cant effect only, refer to:

(i) Appendix 4 (BOX TNL) & FIG. No. MMRC 4 (BOX TNL) for box structures of underground sections;
(ii) Appendix 4 & FIG. No. MMRC 4 for At-Grade and Elevated sections.

(b) Circular Tunnels

In the case of circular tunnel, the cant is provided by raising the outer rail and suitably shifting the centre of the circular tunnel towards inside of curve and upwards. This has same effect as assuming rotation of the circular tunnel about mid-point of top of inner rail resulting in shift of Tunnel centre laterally towards inside of curve and also vertically upwards.
The Rigid OCS shall also be rotated with the tunnel so as to be along the centre line of canted track.
For values of horizontal and vertical shifts of centre of circular tunnel for different values of cant, refer to Appendix-3 & FIG. No. MMRC 3.

(c) Allowance for vertical curve (Vertical throw):

Vertical throw V_1 and V_2 (in mm) for vertical curve shall be calculated as under:

V_1 (with vehicle centre in sag or vehicle end on summit) = 125 x C^2/R
V_2 (with vehicle centre on summit or vehicle end in sag)
= (125 x C_1^2/R)-(125 x C^2/R)
Values of vertical throw due to vertical curves of different radii are given in Appendix–6 & FIG. No. MMRC 6.

1.7.2 OUTSIDE OF CURVE

(A) CURVATURE EFFECT

i) End throw at the end of vehicle = V_O (in mm)

= [125 x C_1^2/R]-[125 x C^2/R]

ii) Allowance due to gauge widening on curves
iii) Additional nosing due to gauge widening on curves

The values of items i) to iii) are shown in Appendix-2

(B) ALLOWANCE FOR SUPER ELEVATION

(a) Under Ground (Box Structures), At-grade and Elevated Sections
The lean 'L' due to cant at any point at height 'h' above rail level is given by:
$L = (-) c_a \times h/g$ (all in mm)
-Ve sign indicates relief due to cant or reduction in clearance required.

Note:

Full relief for lean due to cant (Ca) is to be taken into account only for calculation of track spacing without any structure between tracks. In case there is a structure adjacent to track, relief for lean is to be taken into account only if the cant provided is greater than 50 mm and shall be limited to a value = (Ca - 50) X h/g.

Values of Structure Gauge (F_1) on outside of curve with cant effect only, refer to:

I) Appendix -4 (TNL) & FIG. No. MMRC 4 (TNL) for underground sections (RECTANGULAR BOX)
II) Appendix- 4 & FIG. No. MMRC 4 for At-Grade and Elevated sections

(a) Circular tunnels

In the case of circular tunnel, the cant is provided by raising the outer rail and suitably shifting the centre of the circular tunnel towards inside of curve and upwards. This has same effect as assuming rotation of the circular tunnel about mid-point of top of inner rail resulting in shift of tunnel centre laterally towards inside of curve and also vertically upwards.

The Rigid OCS shall also be rotated with the tunnel so as to be along the centre line of canted track.

For values of horizontal and vertical shifts of centre of circular tunnel for different values of cant, refer to Appendix–3 & FIG. No. MMRC 3.

(b) Allowance for vertical curve (vertical throw)

The provisions at Para1.7.1 (C) above shall be applicable in this case also.

1.8 MINIMUM TRACK SPACING ON CURVES

Underground, At-grade and Elevated Sections:

The worst case will be when the end of a bogie carriage on the inner track is opposite the Centre of a similar carriage on the outer track.

1.8.1 Without any structure between tracks.

The minimum track spacing on curves without any structure between tracks shall be the sum of the following:

i) (E + F),
ii) T_1(extra lateral allowance due to curvature on inside of curve
iii) T_2(extra lateral allowance due to curvature on outside of curve
iv) Minimum clearance between adjacent kinematic envelopes stipulated is as under:

a) 200 mm for under-ground sections
b) 300 mm for At-Grade and Elevated sections

Where:
'E' is the distance from vertical axis of Centre line of canted track to canted kinematic envelope on inside of curve at a height 'h' (from rail level) for a given cant (Appendix-5 &

FIG. No. MMRC 5 for At-Grade and Elevated and Appendix-5(TNL) & FIG. No. MMRC 5 (TNL) for underground tunnels) and

'F' is the distance from vertical axis of Centre line of canted track to canted kinematic envelope on outside of curve at a height 'h'(from rail level) for a given cant (refer toAppendix-5 & FIG. No. MMRC 5 & Appendix-5 (TNL) & FIG. No. MMRC 5 (TNL).

Notes:

i) The value of 'F', calculated from the formula at Appendix-5 & FIG. No. MMRC 5 and Appendix-5 (TNL) & FIG. No. MMRC 5 (TNL) includes full relief due to cant.

ii) The sum of 'E' and 'F' for same height (which are with cant effect only), shall be the maximum of values calculated for various heights from rail level.

For values of E, F, $T_1$and T_2, refer to the Appendices as shown below:

SECTIONS	**FOR E & F** APPENDIX	**FOR T_1&T_2** APPENDIX
I) Underground	5 (TNL)	2
II) At-grade and Elevated	5	2

1.8.2 With a structure between adjacent tracks

The minimum track spacing on curves with a structure between tracks shall be the sum of the following:

i) (**E_1 +T_1**) Minimum clearance to the structure from centre line of track on inside of curve (for outer track)
ii) (**F_1 +T_2**) Minimum clearance to the structure from centre line of track on outside of curve (for inner track)
iii) Width of structure between adjacent tracks (measured across the tracks).

Where,

$E_1$is the horizontal distance from vertical axis of centre line of track to canted Structure Gauge on inside of curve for a given cant,
$F_1$is the horizontal distance from vertical axis of centre line of track to canted Structure Gauge on outside of curve for a given cant,
$T_1$is extra lateral allowance due to curvature on inside of curve and
$T_2$is extra lateral allowance due to curvature on outside of curve

Notes:

a) The values of '**E_1'**and '**F_1'**for a given cant Ca, shall each be the maximum of values at different heights of structure from rail level. In case the cant provided is greater than 50 mm on inner track**,** the value of **F_1**shallbe for the cant of (Ca-50) mm**.** In case the cant provided is 50 mm or less on inner track, the value of F_1shall be for zero cant.
b) Minimum track spacing, so worked out with a structure between the adjacent tracks as per Para 1.8.2 shall not be less than that calculated as per para 1.8.1 for tracks without any structure between adjacent tracks.

For values of **E_1**, **F_1**, **T_1** AND **T_2**, refer to the Appendices as shown in table below:

SECTIONS	**FOR E_1 & F_1** APPENDIX	**FOR T_1&T_2** APPENDIX
I) Underground	4 (Box TNL)	2
II) At-grade and Elevated	4	2

1.9 CANT AND CANT DEFICIENCY

A) Maximum cant on curves = 125 mm
B) Maximum cant deficiency = 100 mm

1.10 PATHWAY/WALKWAYS

(i) Minimum width of Pathway/walkways	552 mm
(ii) Minimum height of Pathway/walkways	1000 mm
(iii) Maximum height of Pathway/walkways	1200 mm

Note:

Extra allowances shall be provided for curves as laid down at para 1.7

(i) Maximum and minimum heights of pathway/walkway on curves are above inner rail.
(ii) No structure, other than signalling and minor signalling equipment post, shall be permitted within the minimum width of pathway/walkway.
(iii) Minimum clearance to pathway/walkway at the nearest edge from kinematic envelope shall be 100mm for underground sections and 150mm for At-Grade and Elevated sections.
(iv) Pathway/Walkway could be used by metro inspection group only in non-operation periods and for evacuation of passengers in emergency.

1.11 DERAILMENT GUARD

a) Derailment guard shall be provided inside/outside of running rail on elevated as well as in tunnel having multiple tracks and at-grade section at locations specified by the Metro railway. For single track tunnel, location for providing derailment guard is given in note. In tunnels, the derailment guard should preferably be provided inside the track, so that it permits less sway of coach towards tunnel wall in case of derailment.

Notes:

In case of single track tunnel, the derailment guards shall be provided:

1. Entry of tunnel: 200 m from tunnel portal outside the tunnel to 50 m inside the tunnel.

2. Exit of tunnel: 50 m from inside of tunnel portal to 200 m outside the tunnel.

3. In curved track having radius 500 m or less including transition portion but excluding locations where check rail is provided.

4. Covering locations of all important installations e.g. Location of any sub-station or hazardous structures inside the tunnel, etc. damage to which in the assessment of metro rail administration can result into serious loss of life or/and infrastructure as a result of derailment in tunnel.

The above is subject to the condition that metro railway shall carry out the risk assessment analysis for derailment in tunnels and ensure that the maintenance practices in the maintenance manual are as per the risk assessment mitigation plan.

b) The lateral clearance between the running rail and the derailment guard shall be 210 ±30 mm. It shall not be lower than 25 mm below the top of the running rail and should be clear of the rail fastenings to permit installation, replacement and maintenance.

CHAPTER - 2
STATION

2.1 SPACING OF TRACKS AT STATIONS

Minimum spacing of tracks at station on straight and on curve of radius of 1000 m and flatter, without any structure between tracks
At-grade, elevated and under-ground stations……4100 mm

2.2 PLATFORMS

2.2.1. Maximum horizontal distance from centre of track to face of passenger platform coping for tangent track

(i)	For At grade and elevated	1680 mm
(ii)	For Underground	1670 mm

2.2.2. Minimum horizontal distance from centre of track to face of passenger platform coping for tangent track

(i)	For At grade and elevated	1670 mm
(ii)	For Underground	1660 mm

Notes:

(i) Platform faces shall be flared away smoothly from the centre line of the track at either end for a distance of 1500 mm so as to give from centre of track area/at platform end so as to give from centre of track a minimum dimension :

Dimension:

- 1795 $\pm$ 5 mm for Under Ground stations
- 1785 $\pm$ 5 mm for At-Grade and Elevated stations

(ii) For additional clearance for platforms on curves, refer to para 2.7.

2.2.3. Height above rail level for passenger platform:

	Maximum	**Minimum**
(a) At-Grade……	1085 mm	1075 mm
(b) Elevated/Under Ground……	1095 mm	1085 mm

2.2.4. (i) Minimum horizontal distance of any isolated structure on a passenger platform from the edge of coping except PSD……2500 mm (At-grade/Elevated) and 2000 mm (Underground), if PSD is provided

(ii) Minimum horizontal distance of any continuous structure on a passenger platform from the edge of coping except PSD……3000 mm (At-grade/Elevated) and 2500 mm (Underground), if PSD is provided

NOTES:

a) The Platform Screen Door (PSD) may be installed at platform as per design of PSD but shall have a minimum clearance of 10mm from kinematic envelope.

b) The structure on the platform is treated as isolated if the length along the platform length is 2000 mm or less. Any structure having a length exceeding 2000 mm is treated as continuous structure. The clocks/mirrors/CCTV/signage/screens etc. shall not be

considered structures and shall be located at a minimum horizontal distance 1000 mm from platform edge /coping with minimum height of 2000mmfrom top of platform.

c) For platform structure setting-out dimensions at stations, refer to FIG. no. MMRC-7 and FIG. no. MMRC-9 for At-Grade /elevated station and FIG. no. MMRC-8 and FIG. no. MMRC-10 for underground station. No fixed structures should infringe the Structure Gauge except for designated railway operational structures. Designated railway operational structures include platform coping, platform screed door, hand railing in back-of-house platform edge, track access gates. Such designated railway operational structures should not infringe the kinematic envelope under any circumstances.

2.2.5. For Structure Gauge at stations, refer to following appendices:

a.	For Under Ground Station (Tunnel)	FIG. no. MMRC-8 & FIG. no.MMRC-10
b.	For At-Grade with One Side Platform	FIG. no. MMRC-7
c.	For Elevated Station with Island Platform	FIG. no. MMRC-9
d.	For Structure Gauge At-Grade and Elevated Station	FIG. no. MMRC-11

2.3 TRACK GRADIENT IN PLATFORM

(a) Maximum Gradient	1 In 400
(b) Desirable	Horizontal

Note: There shall be no change of gradient in platform line.

2.4 INTERLOCKING AND SIGNAL GEAR

Maximum height above rail level of any part of interlocking or signal gear on either side of centre of track subject to the restrictions embodied in note below shall be as under:

(a) <u>For Under Ground Stations</u>

• From C.L. of track to 1450 mm	25 mm
• From 1450 mmto 1585 mm	25 mm Rising To 65 mm
• From 1585 Mmto 1720 mm	65 mm Rising To 200 mm

(b) <u>For At-Grade And Elevated Stations</u>

• From C.L. of Track To 1450 mm	25 mm
• From 1450 mm To 1585 mm	25 mm Increasing To 65 mm
• From 1585 mm To 1745 mm	65 mm Increasing To 200 mm

Note:

Except for check rails of ordinary and diamond crossings, or wing rails and point rails of crossings leading to snag dead ends, or such parts of signaling gear as are required to be actuated by the wheels, no gear or track fittings shall project above rail level for a distance of 229 mm outside and 140 mm inside the gauge face of the rails.

2.5 POINTS & CROSSING

2.5.1.	Maximum clearance of check rail opposite nose of crossing	44mm
2.5.2.	Minimum clearance of check rail opposite nose of crossings	41mm
2.5.3.	Minimumclearance between switch rail and stock rail	52 mm

at heel of switch rail.

2.5.4.	Maximum clearance of wing rail at nose of crossing	44 mm
2.5.5.	Minimum clearance of wing rail at nose of crossings	41mm
2.5.6.	Minimum clearance between toe of open switch and stock rail	160 mm
2.5.7.	Minimum radius of curvature for slip points ,turnoutsand crossover roads	190 metres
2.5.8.	On main lines, the turnouts and diamond crossings shall be of the following types or flatter – (a) 1 In 9 Type Turnout	300 m radius
	(b) 1 In 7 Type Turnout	190 m radius
	(c) Scissors cross-over of 1 In 9 type consisting of 4 turnouts and 1 diamond crossing (d) Scissors cross-over of 1 In 7 type consisting of 4 turnouts and 1 diamond crossing	
2.5.9.	On depot lines, the turnouts and diamond crossings shall be of the following types or flatter (a) 1 In 7 Type Turnout	140 m radius
	(b) Scissor cross-over of 1 in 7 type consisting of 4 turnouts and 1 diamond crossing (c) 1 In 7 derailing switches / 1 in 7 type symmetrical split turnout	
2.5.10.	Diamond crossings not to be flatter than	1 in 4.5

Notes:

a) The above restrictions shall not apply to moveable diamond crossings
b) There must be no change of superelevation (of outer over inner rail), between points 18 metres outside toe of switch rail and nose of crossings respectively, except in the case of special crossing leading to snag dead-ends or under circumstances as provided for in item 2.6 below .

2.5.11. Minimum length of tongue rail: 9000 mm

2.6 SUPERELEVATION AND SPEED ON CURVES WITH TURNOUTS OF CONTRARY AND SIMILAR FLEXURE

2.6.1. Main line:

Subject to the permissible run through speed based on the standard of interlocking, the equilibrium super elevation, calculated for the speed of the fastest train may be reduced by a maximum amount of 100mm without reducing speed on the main line.

2.6.2. Turnouts

i) Curves Of Contrary Flexure
The equilibrium super elevation(**S**) in mm should be = $(1510/127)*(V^2 / R)$
Where, R = radius of turnout in meters and V is speed on turnout in kmph.
The permissible negative super elevation on the turnout (which is also the actual super elevation of the main line) has been specified 100 mm.

ii) Curves of Similar Flexure
The question of reduction or otherwise of super elevation on the main line must necessarily be determined by the administration concerned. In the case of a reverse curve close behind the crossing of a turnout, the super elevation may be run out at the maximum of 1 mm in 440 mm.

2.7 ADDITIONAL CLEARANCE FOR PLATFORMS ON CURVES

The additional clearance for platforms on curves is shown At Appendix–7.

Notes:

(i) As the minimum radius of curve for stations is 1000 meters, there will be no gauge widening at stations on passenger platform line.

(ii) Platforms located in curves shall be fitted with a gap filter wherever necessary to maintain the minimum stepping distance of 75mm. The gap filter shall be of elastic nature and flexible to allow train contact without any adverse effect on passenger safety and stability of trains.

CHAPTER - 3
ROLLING STOCK

3.1 PASSENGER ELECTRIC MULTIPLE UNITS

1.	(a)	length of the coach body: (Maximum including end fairings)	22010 mm
	(b)	The maximum width of the vehicle	3200 mm
	(c)	Height of coach body (maximum with pantograph in lock down position	4048 mm
2.	(a)	Distance between bogie centres	14750 ± 350 mm
	(b)	Maximum distance apart between any two adjacent axles	12900 mm

Note:

Fittings on the end of a vehicle, such as step iron, brake/drainage pipes, electrical connection, cables or boxes, vestibule or gangway, fairings etc. Need not be kept within the prescribed maximum permissible length of the car body, but may project beyond the end of body to a reasonable extent.

3. Kinematic Envelope for level tangent track

(i)	For Underground Sections	FIG. no. MMRC-1(TNL)
(ii)	For At-Grade and Elevated Sections	FIG. no. MMRC-1
(iii)	For Underground Section at platform	FIG. no. MMRC-1 A (TNL)
(iv)	For At-Grade and Elevated Sections at Platform	FIG. no. MMRC-1A
(v)	Same Pantograph Shall Be Used For Underground and Elevated Corridors.	

4.	(a)	Minimum clearance from rail level with fully worn Wheel and under fully loaded condition for bogie Mounted equipment in worst condition *(*The Worst condition means wheels with maximum tread wear and primary springs with maximum deflection) in static condition	75 mm
	(b)	Minimum clearance from rail level under fully loaded condition for body mounted equipment in worse condition* (*The worst condition means deflated secondary air spring, wheels with maximum tread wear and primary spring with maximum deflection) in static condition	102 mm
	(c)	Minimum clearance from rail level, under dynamic Conditions of fully loaded vehicle, with maximum tread wear and primary spring with maximum deflection, with the exception of wheels and attachments there to (vide Note below '#')	50 mm

Note:

A tyre or an attachment to a wheel or sand pipes or wheel/track lubrication nozzle in line with the wheel may project below the minimum height of 50 mm from a distance of 51 mm inside to 216 mm outside of the gauge face of the wheel.

5. Incline of Tread / Wheel Profile FIG. No.MMRC-12 (RDSO Sk-91146)
6. Wheel

a)	Maximum wheel gauge back to back distance	1360 mm
b)	Minimum wheel gauge back to back distance	1358 mm

7.	a)	Maximum diameter on the tread measured At63.5mmfrom the wheel gauge face	860 mm
	b)	Minimum diameter on the tread measured at 63.5mmfromthe wheel gauge face	780 mm
8.	a)	Minimum projection for flange of new wheel measured from tread - at 63.5 mm from the wheel gauge face For profile as per Sk-91146	28.5 mm
	b)	Maximum projection for flange of worn wheel measured from tread at 63.5 mm from the wheel gauge face	34 mm
9.	a)	Maximum thickness of flange of wheel Measured from wheel gauge face at 13 mm From outer edge of flange.	29.4 mm
	b)	Minimum thickness of flange of wheel measured from wheel gauge face at 13 mm from outer edge of flange.	25 mm
10.	Minimum width of wheel		127 mm
11.	Floor Height		
	a)	Maximum height above rail level for floor of any unloaded vehicle	1130 mm
	b)	Minimum height above rail level for floor of fully loaded normal vehicle	1100 mm
12.	a)	Maximum height of centre coupler above rail level for unloaded vehicle	815 mm
	b)	Minimum height of centre coupler above rail level for fully loaded vehicle	740 mm
13.	Maximum length over couplers		23000 mm
14.	Length of rigid wheel base for single bogie		2200 mm to 2600 m

3.2 LOCOMOTIVES AND ENGINEERING SERVICE VEHICLES

Other items of rolling stock, viz shunting locomotives, OHE maintenance and inspection cars, emergency re-railing van, track machines, etc., used on MML3 Metro System(where these cars would be plying)will conform with the Kinematic Envelope of the Passenger Electric Multiple Units as shown in FIG. No.MMRC- 1(TNL) and FIG No MMRC- 1 A (TNL) for Under Ground sections and FIG. no. MMRC-1 and FIG. No. MMRC-1A for At-grade and Elevated sections..

CHAPTER - 4
OVERHEAD ELECTRIC TRACTION 25 KV/AC 50 CYCLES PER SECOND

Note:

Wherever electric traction is in use, special precautions must be taken to maintain following clearances:

4.1 ELECTRICAL CLEARANCES FOR UNDER GROUND

4.1.1 Minimum height from rail level to the underside of wearing copper / metal conductor of rigid OCS
(Overhead Contact System) In Tunnel ……4318 mm

Note:

(a) Location of level crossing from the exit point of the tunnel will take into consideration the OHE height of 4318 mm at the tunnel exit and the permissible contact wire gradient.

(b) In the depot deck portion, if rigid OCS is provided and the track is ballast less, the electrical clearances laid down at paras 4.1.1 to 4.1.4 shall be applicable.

(c) For location of rigid OCS in circular tunnel with canted track, refer to para1.7.1 (B)-b and 1.7.2 (B)-b.

(d) It shall be ensured that environment level inside the tunnel is controlled suitably so that no extra air clearance, over and above the minimum separation prescribed in para 4.1.3 and 4.1.4 on account of pollution, fog etc. is required.

4.1.2 Stagger of Rigid OCS Conductor in Tunnels shall not be more than

(a) On Straight ……..±200 mm
(b) On Curves ……±300 mm

4.1.3 Prescribed minimum clearance between live parts of contact lines and bodies of structures

Air clearance between bodies of structures and live un-insulated parts of contact lines, feeders and current collectors for 25 KV shall be as per IEC 60913 as under:

	Condition	Minimum Clearance Between Live Parts And Structures	Absolute Minimum Dynamic Clearance Between Live Parts And Structures
A)	Long Duration (Static)	270 mm	-
B)	Short Duration (Dynamic)	170 mm	150 mm*

*in exceptional cases and considering operating in climatic conditions (REF: IEC 60913)

4.1.4 Prescribed minimum clearance between live parts of contact lines and bodies of vehicles

Minimum air clearance between bodies of vehicles and the live un-insulated parts of the contact line or feeders for 25 KV

	Condition	Clearance (mm)
A)	Long Duration (Static)	270 mm
B)	Short Duration (Dynamic)	170 mm

4.1.5 Maximum width of pantograph – Under dynamic condition

The Kinematic Envelope for the underground system with ballast less track is shown in FIG. no.MMRC-1(TNL).The pantograph adopted should be such that its actual half KE width does not exceed 820 mm and 980 mm at the top and bottom respectively in pantograph raised condition for a contact wire height of 4318 mm to fulfil electrical clearance as per item 4.1.3

Note:
These limits would not apply to special locations like insulated overlaps and out of run wires.

4.2 ELECTRICAL CLEARANCES FOR AT-GRADE AND ELEVATED SECTIONS

4.2.1 Minimum vertical distance between any live bare conductor (overhead equipment or pantograph) and any earthed structure or other bodies (rolling stock, over bridges, signal gantries etc.)

	Condition	For Flexible OHE
(I)	Long Duration (Static)	270 mm
(Ii)	Short Duration (Dynamic)	220 mm

Note:
A minimum vertical distance of 290 mm shall normally be provided between rolling stock and contact wire to allow for a 20 mm temporary rising of the tracks during maintenance. Wherever the allowance required for track maintenance exceeds 20 mm, the vertical distance between rolling stock and contact wire shall correspondingly be increased.

4.2.2 Minimum lateral distance between any bare live conductors (Over Head Equipment or Pantograph) or any earthed structure or other bodies (rolling stock, over bridges, signal gantries etc.)

	Condition	For Flexible OHE
(I)	Long Duration (Static)	270 mm
(Ii)	Short Duration (Dynamic)	220 mm

4.2.3 Height of contact wire:

Minimum height from rail level to the underside of live conductor wire.

i. Under bridges, in tunnels and in ramp area (Transition length from tunnel to At Grade/Elevated Corridor)……..4318 mm
ii. In the open……..……5000 mm
iii. At level crossings……5500 mm
iv. In Running and carriage sheds wherever staffs are expected to work on the roof of rolling stock……. 5500 mm
v. In depot.…… 5500 mm

Note:

On curves, all vertical distances specified in items 4.2.3 above, shall be measured above level of the inner rail, increased by half the super-elevation.

4.2.4 Maximum variation of the live conductor wire on either side of the centre line of the track under static conditions:

i. On Straight ……..±200 mm
ii. On Curves……±300 mm

Note:

These limits would not apply to special locations like insulated overlaps and out of run wires.

4.2.5 Maximum Width of Pantograph Collector :

The kinematic envelope with the size of pantograph adopted shall be within the kinematic envelope shown at FIG. no. MMRC-1

CHAPTER - 5
PLATFORM SCREEN DOORS

5.1 PLATFORM SCREEN DOORS SETTING OUT DIMENSIONS

Minimum Platform Screen Door Width	Min 2000 mm
Minimum Platform Screen Door Height From Platform Level	Min 1500mm (Partial Height) Min 2100 mm(Full Height)
Minimum Platform Threshold offset from track centreline—straight track (Underground)	1660 mm
Minimum Platform Threshold Offset From Track Centreline – Straight Track (At Grade/ Elevated)	1670 mm
Minimum Platform Screen Door Panel Offset From Track Centreline – Straight Track (a) For Underground (b) For At Grade /Elevated	 1695 mm 1705 mm

Note:

(a) Assumed plus/minus 300 mm stopping accuracy
(b) Curve track through station to be considered separately
(c) Platform Screen Doors are considered as designated railway operational structures. Therefore, PDS may infringe the Structure Gauge, but does not infringe the station Kinematic Envelope and having minimum clearance of 10 mm from Kinematic Envelope to Platform Screen Door

APPENDIX – 1

PERMISSIBLE SPEED, CANT AND MINIMUM TRACK SPACING ON CURVES.

UNDER GROUND (TUNNELS), AT-GRADE AND ELEVATED SECTIONS

(REFERENCE: PARA 1.1)

			MINIMUM DISTANCE BETWEEN	
RADIUS		**MAXIMUM**	**ADJACENT TRACKS**	
OF	**CANT**	**PERMISSIBLE**	**See note (a)**	
CURVE		**SPEED**		
			UNDER GROUND	**AT-GRADE AND ELEVATED**
meters	mm	kmph	mm	Mm
3000	**15**	**85**	**3800**	**3900**
2800	**15**	**85**	**3800**	**3900**
2400	**20**	**85**	**3800**	**3900**
2000	**20**	**85**	**3800**	**3900**
1600	**25**	**85**	**3800**	**3900**
1500	**30**	**85**	**3800**	**3900**
1200	**35**	**85**	**3800**	**3950**
1000	**45**	**85**	**3800**	**3950**
800	**55**	**85**	**3850**	**4000**
600	**70**	**85**	**3850**	**4000**
500	**85**	**85**	**3850**	**4000**
450	**100**	**85**	**3900**	**4000**
400	**115**	**85**	**3900**	**4050**
350	**125**	**80**	**3950**	**4050**
300	**125**	**75**	**4000**	**4100**
260	**125**	**70**	**4000**	**4100**
230	**125**	**65**	**4050**	**4150**
200	**125**	**60**	**4100**	**4200**
150*	**0**	**35**	**4200**	**4300**
120*	**0**	**30**	**4300**	**4400**
100*	**0**	**25**	**4300**	**4400**

Notes:

(a) The track spacing shown in the table above is without any column/structure between two tracks and is with equal cant for both outer and inner tracks.
(b) Track spacing shown in Table above is not applicable to stations which should be calculated depending on specific requirement.
(c) FIG.ures for any intermediate radius of curvature may be obtained adopting value of sharper curve.
(d) Cant provided is limited to desirable value of 125 mm
(e) Maximum cant deficiency is 100 mm.
(f) * The curves of100 to 150 meters radii are used in depot and depot connections.

APPENDIX-2

EXTRA HORIZONTAL SHIFT ON CURVES (CURVATURE EFFECT]
INSIDE OF CURVE

REFERENCE PARA 1.7.1

RADIUS (meters)	MID-THROW (28500/R) (mm) "	NOSING INCLUDED IN K.E/STRUCTURE GAUGE FOR TANGENT TRACK (mm)		EXTRA GAUGE TOLERANCE ON CURVES (mm)	EXTRA HORIZONTAL SHIFT'ON CURVE (mm)	REMARKS
R	(V)	(N)	(N)	(G)	(T_1)	G), EXTRA GAUGE TOLERANCE ON CURVES SHARPER THAN 1000 M RADIUS: 9 mm FOR CURVES WITH RADIUS SHARPER THAN 500 M AND 5mm FOR CURVES WITH RADIUS OF 500 M TO LESS THAN 1000M. T_1=V-N+G V EQUAL TO OR GREATER THAN (N) **T_1 = G for V<(N)**
120	237.5	32.0	32.0	9.0	215	
150	190.0	32.0	32.0	9.0	167	
175	162.9	32.0	32.0	9.0	140	
200	142.5	320	32.0	9.0	120	
230	123.91		32.0	9.0	101	
260	109.61	32.0	32.0	9.0	87	
300	95.0	32.0	32.0	9.0	72	
350	81.4	32.0	32.0	9.0	58	
400	71.3	32.0	32.0	9.0	48	
450	63.3	32.0	32.0	9.0	40	
500	57.0	32.0	32.0	5.0	30	
600	47.5	32.0	32.0	5.0	21	
700	40.7	32.0	32.0	5.0	14	
800	35.6	32.0	32.0	5.0	9	
900	31.7	320	320	5.0	5	
1000	28.5	32.0	32.0	0.0	0	
1200	23.8	32.0	32.0	0.0	0	
1500	19.0	32.0	32.0	0.0	0	
1600	17.8	320	320	0.0	0	
2000	14.3	32.0	32.0	0.0	0	
2400	11.9	32.0	32.0	0.0	0	
2600	10.2	32.0	32.0	0.0	0	
3000	9.5	32.0	32.0	0.0	0	

Mid Throw (in mm) Vo= ($125xC^2$)/R = 28500/R, Where 'C' is the distance between bogie centres = 14.750+0.350=15.100 m OR 14.750-350=14.400m
Worst Case will be with C=15.100M
R is the radius of curve

OUTSIDE OF CURVE

REFERENCE PARA 1.7.2

RADIUS (meters)	END-THROW (34635/R) (mm) "	EXTRA GAUGE TOLERANCE ON CURVES (MM)	EXTRA NOSING DUE TO EXTRA GAUGE TOLERANCE (mm)	EXTRA HORIZONTAL SHIFT'ON CURVE (mm)	REMARK
R	Vo	G	(EN)	T2	(G), EXTRA GAUGE TOLERANCE ON CURVES SHARPER THAN 1000 M RADIUS: 9 mm FOR CURVES WITH RADIUS SHARPER THAN 500 M AND 5mm FOR CURVES WITH RADIUS OF 500 M TO LESS THAN 1000M. **T_2=Vo +G+EN** **EN=G x 0.2555555**
120	288.6	9.0	2.3	300	
150	230.6	9.0	2.3	242	
175	197.9	9.0	2.3	209	
200	173.2	9.0	2.3	184	
230	150.58	9.0	2.3	162	
260	133.21	9.0	2.3	145	
300	115.5	9.0	2.3	127	
350	99.0	9.0	2.3	110	
400	86.6	9.0	2.3	98	
450	77.0	9.0	2.3	88	
500	69.3	5.0	1.3	76	
600	57.7	5.0	1.3	64	
700	49.5	5.0	1.3	56	
800	43.3	5.0	1.3	50	
900	38.5	5.0	1.3	45	
1000	34.6	0.0	0.0	35	
1200	28.9	0.0	0.0	29	
1500	23.1	0.0	0.0	23	
1600	21.6	0.0	0.0	22	
2000	17.3	0.0	0.0	17	
2400	14.4	0.0	0.0	14	
2800	12.4	0.0	0.0	12	
3000	11.5	0.0	0.0	12	

End Throw (in mm) Vo= (125 x $C1^2$) /R - ($125xC^2$)/R = 34635/R, Where 'C' is the distance between bogie centres = 14.750+0.350=15.100 m OR 14.750 -0.350 = 14.400 m ,Worst case will be with C=14.400 '., ' C1 is length of coach In meters: 22.010 m and 'R' radius of curve In meters.

APPENDIX-3

Shift of the Centre of Circular Tunnel Due To Rotation of Tunnel to provide for cant

(WITH D_1 =630 mm)

REFER TO FIG. No. MMRC-3 AND PARA No. 1.7.1 (B) (b)

Cant	sin α= cant/1510	Angle α	tan θ= (r-D1)/(g/2)	Angle θ	Lateral Shift of Tunnel centre=X	Vertical Shift of Tunnel centre=Y
mm		Degrees		Degrees	mm	mm
125	0.08278	4.74846	2.87417	70.8159	182	55
120	0.07947	4.55811	2.87417	70.8159	175	53
115	0.07616	4.36782	2.87417	70.8159	167	51
110	0.07285	4.17757	2.87417	70.8159	160	49
105	0.06954	3.98736	2.87417	70.8159	153	47
100	0.06623	3.79720	2.87417	70.8159	145	45
95	0.06291	3.60708	2.87417	70.8159	138	43
90	0.05960	3.41701	2.87417	70.8159	131	41
85	0.05629	3.22696	2.87417	70.8159	123	39
80	0.05298	3.03696	2.87417	70.8159	116	37
75	0.04967	2.84699	2.87417	70.8159	109	35
70	0.04636	2.65705	2.87417	70.8159	101	33
65	0.04305	2.46714	2.87417	70.8159	94	30
60	0.03974	2.27725	2.87417	70.8159	87	28
55	0.03642	2.08739	2.87417	70.8159	80	26
50	0.03311	1.89756	2.87417	70.8159	72	24
45	0.02980	1.70774	2.87417	70.8159	65	22
40	0.02649	1.51795	2.87417	70.8159	58	19
35	0.02318	1.32817	2.87417	70.8159	51	17
30	0.01987	1.13840	2.87417	70.8159	43	15
25	0.01656	0.94865	2.87417	70.8159	36	12
20	0.01325	0.75891	2.87417	70.8159	29	10
15	0.00993	0.56917	2.87417	70.8159	22	7
10	0.00662	0.37945	2.87417	70.8159	14	5
5	0.00331	0.18972	2.87417	70.8159	7	2
0	0	0.00000	2.87417	70.8159	0	0

Remarks

a. The cant is provided by rotating the outer rail which will mean, rotating the tunnel about the midpoint of the top of inner rail.

b. Lateral shift of the centre of tunnel (X) towards the inside of tunnel = X

$$X = \left[2 \times (r - D_1) \div (\sin\theta) \times \sin\frac{\alpha}{2}\right] \times \cos(90 - \theta - \alpha/2)$$

c. The vertical shift of the centre of the tunnel Upwards = Y

$$Y = \left[2 \times (r - D_1) \div (\sin\theta) \times \sin\frac{\alpha}{2}\right] \times \sin(90 - \theta - \alpha/2)$$

- **'r' is Internal Radius of Circular Tunnel =2800 mm**
- **D_1 =Depth from Invert of Circular Tunnel to Rail Top Level =630 mm**
- **α = Angle of Rotation** $\alpha=\sin^{-1}(\text{cant}/g)$
- **θ = Angle Subtended by line joining top of two rails and the line joining midpoint of top of inner rail and the centre of circular Tunnel**

  $\theta=\tan^{-1}[(r-D1)/(g/2)]=70.8159$

  Distance between Centre to Centre of Rails (g) = 1510mm

APPENDIX-4

CANT EFFECT ON STRUCTURE GAUGE
AT-GRADE OR ELEVATED SECTIONS

REFER TO FIG. No. MMRC-4 AND PARA No. 1.7.1 (B) (a) &1.8.2 (b)

Cant	Alpha Degree	Alpha Radians	Sin Alpha	Cos Alpha	Tan Alpha	h= 305		ab= 1771		h= 880		ab= 1903		h= 1130		ab= 1938		h= 2030		ab= 1938		h= 3300		ab= 1875		h= 3736		ab= 1540		h= 6250		ab= 1540	
						E1	F1	H1	H2	E1	F1	H1	H2	E1	F1	H1	H2	E1	F1	H1	H2	E1	F1	H1	H2	E1	F1	H1	H2	E1	F1	H1	H2
125	4.7485	0.0829	0.0828	0.9966	0.0831	1790	1740	513	220	1969	1824	1097	782	2025	1838	1349	1028	2099	1763	2246	1925	2142	1595	3506	3196	1844	1225	3913	3658	2052	1017	6419	6164
120	4.5581	0.0796	0.0795	0.9968	0.0797	1790	1741	505	223	1967	1827	1088	786	2022	1842	1340	1032	2093	1771	2238	1930	2131	1607	3499	3201	1832	1238	3907	3662	2032	1038	6413	6168
115	4.3678	0.0762	0.0762	0.9971	0.0764	1789	1743	496	227	1964	1830	1080	790	2018	1846	1332	1037	2087	1778	2229	1934	2121	1618	3491	3205	1820	1251	3900	3665	2012	1060	6407	6172
110	4.1776	0.0729	0.0728	0.9973	0.0730	1789	1744	488	230	1962	1834	1071	794	2015	1851	1323	1041	2081	1785	2221	1938	2110	1630	3483	3210	1808	1264	3893	3669	1991	1081	6401	6176
105	3.9874	0.0696	0.0695	0.9976	0.0697	1788	1746	480	234	1960	1837	1063	798	2012	1855	1315	1045	2074	1792	2212	1943	2100	1641	3475	3214	1796	1276	3887	3672	1971	1102	6394	6180
100	3.7972	0.0663	0.0662	0.9978	0.0664	1787	1747	472	237	1957	1841	1054	802	2009	1859	1306	1049	2068	1799	2204	1947	2089	1652	3467	3219	1784	1289	3880	3676	1951	1123	6388	6184
97	3.6831	0.0643	0.0642	0.9979	0.0644	1787	1748	467	239	1956	1843	1049	804	2007	1861	1301	1052	2064	1804	2199	1950	2083	1659	3462	3221	1777	1297	3876	3678	1938	1135	6385	6187
95	3.6071	0.0630	0.0629	0.9980	0.0630	1787	1748	463	240	1955	1844	1045	806	2005	1863	1297	1053	2062	1806	2195	1952	2079	1664	3459	3223	1772	1302	3873	3679	1930	1144	6382	6188
90	3.4170	0.0596	0.0596	0.9982	0.0597	1786	1750	455	244	1952	1847	1037	810	2002	1867	1289	1057	2056	1814	2187	1956	2068	1675	3451	3227	1760	1315	3866	3683	1910	1165	6376	6192
85	3.2270	0.0563	0.0563	0.9984	0.0564	1785	1751	447	247	1950	1850	1028	814	1999	1871	1280	1062	2049	1821	2178	1960	2058	1686	3443	3232	1748	1327	3859	3686	1889	1186	6369	6196
80	3.0370	0.0530	0.0530	0.9986	0.0531	1785	1752	438	251	1947	1854	1020	818	1995	1875	1271	1066	2043	1828	2170	1964	2047	1698	3435	3236	1736	1340	3852	3689	1869	1207	6363	6200
75	2.8470	0.0497	0.0497	0.9988	0.0497	1784	1754	430	254	1944	1857	1011	822	1992	1879	1262	1070	2036	1835	2161	1969	2037	1709	3427	3240	1724	1353	3845	3692	1849	1228	6356	6203
70	2.6570	0.0464	0.0464	0.9989	0.0464	1783	1755	422	258	1942	1860	1002	826	1988	1884	1254	1074	2030	1842	2153	1973	2026	1720	3418	3245	1712	1365	3838	3696	1828	1249	6350	6207
60	2.2773	0.0397	0.0397	0.9992	0.0398	1782	1757	405	264	1936	1867	985	834	1981	1892	1236	1082	2017	1856	2135	1981	2005	1742	3402	3253	1687	1390	3824	3702	1787	1290	6336	6214
55	2.0874	0.0364	0.0364	0.9993	0.0364	1781	1759	397	268	1934	1870	976	838	1978	1896	1227	1086	2011	1863	2127	1986	1994	1754	3394	3257	1675	1403	3817	3705	1767	1311	6329	6217
50	1.8976	0.0331	0.0331	0.9995	0.0331	1780	1760	388	271	1931	1873	968	842	1974	1900	1219	1090	2004	1870	2118	1990	1983	1765	3385	3261	1663	1415	3810	3708	1746	1332	6323	6221
45	1.7077	0.0298	0.0298	0.9996	0.0298	1779	1761	380	275	1928	1876	959	845	1971	1903	1210	1094	1998	1877	2109	1994	1973	1776	3377	3265	1651	1428	3803	3711	1726	1353	6316	6224
40	1.5179	0.0265	0.0265	0.9996	0.0265	1778	1762	372	278	1926	1879	950	849	1967	1907	1201	1098	1991	1884	2101	1998	1962	1787	3369	3269	1638	1440	3795	3714	1705	1374	6309	6227
35	1.3282	0.0232	0.0232	0.9997	0.0232	1778	1763	363	281	1923	1882	941	853	1964	1911	1192	1102	1985	1890	2092	2002	1951	1798	3360	3273	1626	1453	3788	3717	1684	1395	6302	6230
30	1.1384	0.0199	0.0199	0.9998	0.0199	1777	1765	355	285	1920	1885	933	857	1960	1915	1183	1106	1978	1897	2083	2006	1940	1809	3352	3277	1614	1465	3781	3720	1664	1416	6294	6233
25	0.9486	0.0166	0.0166	0.9999	0.0166	1776	1766	347	288	1917	1888	924	861	1956	1919	1174	1110	1971	1904	2074	2010	1929	1820	3343	3281	1602	1478	3773	3722	1643	1436	6287	6236
20	0.7589	0.0132	0.0132	0.9999	0.0132	1775	1767	338	292	1914	1891	915	865	1953	1923	1166	1114	1965	1911	2065	2014	1919	1831	3335	3285	1589	1490	3766	3725	1623	1457	6280	6239
15	0.5692	0.0099	0.0099	1.0000	0.0099	1774	1768	330	295	1912	1894	906	869	1949	1927	1157	1118	1958	1918	2057	2018	1908	1842	3326	3289	1577	1503	3759	3728	1602	1478	6272	6242
10	0.3794	0.0066	0.0066	1.0000	0.0066	1773	1769	322	298	1909	1897	898	872	1945	1930	1148	1122	1951	1925	2048	2022	1897	1853	3317	3293	1565	1515	3751	3731	1581	1499	6265	6245
5	0.1897	0.0033	0.0033	1.0000	0.0033	1772	1770	313	302	1906	1900	889	876	1942	1934	1139	1126	1945	1931	2039	2026	1886	1864	3309	3296	1552	1528	3744	3733	1561	1519	6258	6247
0	0.0000	0.0000	0.0000	1.0000	0.0000	1771	1771	305	305	1903	1903	880	880	1938	1938	1130	1130	1938	1938	2030	2030	1875	1875	3300	3300	1540	1540	3736	3736	1540	1540	6250	6250

REFER TO FIG. NO. MMRC-4
All dimensions are in mm
Where:

g= 1510
h= Height above rail level measured perpendicular to plane of track.
$E_1 = [ab + (h \times \text{Tan } \alpha)] \times \text{Cos } \alpha$
$F_1 = [Ab - (h \times \text{Tan } \alpha)] \times \text{Cos } \alpha$
$H_1 = (Ca / 2) + (h / \text{Cos } \alpha) + (Ab - h \times \text{Tan } \alpha) \times \text{Sin } \alpha$
$H_2 = (Ca / 2) + (h / \text{Cos } \alpha) - (ab + h \times \text{Tan } \alpha) \times \text{Sin } \alpha$
ab=Ab = Distance from centre line of vehicle to Structure Gauge for Tangent track at height "h" from rail level.

APPENDIX-4 (BOX TNL)

CANT EFFECT ON STRUCTURE GAUGE
UNDERGROUND SECTIONS (RECTANGULAR BOX TUNNEL)

REFER TO FIG. No. MMRC-4 AND PARA No. 1.7.1 (B) (a) &1.8.2 (b)

Cant	Alpha Degree	Alpha Radians	Sin Alpha	Cos Alpha	Tan Alpha	h= 305		ab= 1720		h= 880		ab= 1851		h= 1130		ab= 1875		h= 2030		ab= 1875		h= 3346		ab= 1815		h= 3738		ab= 1390		h= 4838		ab= 1390	
						E1	F1	H1	H2	E1	F1	H1	H2	E1	F1	H1	H2	E1	F1	H1	H2	E1	F1	H1	H2	E1	F1	H1	H2	E1	F1	H1	H2
125	4.7485	0.0829	0.0828	0.9966	0.0831	1739	1689	509	224	1917	1772	1093	786	1962	1775	1344	1033	2037	1701	2241	1930	2086	1532	3547	3247	1695	1076	3903	3673	1786	985	4999	4769
120	4.5581	0.0796	0.0795	0.9968	0.0797	1739	1690	501	227	1915	1775	1084	790	1959	1779	1335	1037	2030	1708	2233	1935	2075	1543	3540	3251	1683	1089	3897	3676	1770	1001	4993	4772
115	4.3678	0.0762	0.0762	0.9971	0.0764	1738	1692	493	231	1913	1779	1076	794	1956	1783	1327	1041	2024	1715	2224	1939	2065	1555	3532	3256	1671	1101	3891	3679	1754	1018	4987	4776
110	4.1776	0.0729	0.0728	0.9973	0.0730	1738	1693	484	234	1910	1782	1068	798	1952	1788	1319	1045	2018	1722	2216	1943	2054	1566	3524	3260	1659	1114	3884	3682	1739	1034	4981	4779
100	3.7972	0.0663	0.0662	0.9978	0.0664	1736	1696	468	240	1905	1789	1051	805	1946	1796	1302	1053	2005	1736	2200	1951	2033	1589	3509	3268	1634	1139	3872	3688	1707	1067	4969	4785
105	3.9874	0.0696	0.0695	0.9976	0.0697	1737	1695	476	237	1908	1785	1059	802	1949	1792	1310	1049	2012	1729	2208	1947	2043	1578	3517	3264	1647	1127	3878	3685	1723	1050	4975	4782
95	3.6071	0.0630	0.0629	0.9980	0.0630	1736	1697	460	244	1903	1792	1042	809	1942	1800	1293	1057	1999	1744	2191	1956	2022	1601	3501	3273	1622	1152	3866	3691	1692	1083	4963	4788
90	3.4170	0.0596	0.0596	0.9982	0.0597	1735	1699	452	247	1900	1795	1034	813	1939	1804	1285	1061	1993	1751	2183	1960	2011	1612	3493	3277	1610	1165	3859	3694	1676	1099	4957	4792
85	3.2270	0.0563	0.0563	0.9984	0.0564	1734	1700	444	250	1898	1799	1025	817	1936	1808	1276	1065	1986	1758	2175	1964	2000	1624	3485	3281	1598	1177	3853	3696	1660	1115	4951	4795
80	3.0370	0.0530	0.0530	0.9986	0.0531	1734	1701	436	253	1895	1802	1017	821	1932	1812	1268	1069	1980	1765	2166	1968	1990	1635	3477	3285	1586	1190	3846	3699	1644	1132	4945	4798
75	2.8470	0.0497	0.0497	0.9988	0.0497	1733	1703	428	257	1892	1805	1008	824	1929	1817	1259	1073	1974	1772	2158	1972	1979	1647	3470	3289	1574	1203	3840	3702	1629	1148	4939	4800
70	2.6570	0.0464	0.0464	0.9989	0.0464	1732	1704	419	260	1890	1808	1000	828	1925	1821	1251	1077	1967	1779	2150	1976	1968	1658	3462	3293	1562	1215	3833	3705	1613	1164	4932	4803
65	2.4671	0.0431	0.0430	0.9991	0.0431	1732	1705	411	263	1887	1811	991	832	1922	1825	1242	1081	1961	1786	2141	1980	1957	1669	3454	3297	1550	1228	3827	3707	1597	1180	4926	4806
50	1.8976	0.0331	0.0331	0.9995	0.0331	1729	1709	387	273	1879	1821	966	843	1911	1837	1216	1092	1941	1807	2116	1992	1925	1703	3429	3309	1513	1265	3807	3715	1549	1229	4906	4814
45	1.7077	0.0298	0.0298	0.9996	0.0298	1728	1710	379	276	1876	1824	957	847	1908	1840	1208	1096	1935	1814	2107	1996	1914	1714	3421	3313	1501	1278	3800	3717	1534	1245	4900	4817
40	1.5179	0.0265	0.0265	0.9996	0.0265	1727	1711	370	279	1874	1827	949	851	1904	1844	1199	1100	1928	1821	2099	2000	1903	1726	3413	3317	1489	1290	3794	3720	1518	1261	4893	4819
35	1.3282	0.0232	0.0232	0.9997	0.0232	1727	1712	362	283	1871	1830	940	854	1901	1848	1191	1104	1922	1827	2090	2003	1892	1737	3405	3321	1476	1303	3787	3722	1502	1277	4886	4822
30	1.1384	0.0199	0.0199	0.9998	0.0199	1726	1714	354	286	1868	1833	932	858	1897	1852	1182	1108	1915	1834	2082	2007	1881	1748	3396	3324	1464	1315	3780	3725	1486	1294	4880	4824
25	0.9486	0.0166	0.0166	0.9999	0.0166	1725	1715	346	289	1865	1836	923	862	1893	1856	1173	1111	1908	1841	2073	2011	1870	1759	3388	3328	1452	1328	3773	3727	1470	1310	4873	4827
20	0.7589	0.0132	0.0132	0.9999	0.0132	1724	1716	338	292	1862	1839	914	865	1890	1860	1165	1115	1902	1848	2065	2015	1859	1771	3380	3332	1439	1340	3766	3729	1454	1326	4866	4829
15	0.5692	0.0099	0.0099	1.0000	0.0099	1723	1717	330	295	1860	1842	906	869	1886	1864	1156	1119	1895	1855	2056	2019	1848	1782	3371	3335	1427	1353	3759	3732	1438	1342	4859	4831
10	0.3794	0.0066	0.0066	1.0000	0.0066	1722	1718	321	299	1857	1845	897	873	1882	1867	1147	1123	1888	1862	2047	2023	1837	1793	3363	3339	1415	1365	3752	3734	1422	1358	4852	4834
5	0.1897	0.0033	0.0033	1.0000	0.0033	1721	1719	313	302	1854	1848	889	876	1879	1871	1139	1126	1882	1868	2039	2026	1826	1804	3354	3342	1402	1378	3745	3736	1406	1374	4845	4836
0	0.0000	0.0000	0.0000	1.0000	0.0000	1720	1720	305	305	1851	1851	880	880	1875	1875	1130	1130	1875	1875	2030	2030	1815	1815	3346	3346	1390	1390	3738	3738	1390	1390	4838	4838

REFER TO FIG. No. MMRC-4 (BOX TNL)
All dimensions are in mm

Where:

g= 1510
h= Height above rail level measured perpendicular to plane of track.
$E_1 = [ab + (h \times \text{Tan } \alpha)] \times \text{Cos } \alpha$
$F_1 = [Ab - (h \times \text{Tan } \alpha)] \times \text{Cos } \alpha$
$H_1 = (Ca / 2) + (h / \text{Cos } \alpha) + (Ab - h \times \text{Tan } \alpha) \times \text{Sin } \alpha$
$H_2 = (Ca / 2) + (h / \text{Cos } \alpha) - (ab + h \times \text{Tan } \alpha) \times \text{Sin } \alpha$
Ab=Ab = Distance from centre line of vehicle to Structure Gauge for Tangent track at height "h" from rail level.

APPENDIX-5

CANT EFFECT ON KINEMATIC ENVELOPE AT-GRADE OR ELEVATED SECTIONS

Cant	Alpha Degree	Alpha Radians	Sin Alpha	Cos Alpha	Tan Alpha	h=165		ab=1585		h=880		ab=1749		h=1130		ab=1788		h=2030		ab=1788		h=3300		ab=1725		h=3736		ab=1285		h=4115		ab=1220		H=5018		Ab=880	
						E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2
125	4.7485	0.0829	0.0828	0.9966	0.0831	1593	1566	358	96	1816	1670	1084	795	1875	1688	1337	1041	1950	1614	2234	1938	1992	1446	3494	3208	1590	971	3892	3679	1556	875	4264	4062	1292	462	5136	4990
120	4.5581	0.0796	0.0795	0.9968	0.0797	1593	1567	350	99	1813	1674	1076	798	1872	1693	1329	1044	1944	1621	2226	1941	1982	1457	3487	3212	1578	984	3886	3682	1543	889	4259	4065	1276	478	5132	4992
115	4.3678	0.0762	0.0762	0.9971	0.0764	1593	1568	343	101	1811	1677	1068	802	1869	1697	1320	1048	1937	1628	2218	1945	1971	1469	3479	3217	1566	997	3881	3685	1530	903	4253	4068	1260	495	5128	4994
110	4.1776	0.0729	0.0728	0.9973	0.0730	1593	1569	335	104	1808	1680	1060	805	1866	1701	1312	1052	1931	1635	2210	1949	1961	1480	3472	3221	1554	1009	3875	3687	1517	917	4248	4070	1243	512	5124	4996
105	3.9874	0.0696	0.0695	0.9976	0.0697	1593	1570	327	107	1806	1684	1052	809	1862	1705	1304	1055	1925	1643	2202	1953	1950	1491	3464	3225	1542	1022	3869	3690	1503	931	4242	4073	1227	529	5120	4997
100	3.7972	0.0663	0.0662	0.9978	0.0664	1592	1571	320	110	1803	1687	1044	812	1859	1709	1296	1059	1919	1650	2194	1957	1940	1503	3457	3229	1530	1035	3863	3693	1490	945	4237	4075	1210	546	5115	4999
95	3.6071	0.0630	0.0629	0.9980	0.0630	1592	1571	312	112	1801	1690	1036	816	1856	1713	1288	1063	1912	1657	2186	1961	1929	1514	3449	3232	1518	1047	3857	3695	1476	959	4231	4078	1194	563	5111	5000
90	3.4170	0.0596	0.0596	0.9982	0.0597	1592	1572	304	115	1798	1693	1028	819	1852	1717	1280	1066	1906	1664	2178	1965	1919	1525	3442	3236	1505	1060	3851	3698	1463	973	4225	4080	1178	579	5107	5002

REFER TO FIG. No. MMRC-5 AND PARA No. 1.8.1

85	3.2270	0.0563	0.0563	0.9984	0.0564	1592	1573	296	118	1796	1697	1020	823	1849	1722	1271	1070	1899	1671	2170	1969	1908	1537	3434	3240	1493	1073	3845	3700	1450	986	4220	4082	1161	596	5102	5003
80	3.0370	0.0530	0.0530	0.9986	0.0531	1592	1574	289	121	1793	1700	1011	826	1845	1726	1263	1074	1893	1678	2162	1972	1897	1548	3427	3244	1481	1085	3839	3703	1436	1000	4214	4085	1145	613	5098	5004
75	2.8470	0.0497	0.0497	0.9988	0.0497	1591	1575	281	124	1791	1703	1003	830	1842	1730	1255	1077	1887	1685	2154	1976	1887	1559	3419	3248	1469	1098	3833	3705	1423	1014	4208	4087	1128	630	5093	5006
70	2.6570	0.0464	0.0464	0.9989	0.0464	1591	1576	273	126	1788	1706	995	833	1838	1734	1247	1081	1880	1692	2146	1980	1876	1570	3411	3251	1457	1110	3827	3707	1409	1028	4202	4089	1112	646	5088	5007
65	2.4671	0.0431	0.0430	0.9991	0.0431	1591	1576	266	129	1785	1709	987	836	1835	1738	1238	1084	1874	1699	2138	1984	1865	1581	3404	3255	1445	1123	3820	3710	1396	1042	4196	4091	1095	663	5084	5008
55	2.0874	0.0364	0.0364	0.9993	0.0364	1590	1578	250	135	1780	1716	971	843	1828	1746	1222	1092	1861	1713	2121	1991	1844	1604	3388	3262	1420	1148	3808	3714	1369	1069	4184	4095	1062	697	5074	5010
45	1.7077	0.0298	0.0298	0.9996	0.0298	1589	1579	235	140	1774	1722	954	850	1821	1754	1205	1099	1848	1727	2105	1998	1823	1626	3372	3270	1396	1173	3795	3719	1342	1097	4172	4099	1029	730	5064	5012
40	1.5179	0.0265	0.0265	0.9996	0.0265	1589	1580	227	143	1772	1725	946	853	1817	1757	1197	1102	1841	1734	2097	2002	1812	1637	3365	3273	1384	1186	3789	3721	1329	1111	4166	4101	1013	747	5060	5013
35	1.3282	0.0232	0.0232	0.9997	0.0232	1588	1581	219	146	1769	1728	938	857	1814	1761	1189	1106	1835	1740	2088	2006	1801	1648	3357	3277	1371	1198	3782	3723	1315	1124	4160	4103	996	763	5055	5014
30	1.1384	0.0199	0.0199	0.9998	0.0199	1588	1581	211	148	1766	1731	930	860	1810	1765	1180	1109	1828	1747	2080	2009	1790	1659	3349	3280	1359	1211	3776	3725	1302	1138	4153	4105	980	780	5049	5015
25	0.9486	0.0166	0.0166	0.9999	0.0166	1588	1582	204	151	1763	1734	921	863	1806	1769	1172	1113	1821	1754	2072	2013	1779	1670	3341	3283	1347	1223	3769	3727	1288	1152	4147	4107	963	797	5044	5015
20	0.7589	0.0132	0.0132	0.9999	0.0132	1587	1583	196	154	1761	1737	913	867	1803	1773	1164	1116	1815	1761	2064	2016	1769	1681	3333	3287	1334	1235	3763	3729	1274	1165	4141	4108	946	813	5039	5016
15	0.5692	0.0099	0.0099	1.0000	0.0099	1587	1583	188	157	1758	1740	905	870	1799	1777	1155	1120	1808	1768	2055	2020	1758	1692	3324	3290	1322	1248	3756	3731	1261	1179	4134	4110	930	830	5034	5017
10	0.3794	0.0066	0.0066	1.0000	0.0066	1586	1584	180	159	1755	1743	897	873	1795	1780	1147	1123	1801	1775	2047	2023	1747	1703	3316	3294	1310	1260	3749	3732	1247	1193	4128	4112	913	847	5029	5017
5	0.1897	0.0033	0.0033	1.0000	0.0033	1586	1584	173	162	1752	1746	888	877	1792	1784	1138	1127	1795	1781	2038	2027	1736	1714	3308	3297	1297	1273	3743	3734	1234	1206	4122	4113	897	863	5023	5018
0	0.0000	0.0000	0.0000	1.0000	0.0000	1585	1585	165	165	1749	1749	880	880	1788	1788	1130	1130	1788	1788	2030	2030	1725	1725	3300	3300	1285	1285	3736	3736	1220	1220	4115	4115	880	880	5018	5018

REFER TO FIG. No. MMRC-5
All dimensions are in mm

Where:
g = 1510 Rail centre to centre distance
h= Height above rail level measured perpendicular to plane of track.

E = [ab + (h x Tan α)] x Cos α
F = [Ab - (h x Tan α)] x Cos α
H1 = (Ca / 2) + (h / Cos α) + (Ab - h x Tan α) x Sin α
H2 = (Ca / 2) + (h / Cos α) - (ab + h x Tan α) x Sin α
ab=Ab =Distance from centre line of vehicle to Kinematic Envelope for Tangent track at height "h" from rail level.

APPENDIX-5 (TNL)

CANT EFFECT ON KINEMATIC ENVELOPE UNDERGROUND SECTIONS

REFER TO FIG. No. MMRC-5 (TNL) AND PARA No. 1.8.1

Alpha Degree	Alpha Radians	Sin Alpha	Cos Alpha	Tan Alpha	h= 165		ab= 1585		h= 880		ab= 1749		h= 1130		ab= 1775		h= 2030		ab= 1775		h= 3300		ab= 1715		h= 3727		ab= 1255		h= 4145		ab= 1097		h= 4145		ab= 980		h= 4318		ab= 820	
					E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2
4.7485	0.0829	0.0828	0.9966	0.0831	1593	1566	358	96	1816	1670	1084	795	1862	1675	1336	1042	1937	1601	2232	1939	1982	1436	3493	3209	1559	942	3881	3673	1436	750	4284	4102	1320	634	4274	4112	1175	460	4434	4298
4.5581	0.0796	0.0795	0.9968	0.0797	1593	1567	350	99	1813	1674	1076	798	1859	1680	1327	1045	1931	1608	2225	1943	1972	1447	3486	3213	1547	955	3875	3675	1423	764	4279	4105	1306	647	4270	4114	1161	474	4430	4299
4.3678	0.0762	0.0762	0.9971	0.0764	1593	1568	343	101	1811	1677	1068	802	1856	1684	1319	1049	1924	1615	2217	1946	1961	1459	3479	3217	1535	968	3869	3678	1409	778	4274	4107	1293	661	4265	4116	1146	489	4425	4301

4.1776	0.0729	0.0728	0.9973	0.0730	1593	1569	335	104	1808	1680	1060	805	1853	1688	1311	1053	1918	1622	2209	1950	1951	1470	3471	3221	1523	980	3864	3681	1396	792	4269	4109	1279	675	4260	4118	1132	503	4421	4302
3.9874	0.0696	0.0695	0.9976	0.0697	1593	1570	327	107	1806	1684	1052	809	1849	1692	1303	1056	1912	1630	2201	1954	1940	1481	3464	3225	1511	993	3858	3683	1383	806	4264	4111	1266	689	4256	4119	1118	518	4417	4303
3.7972	0.0663	0.0662	0.9978	0.0664	1592	1571	320	110	1803	1687	1044	812	1846	1696	1295	1060	1906	1637	2193	1958	1930	1493	3456	3229	1499	1005	3852	3686	1369	820	4259	4113	1252	703	4251	4121	1104	532	4413	4304
3.6071	0.0630	0.0629	0.9980	0.0630	1592	1571	312	112	1801	1690	1036	816	1843	1700	1287	1064	1899	1644	2185	1962	1919	1504	3449	3233	1487	1018	3846	3688	1356	834	4253	4115	1239	717	4246	4123	1090	547	4409	4305
3.4170	0.0596	0.0596	0.9982	0.0597	1592	1572	304	115	1798	1693	1028	819	1839	1704	1279	1067	1893	1651	2177	1966	1909	1515	3441	3237	1475	1031	3840	3691	1342	848	4248	4117	1225	731	4241	4124	1076	561	4404	4306
3.2270	0.0563	0.0563	0.9984	0.0564	1592	1573	296	118	1796	1697	1020	823	1836	1709	1271	1071	1886	1658	2169	1969	1898	1527	3434	3241	1463	1043	3834	3693	1329	862	4243	4119	1212	745	4236	4126	1062	576	4400	4307
3.0370	0.0530	0.0530	0.9986	0.0531	1592	1574	289	121	1793	1700	1011	826	1832	1713	1262	1074	1880	1665	2161	1973	1887	1538	3426	3245	1451	1056	3828	3695	1315	876	4237	4121	1198	759	4231	4127	1048	590	4395	4308
2.8470	0.0497	0.0497	0.9988	0.0497	1591	1575	281	124	1791	1703	1003	830	1829	1717	1254	1078	1874	1672	2153	1977	1877	1549	3419	3248	1439	1068	3822	3698	1302	890	4232	4123	1185	773	4226	4129	1033	605	4391	4309
2.6570	0.0464	0.0464	0.9989	0.0464	1591	1576	273	126	1788	1706	995	833	1825	1721	1246	1082	1867	1679	2145	1981	1866	1560	3411	3252	1426	1081	3816	3700	1288	904	4226	4125	1171	787	4221	4130	1019	619	4386	4310
2.4671	0.0431	0.0430	0.9991	0.0431	1591	1576	266	129	1785	1709	987	836	1822	1725	1238	1085	1861	1686	2137	1984	1855	1571	3403	3256	1414	1093	3810	3702	1274	918	4221	4126	1158	801	4216	4131	1005	633	4382	4311
2.0874	0.0364	0.0364	0.9993	0.0364	1590	1578	250	135	1780	1716	971	843	1815	1733	1221	1092	1848	1700	2121	1992	1834	1594	3388	3263	1390	1118	3798	3706	1247	945	4210	4130	1130	828	4205	4134	977	662	4373	4313
1.7077	0.0298	0.0298	0.9996	0.0298	1589	1579	235	140	1774	1722	954	850	1808	1741	1205	1099	1835	1714	2104	1999	1813	1616	3372	3270	1366	1143	3785	3710	1220	973	4198	4133	1103	856	4195	4136	948	691	4363	4314
1.5179	0.0265	0.0265	0.9996	0.0265	1589	1580	227	143	1772	1725	946	853	1804	1744	1197	1103	1828	1721	2096	2002	1802	1627	3364	3273	1353	1156	3779	3712	1206	987	4193	4134	1089	870	4190	4138	934	705	4358	4315
1.3282	0.0232	0.0232	0.9997	0.0232	1588	1581	219	146	1769	1728	938	857	1801	1748	1188	1106	1822	1727	2088	2006	1791	1638	3356	3277	1341	1168	3773	3714	1193	1001	4187	4136	1076	884	4184	4139	920	720	4353	4315
1.1384	0.0199	0.0199	0.9998	0.0199	1588	1581	211	148	1766	1731	930	860	1797	1752	1180	1110	1815	1734	2080	2009	1780	1649	3348	3280	1329	1181	3766	3716	1179	1014	4181	4137	1062	897	4179	4140	906	734	4348	4316
0.9486	0.0166	0.0166	0.9999	0.0166	1588	1582	204	151	1763	1734	921	863	1793	1756	1172	1113	1808	1741	2072	2013	1769	1660	3340	3284	1317	1193	3760	3718	1165	1028	4175	4139	1048	911	4173	4141	891	748	4343	4316
0.7589	0.0132	0.0132	0.9999	0.0132	1587	1583	196	154	1761	1737	913	867	1790	1760	1163	1116	1802	1748	2063	2016	1759	1671	3332	3287	1304	1206	3753	3720	1152	1042	4169	4140	1035	925	4168	4142	877	763	4338	4317
0.5692	0.0099	0.0099	1.0000	0.0099	1587	1583	188	157	1758	1740	905	870	1786	1764	1155	1120	1795	1755	2055	2020	1748	1682	3324	3290	1292	1218	3747	3722	1138	1056	4163	4141	1021	939	4162	4143	863	777	4333	4317
0.3794	0.0066	0.0066	1.0000	0.0066	1586	1584	180	159	1755	1743	897	873	1782	1767	1147	1123	1788	1762	2047	2023	1737	1693	3316	3294	1280	1230	3740	3724	1124	1070	4157	4143	1007	953	4156	4143	849	791	4328	4317
0.1897	0.0033	0.0033	1.0000	0.0033	1586	1584	173	162	1752	1746	888	877	1779	1771	1138	1127	1782	1768	2038	2027	1726	1704	3308	3297	1267	1243	3734	3725	1111	1083	4151	4144	994	966	4151	4144	834	806	4323	4318
0.0000	0.0000	0.0000	1.0000	0.0000	1585	1585	165	165	1749	1749	880	880	1775	1775	1130	1130	1775	1775	2030	2030	1715	1715	3300	3300	1255	1255	3727	3727	1097	1097	4145	4145	980	980	4145	4145	820	820	4318	4318

REFER TO FIG. No MMRC-5 (TNL)
All dimensions are in mm
Where:
g = 1510 Rail centre to centre distance
h= Height above rail level measured perpendicular to plane of track.

E = [ab + (h x Tan α)] x Cos α
F = [Ab - (h x Tan α)] x Cos α
H1 = (Ca / 2) + (h / Cos α) + (Ab - h x Tan α) x Sin α
H2 = (Ca / 2) + (h / Cos α) - (ab + h x Tan α) x Sin α
ab=Ab = Distance from centre line of vehicle to Kinematic Envelope for Tangent track at height "h" from rail level.

APPENDIX-6

EFFECT OF VERTICAL CURVES ON STRUCTURAL GAUGE

REFER TO FIG. No. MMRC-6) AND PARA No. 1.7.1 (B) (c)

Radius of Vertical Curve (Meters)	Vehicle Centre in Sag or Vehicle End on Summit V_1 (mm)	Vehicle Centre on Summit or Vehicle End in Sag V_2 (mm)
1500	19	23
1600	18	22
1700	17	20
1800	16	19
1900	15	18
2000	14	17
2100	14	16
2200	13	16
2300	12	15
2400	12	14
2500	11	14
2600	11	13
2700	11	13
2800	10	12
2900	10	12
3000	10	12
3100	9	11
3200	9	11
3300	9	10
3400	8	10
3500	8	10
3600	8	10
3700	8	9
3800	8	9
3900	7	9
4000	7	9

- **Mid throw (in mm) V1 = (125 x C^2) /R= 28500/R**

  Where 'C' is the distance between bogie centres = 14.750+0.350=15.100 m OR 14.750 - 0.350=14.400 m. .

  The worst case will be with C=15.100 m

  R is the radius of curve in metres.

- **End Throw (in mm) V2 = (125 x $C1^2$) /R - (125xC^2)/R = 34635/R**

  Where 'C' is the distance between bogie centres = 14.750+0.350=15.100m OR 14.750-0.350=14.400 m.

  Worst case will be with C=14.400 m

  'C1' is length of coach in meters = 22.010 m and 'R' is radius of curve in meters.

APPENDIX-7

ADDITIONAL CLEARANCE FOR PLATFORMS ON CURVES UNDERGROUND, AT-GRADE & ELEVATED STATIONS EXTRA CLEARANCE

REFER TO PARA No. 2.7

INSIDE OF CURVE									OUTSIDE OF CURVE					
AT CENTRELINE OF BOGIES					AT EDGE OF OPEN DOOR NEAREST TO C.L OF BOGIES				AT END OF COACH	AT EDGE OF OPEN DOOR FARTHEST FROM C.L OF BOGIES				
RADIUS	MID THROW (28500/R)	NOSING	Additional Clearance on CURVES (mm) (Rounded off to nearest 1mm)	Additional Clearance (Rounded off to nearest 5mm)	THROW (28498/R)	NOSING =(15.85X0.873/10.97)	Additional Clearance on CURVES	Additional Clearance (Rounded off to nearest 5mm)	End throw (33910/R)	THROW (19340/R)	NOSING =(15.85X9.59/10.97) rounded to next 1mm	Difference between N and N2	Additional Clearance on CURVES	Additional Clearance (Rounded off to nearest 5mm)
R	V	N	(V-N)	(V-N)	V3	N1	V3-(N-N1)	V3-(N-N1)	V0	V4	N2	N-N2	V4-(N-N2)	V4-(N-N2)
Metres	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	2.0	3	4a	4	5	6	7a	7	8	9	10	11	12a	12
3000	9.5	15.85	-6	0.0	9.5	1.3	-5.1	0.0	11.3	6.4	13.9	2	4.4	5
2000	14.3	15.85	-2	0.0	14.2	1.3	-0.3	0.0	17.0	9.7	13.9	2	7.7	10
1600	17.8	15.85	2	5.0	17.8	1.3	3.3	5.0	11.3	12.1	13.9	2	10.1	10
1500	19.0	15.85	3	5.0	19.0	1.3	4.4	5.0	21.1	12.9	13.9	2	10.9	15
1200	23.8	15.85	8	10.0	23.7	1.3	9.2	10.0	28.3	16.1	13.9	2	14.1	15
1000	28.5	15.85	13	15.0	28.5	1.3	13.9	15.0	33.9	19.3	13.9	2	17.3	20

NOTES:

1 **For outside of curve, the difference between clearance required at coach end that at the farthest door edge is less than 25mm.As half width of coach at ends ia at least 25mm less than that at door locations, additional clearance to be provided is additional clearance required at the farthest door edge (column 12)**

2 **Values of additional clearances (columns 4,7 and 12) are rounded off to the nearest 5mm**

3 **Negative values of additional clearance are taken as Zero in the columns 4 and 7 with rounded off Figures.**

4 **Extra clearance for curve:**

- **Inside of curve :**

$V = (125C^2 / R)) = 28500/ R$ with C= 15.10m for the worst case.
$V_3 = [(125) X (15.1^2 - 4 x 0.873x.873) / R] =28498/ R$
$N_1 = N x (x) / (c_1 / 2) = 13 x 0.873 10 .97 =1.03$ mm 13X0.873/10.97=1.03
Minimum distance ' for the nearest edge of an open door from centre line of Bogies is 0.873 metre.
Higher of (i) columns 4 and (ii) column 7 shall be adopted

- **Outside of curve**

$V_0 = (125C_1^{-2}/ R- (125C^2 / R) = 33910/R$ for coach and with c = 14.4 metres and C1 = 2x10.97 m

$V_4 =125 x (19.18 x 19.18 -14.4 x 14.4) / R = 20064/R$ for farthest edge of end door in open position with $C_1 = 2 x 9.590 = 19.18$ meters and C = 14.40 meters for the worst case.
N_2 = Nosing at the farthest edge of an open door = $N x 9.59/ (C_1)= 13 x 9.59 / 10.97$mm = 11.3mm
R = Radius of curve in metres
Maximum distance (X) for the farthest edge of open door from centre line of two Bogies = 9.590 M

5 **There will be no super elevation on curves in platform Portions.**