

Minutes of Meeting Pre –bid meeting held in the Conference Hall of KINFRA Hi Tech Park and via Google Meet on 25.10.2021 at 02:30 PM.

Name of work: Development of KINFRA Petrochemical Park at Ambalamughal, Kochi, Kerala – Phase I works

Participants:

KINFRA:

Ms. Ambili T B	- Manager Technical
Ms. Geesha A K	- Deputy Manager
Ms. Sreedevi S	- Finance Officer
Mr. Mathew George	- Junior Manager (Technical)
Mr. Shine A	- Junior Manager (Civil)
Mr. Sudeep S G	- Junior Manager (Electrical)
Mr. Rakhil A	- Junior Manager (Co ordination)
Mr. Akhil S	- Project Management Executive (Civil)
Mr. E J Nirmal	- Managerial Service (Staff)

M/s. VOYANTS Solutions Pvt. Ltd. - (DPR Consultant)

Mr. Sourav Das	- Consultant
Mr. Gajendra	- Consultant Electrical

M/s. Shrikhande Consultants Pvt. Ltd. - (PMC)

Mr. Hitesh Sardesai	- Vice President (Planning & Development)
Ms. Vasudha Dangare	- Vice President (Operations)

Bidders:

Offline Participants

1. Varindera construction Limited
2. Deens Constructions
3. Bridge and Roof Co. (India) Ltd

Online Participants

1. The Uralungal Labour Contract Co-operative Society Ltd.
2. Raji Mathew & Co.
3. Rahul Construction
4. EKK Infrastructure Limited
5. Jampana Construction Private Limited
6. MARYMATHA INFRASTRUCTURE PVT. LTD
7. Cherian Varkey Construction Co. Pvt.

The queries and reply are attached as follows.

General Queries		
Sl. No	Queries	Reply
1	Which all are the Financial Years considered for average annual financial turnover?	1. Clause No. 1 (d) should be read as- Should have an average annual financial turnover of Rs 127.70 Crores in any three financial years out of last five years ending 31st March 2021 (2016-17,2017- 18,2018-19,2019-20,2020-21) (Balance sheet and profit & loss account certified by Chartered Accountant to be uploaded).
2	As per the above-mentioned tender, there is no clause regarding the mobilization advance. We, therefore request your good-selves to consider the same at 10% of the contract value, against Bank Guarantee.	Refer as per clause No 10(B) of General Contract Condition
3	We presume that the scope of the shifting of existing Utilities lies with Client and getting permissions from various authorities will be in client's scope.	Inside the campus necessary shifting of Utilities will be done by owner of utilities and KINFRA will coordinate. Along the PWD road for pipe laying, KINFRA will arrange permission and balance work should be done by contractor.
4	Establishment of labour camp, site office, Materail Yard etc	The labour camp facility is not permitted inside the area. Site office can be constructed ,Material yard shall be permitted with prior intimations. The necessary site leveling and grading has to be done by the contractor.
5	Whether permitted for allowing subcontracting for Electrical Works	As per tender conditions subcontracting/JV is not permitted, Contractor can engage an Electrical A class contractor as signing authority for taking necessary approvals.
6	Whether a cooperative society can also participate	Yes
7	Whether blasting is permitted or not	Controlled blasting can be permitted

General Queries		
Sl. No	Queries	Reply
8	Do Arrangement of temporary electricity, water supply at site as a single source and internal networking have to be done by Contractor	Water supply has to be ensured by the Contractor, Necessary permission for constructing Rain Water harvesting/ Borewell shall be given for construction purpose. Temporary power connection for construction shall be provided by KINFRA. Necessary infrastructure work for the connection has to be done by the contractor. They may also remit electricity charges.
9	Whether Tree cutting and removal is under contractors scope or not, if any forest permission is required for Tree cutting	The forest approval is under process and is in the final stage, Necessary approval will be obtained by KINFRA. Cutting of trees in the construction area has to be done in the scope of Contract and to be stacked on species wise.
10	Kindly confirm about the materials advance, if any.	Refer Clause No. 25 of NIT
11	During the construction stage will there be any security clearance required for the work force to enter the site boundary, please clarify.	KINFRA will provide security to the park and security passes will be issued to the contractor. Also informed all the workers should have identity cards of the company.
12	Which gate can be used as material shifting gate	Brahmapuram gate can be used as material shifting gate, additional temporary gate depending upon the workfront requirement can be considered with prior approval from KINFRA
13	Is Hardcopy submission required for the tender, if so please provide the due date by which it must be submitted.	No, Hardcopy submission is not required
14	What is Percentage of GST Applicable?	Existing GST 18 % will be paid extra during billing. The quote of the bidder should be excluding GST. Any changes in GST % as per Govt. rules will be applicable to this work also.
15	Details about tax deduction structure.	Prevailing statutory deductions as per norms - TDS 2%, GST TDS 2%, KLWWF 1% will be deducted from the payment

General Queries		
Sl. No	Queries	Reply
16	The statutory approvals are under the scope of contractor or not	All statutory approvals are under scope of contractor. Refer Serial No. 69 of Technical Queries in the Minutes of Pre - Bid Meeting.
17	Whether price escalation applicable?	Price escalation is not applicable
18	Arbitration clause	Refer to Clause 25 of General Contract Condition
19	Details of Liquidity damages & Penalties	Refer to Clause No. 2 and 5.5 of General Contract Condition
20	Defect Liability Period applicable for entire scope of work	Defect Liability Period will be 60 months as per the tender conditions
21	Payment Procedure	Refer Clause No. 7 of General Contract Condition and schedule F in Tender document
22	As per tender condition 50% of the performance guarantee need to be submitted as Treasury Fixed Deposit. Kindly accept 100% of the performance guarantee in the form of Bank Guarantee. After the Covid 19 pandemic the construction industry is being struggling and material prices has increased exponentially. During this challenging times providing performance guarantee in the form of Treasury Fixed Deposit will cause huge overhead costs to the contractor, resulting in high estimate.	As per G.O (P) No.7/2021/Fin dated 07/01/2021, Performance Security/ Security Deposit to be submitted at the time of executing the Agreement is reduced from the existing rate of 5% to 3% of the contract amount. At least 50% of this deposit shall be collected in the form of Treasury Fixed Deposit and the rest in the form of Bank Guarantee.
23	Regarding additional performance guarantee also, the Government had issued relief vide the GO(P) No.7/2021/Fin dated 07.01.2021 by waiving off the condition and to obtain an undertaking from the contractor to execute all the low quoted items in full. Kindly avoid the additional performance guarantee condition.	As per GO (P) No.7/2021/Fin dated 07/01/2021, Additional Performance Guarantee is waived for the low quoted items on the condition that the bidder shall furnish an undertaking to execute all low quoted items in full as per contract terms
24	Extension for Bid Submission	The last date for bid submission is extended up to 16/11/2021 5:00 PM and Tender opening on 19/11/2021 11:00 PM

General Queries		
Sl. No	Queries	Reply
25	Earnest Money Deposit (EMD) amounting to Rs.5 Lakhs (Rupees Five Lakhs only) to be remitted online through e-GP site by the bidder EMD allow to submit bid declaration	As per Tender document
26	The custodian of Tree after the "Tree cutting works", are not specifically mentioned and the place for staking of tree after cutting are also not mentioned. Please convey	Cut trees have to be stacked species wise with measurement by the contractor in the yard allotted by KINFRA. Tree Custodian shall be KINFRA
27	If there is any environmental clearances is required or not if the borelog quantity is high	If any ammendment is required, KINFRA shall arrange the same.
28	The compond wall drawings for the park is available in tender drawings or not	Necessary drawings are provided in the tender drawings
29	The approval from PWD for laying the pipe is under the scope of contractor or not	The necessary approvals will be arranged by KINFRA however required drawings should be provided by the contractor
30	Bidder enquired about the earth cutting and conveyance	The excess cut earth is proposed to be deposited in low lying areas of park as per the direction of Engineer in charge. Conveyance is included in the respective BOQ item.
31	Whether a concrete mixing plant can be provided inside the area/Contractor have concrete mixing plant in other areas, is it is necessary to install a plant inside the area.	Concrete mixing plant/ Batching plant can be arranged inside the park premise as designated by Engineer in charge. If to be brought from outside, necessary quality check for the concrete has to be performed as per the tender conditions and instruction of Engineer in charge.
32	The design and Soil investigation for Pipe Bridge	The design will be provided by KINFRA/ Consultant based on soil investigation
33	Any Additional details to be furnished along with the Tender Document	The Name, copy of Company Identity Card, email ID, Contact Number of the contract signing authority should be included in the Technical Bid Document

Pre qualification criteria Queries		
Sl.no	Queries	Reply
1	In the prequalification criteria under the head 'Eligibility criteria', the criteria for similar work is given as, "*Similar work means infrastructure development works which includes BM/BC Road, allied civil works and land development works, water distribution network system, High Tension Power Supply system".Kindly amend the condition as follows,"*Similar work means infrastructure development works which includes any of the key activity experiences like BM/BC Road, allied civil works and land development works, water distribution network system, High Tension Power Supply system.Since specific key activity experiences are already given in the cl. b. iii. 1), 2) & 3), which will prove the contractor's experience, kindly accept similar works including any of the key experiences.	PQ criteria to be followed
2	In the prequalification criteria given under the head 'Eligibility criteria', it is given as cl. (b) "Should have satisfactorily completed the works as principal contractor as mentioned below during the last Seven years ending last day of the month previous to the one in which tenders are invited."In the above criteria please accept the experience of similar works as Subcontractor and Joint venture member.	PQ criteria to be followed
3	In the prequalification criteria under the head 'Eligibility criteria', the criteria is given as, cl. b. iii. 2) "Development of water distribution network system with DI pipe Lines for a length of at least 2 KM."Kindly accept experience in sewage network system and gas pipeline system also, as the works are similar.	PQ criteria to be followed
4	With reference to the above, as per the clause (iii) (3) of the eligibility criteria whether it is required a substation to be completed or partially completed of the minimum required eligibility criteria in the bidding document. We have minimum required eligibility criteria in all respects as per the bidding document norms. The kinfra may kind enough to reduce the eligibility criteria for substation to a reasonable qualification process.	Only the completed works can be considered as per the PQ criteria
5	We have completed substation work as per your PQ requirement in an ongoing composite project with Indian Railways where we have completed 95% of work. Project awarded with a value of Rs. 31 Cr in which we have completed the work to a value of Rs. 40 Cr (Including variations and new scope).Some additional scope to an extent of 5% is under progress and it is likely to be completed by December.Whether you will consider the above completed substation work for the pre-qualifying criteria?We are fulfilling all other criteria's.	Only the completed works can be considered as per the PQ criteria
6	While going through the eligibility criteria it have been noted that "your eligibility requirement of development of water distribution network system with DI pipe Lines for a length of at least 2 KM, is not perfectly matching with our qualification since we are executed the similar type of job with GI/MS/CS steel pipes. In this context we are requesting you to consider the GI/MS/CS piping instead of DI pipe line as in your pre-qualification. Also we have executed bituminous macadam/concrete works in connection with Palsit to Dakuni (Km. 581 to Km. 646) section of NH-2 in the state of West Bengal during the year 2010, we request you to the exemption in time period of last seven years and consider in your pre qualification criteria for Construction of BM/BC Road work for a length of at least 3 KM." We hope that it will satisfy your requirements.	Only the completed works can be considered as per the PQ criteria

Pre qualification criteria Queries		
Sl.no	Queries	Reply
7	<p>Cl. 1 on Page 3 of Information & Instruction to Bidders : Eligibility Criteria Similar work means infrastructure development works which includes BM/BC Road, allied civil works and land development works, water distribution network system, High Tension Power Supply system) As against the Qualification requirement kindly consider infra project with BM/BC Road with allied activities only.</p> <p>As far as 2) Development of water distribution network system with DI pipe Lines for a length of at least 2 KM & 3) High Tension Power Supply system with Substation & 11kV Ring Main distribution system using underground cabling is concerned, the Contractor can get these activities executed from subcontractor agencies. Therefore the bidder shall be allowed to submit or undertaking to execute these work by reputed agencies with Class "A" Registration for similar work experience</p>	PQ criteria to be followed
8	Whether a bidder can qualify if Bitumen Road of 36000sqm is completed	Refer PQ criteria

Technical Queries			
SI.No	BOQ No.	Specification	Reply
1	4.101	Supply, delivery and fixing of floor mounted type FCMA Air/ Oil Cooled soft starter suitable for the LT motor offered for operation in AC three Phase 50Hz (+/- 5%), 415V(+/-10%) including line contactors suitable for next standard higher KW rating, Over load relay, instrument panel with frequency meter, Ammeter, Voltmeter, indicating lamp 6Nos, LED ON/OFF type and Start /Stop push button. - Motor capacity is not specified .	The Discharge Pressure and head for the pump is mentioned in the line item, contractor have to design corresponding HP from the approved Vendors
2	4.103	Providing and laying earth connection from earth electrode with 6 SWG dia G.I. Wire in 15 mm dia G.I.pipe from earth electrode including connection with G.I. thimble excavation and re-filling as required. - Average length of connection	2mtrs of 6 SWG GI Wire can be considered as average length
3	6.159	Supply, Installation, Testing and Connection of CAT-6A cable with necessasary end termination for connectivity between data switches and with require all accessories to finish the job -- Quantity is in meters	CAT 6A cable can be considered in metres
4	6.163	Supplying and drawing PVC flexible telephone unarmoured tinned copper cable - 2 Pair - Supply of PVC conduit included or not	Line item mentioned is excluding supply of conduit
5	6.164	Supply, laying, testing and comissioning of 20 pair with 0.5 mm dia jelly filled telephone armoure cable with all require accessories. - Supply of PVC conduit included or not	
7	7.233	Battery charger (Float-cum-Boost charger) suitable for item above with all auxiliaries & accessories complete as per specification - Capacity is not specified	Battery bank with minimum capacity is mention in BOQ No 7.232, Battery charger with suitable rating can be considered
8	7.252	2x10 KVA 3phase input- 1phase output High Performance IGBT/PWM based True-On-Line DoubleConversion Microprocessor Controlled Parallel Redundant UPS system including UPS panel– with 60 min backup on each UPS with all related accessories.Batteries 02 bank of sealed maintenance Free (SMF) Exide make of batteries with 65 AH x 20 batteries, Complete, inter-connecting links, DC cable for 5 mtrs distance. Inclusive of freight, Loading & Unloading, Installation & Commissioning - Clarification for number of inverters and battery banks . (total 2No or 4nos)	2nos of 10 kVA UPS is mentioned in each Zonal Substation
9	7.253	Supply, installation the Inverter Air Coditioner for Scada Room 3.0 Tonne Capacity (Split Type) inculding voltage Stbiliser ,time delay relays etc - split up of A/C unit is not clear (3nos of 1TR or 3Nos of 3TR).	3 nos of 3 tonne AC can be considered
10	7.257	Supplying and making indoor cable end termination with heat shrinkable jointing kit completewith all accessories including lugs suitable for following size of 3 core, XLPE aluminium conductor cable of 33 KV grade as required :240 sq. mm - clarification about cable termination size 240 or 300SQmm .(size of cable in 7.256 is 300SQ mm).	300 sqmm cable termination can be considered

Technical Queries			
Sl.No	BOQ No.	Specification	Reply
11	7.260	Supplying and making indoor cable end termination with heat shrinkable jointing kit complete with all accessories including lugs suitable for following size of 3 core, XLPE aluminium conductor cable of 11 kV grade as required: 11kV, 1C 630 sqmm - 3core or 1core?	1 core can be considered
12	7.261	Supplying and making Outdoor cable end termination with heat shrinkable jointing kit complete with all accessories including lugs suitable for following size of 3 core, XLPE aluminium conductor cable of 11 kV grade as required: 11kV, 1C 630 sqmm - 3core or 1core?	
13	7.284	Design, Engineering, Manufacturing, Testing, Supply and Installation of 11KV Outdoor Uni pack version CSS with 250KVA, 11KV/415V, 3 phase, outdoor type, vector DYN-11 transformer with off circuit tappings from +5% to -10% in steps of 2.5%, changeable on off circuit by tap links provided, with WTI & LV terminals suitable for 2 runs of PVCA cable with LTCTs for TTOD and HV terminals connected to 11 KV, 26. KA, 630 A Load Break Switch, with incoming suitable for XLPE cable, with HT HRC fuses, and output connected to 11KV seal off bushings to the transformer including earthings and all allied materials with civil work (construction the foundation) to complete the job - for installation of 250kVA uss - earthing specification (seperate earth pits required or not) are not mentioned and in scheme the rating of uss is 200Kva.	Follow as per BOQ
14	7.289	Design, Fabrication, Supply, installation, testing and commissioning of cubicle type dust and vermin proof, made out of 16SWG /1.6 mm thick CRCA sheet duely rust inhibited, zinc passivated, phosphated and powder coated with approved colour, hinged and earthed front doors with name plate, danger notice board, heavy duty rubber gaskets removable gland plates made out of 2mm thick sheet steel as per specifications and interconnected with suitable AL. Busbar. Rate shall be inclusive of necessary control wirings and terminations as required and as instructed by engineer incharge - DG Panel. Incomer 1 TPN bus bar with SMC supports, heat shrinkable sleeves etc complete as required. RYB phase indicating :160A FP 36kA MCCB with thermal magnetic release 160A 415V, 25kA best conductivity Al extensible LED lamps with control fuses and switches -1 set. Multi Function Digital Meter with CT, control fuses etc - 1 no. Analogue kWh Meter with CT, control fuses etc. - 1 no (DG incomer) Analogue kWh Meter with control fuses etc. - 4 no (Outgoings) Class B & Class C/ Class 1 & Class 2 Surge arrestor device - 1 no. Outgoings 63A, 25kA FP thermal magnetic MCCB - 2 Nos. 80A, 25kA FP thermal magnetic MCCB - 2 Nos. - in scheme it is 60kVAR.	30kVAR can be considered

Technical Queries			
Sl.No	BOQ No.	Specification	Reply
15	4.044	Plastering in 12 mm cement plaster 1:3 (1 cement: 3 fine sand) finished with a floating coat of neat cement on the rough side of single or half brick wall. thick for R.C.C sponge finishing, including cost, and conveyance of all materials like cement, sand, water etc., to site and labour charges, all operations, mixing mortar, finishing, scaffolding, curing, etc., complete for finished item of work and as directed by Engineer -In Charge. (For Internal Plastering) - Unit of item is not correct. Plastering unit mentioned in mt	Units to be read as Square Metres
16	4.045	Plastering in 12 mm cement plaster 1:4 (1 cement: 4 fine sand) finished with a floating coat of neat cement on the rough side of single or half brick wall. thick for R.C.C sponge finishing, including cost, and conveyance of all materials like cement, sand, water etc., to site and labour charges, all operations, mixing mortar, finishing, scaffolding, curing, etc., complete for finished item of work and as directed by Engineer -In Charge. (For External Plastering) - Unit of item is not correct. Plastering unit mentioned in mt	Units to be read as Square Metres
17	4.077	Plastering in 12 mm cement plaster 1:3 (1 cement: 3 fine sand) finished with a floating coat of neat cement on the rough side of single or half brick wall. thick for R.C.C sponge finishing, including cost, and conveyance of all materials like cement, sand, water etc., to site and labour charges, all operations, mixing mortar, finishing, scaffolding, curing, etc., complete for finished item of work and as directed by Engineer -In Charge. (For Internal Plastering) - Unit of item is not correct. Plastering unit mentioned in mt	Units to be read as Square Metres
18	4.078	Plastering in 12 mm cement plaster 1:4 (1 cement: 4 fine sand) finished with a floating coat of neat cement on the rough side of single or half brick wall. thick for R.C.C sponge finishing, including cost, and conveyance of all materials like cement, sand, water etc., to site and labour charges, all operations, mixing mortar, finishing, scaffolding, curing, etc., complete for finished item of work and as directed by Engineer -In Charge. (For External Plastering) - Unit of item is not correct. Plastering unit mentioned in mt	Units to be read as Square Metres
19	4.035	Using Concrete mixture all works up to Plinth Level: Plain Cement concrete nominal mix (1:4:8) prop (Cement : fine aggregate: coarse aggregate) using 40mm size Hard Granite Machine Crushed Metal including cost and conveyance of all materials like cement, sand, coarse aggregate water etc., to site, seigniorage charges on all materials, labour charges, for mixing, laying, concrete, ramming in 15 cm layers, finishing top surface to the required level curing etc., complete for finished item of work for foundation and under flooring bed. - Unit of item is not correct	Unit in the BOQ to be followed

Technical Queries

Sl.No	BOQ No.	Specification	Reply
20	4.036	Providing and laying in position machine batched and machine mixed design mix M-25 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer-in-charge.“(Note :- Cement content considered in this item is @ 330 kg/cum.“Excess/ less cement used as per design mix is payable/recoverable seperately) Including Extra a for providing richer mixes - M-30 Grade All works up to plinth level - Unit of item is not correct	Units to be read as Cubic Metres
	4.037	Providing and laying in position machine batched and machine mixed design mix M-25 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer-in-charge.“(Note :- Cement content considered in this item is @ 330 kg/cum.“Excess/ less cement used as per design mix is payable/recoverable seperately).Inculding Extra for providing richer mixes - M-30 GradeAll works above plinth level upto floor V level - Unit of item is not correct	Units to be read as Cubic Metres
21	4.066	Providing and laying in position machine batched and machine mixed design mix M-25 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer-in-charge.“(Note :- Cement content considered in this item is @ 330 kg/cum.“Excess/ less cement used as per design mix is payable/recoverable seperately).Including Extra for providing richer mixes - M-30 GradeAll works up to plinth level - Unit of item is not correct	Units to be read as Cubic Metres

Technical Queries

Sl.No	BOQ No.	Specification	Reply
22	4.067	Providing and laying in position machine batched and machine mixed design mix M-25 grade cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer-in-charge. (Note :- Cement content considered in this item is @ 330 kg/cum. "Excess/ less cement used as per design mix is payable/recoverable separately). Including Extra for providing richer mixes - M-30 Grade All works above plinth level upto floor V level - Unit of item is not correct	Units to be read as Cubic Metres
23	1.045	Plain/Reinforced Cement Concrete in Open Foundation complete as per Drawing and Technical Specifications RCC Grade M20 With Batching Plant, Transit Mixer and Concrete Pump - clarification required for RMC including or excluding formwork.	Item is inclusive of formwork
24	2.031	Extra for providing richer mixes at all floor levels. Note:- Excess/less cement over the specified cement content used is payable/ recoverable separately. Providing M-30 grade concrete instead of M-25 grade BMC/RMC. (Note:- Cement content considered in M-30 is @ 340 kg/cum).- Please Clarify	The concrete item for M25 is provisioned in the Tender as item No. 2.029 and 2.030. The additional rate for M 30 mix deducting the rate for M25 per cum needs to be quoted
25	2.045	Extra for plastering exterior walls of height more than 10 m from ground level for every additional height of 3 m or part thereof - Please Clarify	The additional rate for plastering above 10 M for the plastering item mentioned in item no. 2.044 to be quoted
26	8.102	Providing and fixing 100 mm brass locks (best make of approved quality) for aluminium doors including necessary cutting and making good etc. complete - Brass lock unit mentioned in KG instead of Nos.	Unit to be read as 'Each'
27	1.013	Loading and Unloading of Stone Boulder/ Stone aggregates/ Sand/ Kanker/Moorum. Placing tipper at loading point, loading with front end loader, dumping, turning for return trip, excluding time for haulage and return trip - Lead is not specified	Lead is 2 KM
28	1.017	Construction of sub-grade and earthen shoulders with approved material obtained from borrow pits with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2 - Weather borrow pit is of contractor scope including all royalties. Otherwise specify the lead	Borrow pit is of contractor scope including all royalties. The earth
29	1.084	Assembling, joining and laying of reinforcing elements. of synthetic geogrids for Reinforced Earth Structures - Item is including material or not	Item is including material
30	1.085	Assembling, joining and laying of reinforcing elements of Glass reinforced polymer/ fibre reinforced polymer/ polymeric strips Reinforced for Earth Structures - item is including material or not	

Technical Queries			
Sl.No	BOQ No.	Specification	Reply
31	1.088	Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2. - 1.088 and 1.090 Both of the item is same or not	Vibratory Roller of above 8 to 10 Tonne capacity should be considered
32	1.090	Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2. - 1.088 and 1.090 Both of the item is same or not	Vibratory Roller of 8 Tonne capacity should be considered
33	2.089	"Manufacture, Supply and delivery of DI D/F Butterfly Valves with GGG-40/SG-400/15 or GGG-50/SG 500/7 or equivalent grade as per I.S.3896-part 2-1985 and subsequent revisions, Double eccentric Disc., with renewable soft seal on the disc and Body seat face of stainless steel / nickel weld overlay, with powder or liquid Epoxy coating with minimum thickness of 250 microns applied on both body and disc inside and outside. Face to face dimensions as per AWWA C 504 or BS 5155 or IS:13095. Drilled as per requirement of dept." - Valve size not mentioned in item description	150 mm dia to be considered
34	2.090	Manufacture, Supply and delivery of DI D/F Swing Check Valves Slanted/Straight seated with metallic, corrosion proof and wear resistant seat faces resilient seat, Body and Disc of ductile cast iron GGG 40/SG 400/15 or GGG-50/SG- 500/7 or equivalent grade as per IS 3896(part2)-1985 and subsequent revisions. All the inside and outside of the body is to be coated with double coating of epoxy liquid. Drilled as per requirement of dept.. Specification and Dimensions as per I.S 5312 or equivalent codes - Valve size not mentioned in item description	150 mm dia to be considered
35	2.096	Manufacture, Supply and delivery of DI D/F Swing Check Valves Slanted/Straight seated with metallic, corrosion proof and wear resistant seat faces resilient seat, Body and Disc of ductile cast iron GGG 40/SG 400/15 or GGG-50/SG- 500/7 or equivalent grade as per IS 3896(part2)-1985 and subsequent revisions. All the inside and outside of the body is to be coated with double coating of epoxy liquid. Drilled as per requirement of dept.. Specification and Dimensions as per I.S 5312 or equivalent codes - Valve size not mentioned in item description	400mm dia to be considered
36	3.042	Providing laying, testing & commissioning of 'C' class heavy duty MS Pipe conforming to IS 1239/3589 i/c fittings like elbows, tees, flanges, tapers, nuts bolts, gaskets etc. in ground including welding, excavation & providing cement concrete blocks as supports, anticorrosive treatment with coaltar/asphalt tape as per IS 10221, refilling the trench etc. of following sizes complete as required. - Pipe dia not specified	Rate has to quoted for 200 mm dia for a Length 4708 Metres and 150 mm dia for a length of 1699 Metres.

Technical Queries

Sl.No	BOQ No.	Specification	Reply
37	3.043	Supplying and fixing single headed Internal / External hydrant valve with instantaneous Gun metal couplings of 63mm dia with Cast iron wheel ISI marked conforming to IS 5290 (Type - A) with blank Gun Metal cap and chain as required. Makes: Newage/ Winco/ Padmini / Safex/Minimax - Valve size not mentioned in item description	63 mm dia to be considered
38	3.044	Supplying, fixing, testing and commissioning of butterfly valve PN 1.6, with Bronze / Gun metal seat duly ISI marked complete with Nuts, Bolts, Washers, gaskets, conforming to IS 13095 of following sizes as required. Makes: Audco / Kirloskar / BDK / HShankar / Leader/ Zolotto / Valtree - Valve size not mentioned in item description	200 mm dia to be considered
39	3.045	Supplying, fixing, testing and commissioning of butterfly valve PN 1.6, with Bronze / Gun metal seat duly ISI marked complete with Nuts, Bolts, Washers, gaskets, conforming to IS 13095 of following sizes as required. Makes: Audco / Kirloskar / BDK / HShankar / Leader/ Zolotto / Valtree - Valve size not mentioned in item description	150 mm dia to be considered
40	3.046	Providing, installation, testing and commissioning of Flat type non - return valve of following sizes confirming to IS: 5312 complete with rubber gasket, GI bolts, nuts, washers etc as required Makes: Audco / Kirloskar / BDK / H-Shankar / Leader/ Zolotto / Valtree - Valve size not mentioned in item description	200 mm dia to be considered
41	3.047	Providing, installation, testing and commissioning of Flat type non - return valve of following sizes confirming to IS: 5312 complete with rubber gasket, GI bolts, nuts, washers etc as required Makes: Audco / Kirloskar / BDK / H- Shankar / Leader/ Zolotto / Valtree - Valve size not mentioned in item description	150 mm dia to be considered
42	3.048	8 Manufacture, Supply and delivery of CI Wafer Lug type Butterfly Valves conforming to IS 13095/1991 (Reaffirmed 1998) excluding transportation, CED and taxes etc., complete. Operation done with worm actuator ISI marked Rate at Ex- Factory Makes: Audco / Kirloskar / BDK / H-Shankar / Leader/ Zolotto / Valtree - Valve size not mentioned in item description	200 mm dia to be considered
43	3.049	Manufacture, Supply and delivery of CI Wafer Lug type Butterfly Valves conforming to IS 13095/1991 (Reaffirmed 1998) excluding transportation, CED and taxes etc., complete. Operation done with worm actuator ISI marked Rate at Ex- Factory Makes: Audco / Kirloskar / BDK / H-Shankar / Leader/ Zolotto / Valtree - Valve size not mentioned in item description	150 mm dia to be considered
44	1.006	Clearing and grubbing road land including uprooting rank vegetation, grass, bushes, shrubs, saplings and trees girth up to 300 mm, removal of stumps of trees cut earlier and disposal of unserviceable materials and stacking of serviceable material to be used or auctioned, up to a lead of 1000 metres including removal and disposal of top organic soil not exceeding 150 mm in thickness In area of light jungle - By Mechanical Means - The unit for the item no. are not clarified in the documents. Kindly clarify	Units may be read as Hecter

Technical Queries			
Sl.No	BOQ No.	Specification	Reply
45	6.034	Providing and fixing ISI marked flush door shutters conforming to IS : 2202 (Part I) decorative type, core of block board construction with frame of I st class hard wood and well matched teak 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters.35 mm thick including ISI marked Stainless Steel butt hinges with necessary screws - The unit for the item no. are not clarified in the documents. Kindly clarify	Unit may be read as Square Metres
46	1.052	Supplying, fitting FRP Grating complete as per drawing and Technical Specifications - The dimension of Item no. 1.052, "FRP grating" are not provided. Please provide	0.45 x 0.45 M dimension to be considered
47		Kindly specify the item of Facia Panel in the MSE wall if any and provide the drawings of MSE wall for our further reference.	Item of Facia Panel in the MSE wall is Galvanised steel mesh. The shop drawings have to be provided by the Contractor and get approved from KINFRA
48	6.177	Supply, installation testing and commissioning of the following minimum capacity Hi wall Split inverter type air conditioning unit (Indoor and Outdoor Unit) complete with suitable capacity drive motor, air cooled condenser with all accessories, hermetically sealed scroll/rotary compressor, outdoor unit and hi wall units for single or three phasesupply minimum 5 star rated as per BEE and with suitable stabilizer with necessary supports vibration isolators suitable as required as per manufacturers recommendation, suitably sized copper refrigerant piping as per relevant ASHRAE Standards (both suction and liquid piping) including 19 mm thick closed cell nitrile rubber insulation as per specification interconnecting indoor & outdoor units with required pipe fittings and accessories like bends, tees, reducers, supports finished with 7 mils factory laminated treated fibre glass cloth, necessary power/control cabling, suitably supported on trays/ split clamps etc., CPVC condensate drain pipe (upto 5 m) 6kg/sq.cm of suitable dia connecting the drain pan of the indoor units to nearest drain point with U-trap, insulated with 9 mm thick closed cell nitrile rubber insulation, required pipe fittings and accessories like bends, tees, reducers,supports, clamps, finished with 7 mils factory laminated treated fibre glass cloth, first charge refrigerant gas R410A/R407C, cordless remote etc complete asrequired as per specification/ISHRAE standards.2.5 TR - an inverter Hi wall unit with a 5-star rating needs to be provided. But those unit is not available with the approved vendors in the make list, Hi wall unit with R410A/R407C refrigerant gas needs to be provided. But the specified refrigerant gas is not available with most of the approved vendors	R32 and 3 star or higher can be considered

Technical Queries

Sl.No	BOQ No.	Specification	Reply
49	6.178	<p>Supply, installation testing and commissioning of the following minimum capacity Hi wall Split inverter type air conditioning unit (Indoor and Outdoor Unit) complete with suitable capacity drive motor, air cooled condenser with all accessories, hermetically sealed scroll/rotary compressor, outdoor unit and hi wall units for single or three phases supply minimum 5 star rated as per BEE and with suitable stabilizer with necessary supports vibration isolators suitable as required as per manufacturers recommendation, suitably sized copper refrigerant piping as per relevant ASHRAE Standards (both suction and liquid piping) including 19 mm thick closed cell nitrile rubber insulation as per specification interconnecting indoor & outdoor units with required pipe fittings and accessories like bends, tees, reducers, supports finished with 7 mils factory laminated treated fibre glass cloth, necessary power/control cabling, suitably supported on trays/ split clamps etc., CPVC condensate drain pipe (upto 5 m) 6kg/sq.cm of suitable dia connecting the drain pan of the indoor units to nearest drain point with U-trap, insulated with 9 mm thick closed cell nitrile rubber insulation, required pipe fittings and accessories like bends,tees reducers,supports, clamps, finished with 7 mils factory laminated treated fibre glass cloth, first charge refrigerant gas R410A/R407C, cordless remote etc complete asrequired as per specification/ISHRAE standards.2.0 TR -Hi wall unit with R410A/R407C refrigerant gas needs to be provided. But the specified refrigerant gas is not available with most of the approved vendors</p>	R 32 can be considered

Technical Queries

Sl.No	BOQ No.	Specification	Reply
50	6.179	<p>Supply, installation testing and commissioning of the following minimum capacity Hi wall Split inverter type air conditioning unit (Indoor and Outdoor Unit) complete with suitable capacity drive motor, air cooled condenser with all accessories, hermetically sealed scroll/rotary compressor, outdoor unit and hi wall units for single or three phasesupply minimum 5 star rated as per BEE and with suitable stabilizer with necessary supports vibration isolators suitable as required as per manufacturers recommendation, suitably sized copper refrigerant piping as per relevant ASHRAE Standards (both suction and liquid piping) including 19 mm thick closed cell nitrile rubber insulation as per specification interconnecting indoor & outdoor units with required pipe fittings and accessories like bends, tees, reducers, supports finished with 7 mils factory laminated treated fibre glass cloth, necessary power/control cabling, suitably supported on trays/ split clamps etc., CPVC condensate drain pipe (upto 5 m) 6kg/sq.cm of suitable dia connecting the drain pan of the indoor units to nearest drain point with U-trap, insulated with 9 mm thick closed cell nitrile rubber insulation, required pipe fittings and accessories like bends, tees, reducers,supports, clamps, finished with 7 mils factory laminated treated fibre glass cloth, first charge refrigerant gas R410A/R407C, cordless remote etc complete asrequired as per specification/ISHRAE standards.1.0 TR - For Server Rooms (1W+1S) -Hi wall unit with R410A/R407C refrigerant gas needs to be provided. But the specified refrigerant gas is not available with most of the approved vendors, 1 duty+ 1 standby hi wall units of 1TR capacity is required for server rooms and the quantity required is 5 Nos. Kindly confirm the total quantity including duty and standby units.</p>	<p>R 32 can be considered, 1Tr X 5 Nos of split AC has been given. The item can be used for both server rooms and office areas</p>

Technical Queries

Sl.No	BOQ No.	Specification	Reply
51	7.225	<p>Supply, installation testing and commissioning of the following minimum capacity Hi wall Split inverter type air conditioning unit (Indoor and Outdoor Unit) complete with suitable capacity drive motor, air cooled condenser with all accessories, hermetically sealed scroll/rotary compressor, outdoor unit and hi wall units for single or three phases supply minimum 5 star rated as per BEE and with suitable stabilizer with necessary supports vibration isolators suitable as required as per manufacturers recommendation, suitably sized copper refrigerant piping as per relevant ASHRAE Standards (both suction and liquid piping) including 19 mm thick closed cell nitrile rubber insulation as per specification interconnecting indoor & outdoor units with required pipe fittings and accessories like bends, tees, reducers, supports finished with 7 mils factory laminated treated fibre glass cloth, necessary power/control cabling, suitably supported on trays/ split clamps etc., CPVC condensate drain pipe (upto 5 m) 6kg/sq.cm of suitable dia connecting the drain pan of the indoor units to nearest drain point with U-trap, insulated with 9 mm thick closed cell nitrile rubber insulation, required pipe fittings and accessories like bends, tees, reducers, supports, clamps, finished with 7 mils factory laminated treated fibre glass cloth, first charge refrigerant gas R410A/R407C, cordless remote etc complete as required as per specification/ISHRAE standards.1.5 TR -Hi wall unit with R410A/R407C refrigerant gas needs to be provided. But the specified refrigerant gas is not available with most of the approved vendors copper piping length and requirement of the drain pump are not specified. Kindly confirm the requirement.</p>	R 32 can be considered
52		The fire pump discharge rate as the specified rate is not mentioned in the latest kerala fire Checklist. If the same is discussed with concerned Fire Officer kindly share the Initial fire NOC obtained.	As per tender specification. The initial NOC is in the Contractor's scope
53		The fire pump head is mentioned as 120mh as it is the maximum pressure that can be withstand by a fire protection system. If 120 m head is to be followed no orifice plate or pressure reducing valve is included.	To be considered as per tender specification
54		Only hydrant valves are included in the boq, no hose box or any other hydrant system is included in the case of yard hydrants .	Only hydrant valves needs to be considered
55		As per the BOQ it is mentioned that internal or external hydrants but no internal hydrants are included in the BOQ.	Internal hydrants are not included in the BoQ

Technical Queries

Sl.No	BOQ No.	Specification	Reply
56	2.090	Manufacture, Supply and delivery of DI D/F Swing Check Valves Slanted/Straight seated with metallic, corrosion proof and wear resistant seat faces resilient seat, Body and Disc of ductile cast iron GGG 40/SG 400/15 or GGG-50/SG-500/7 or equivalent grade as per IS 3896(part2)-1985 and subsequent revisions. All the inside and outside of the body is to be coated with double coating of epoxy liquid. Drilled as per requirement of dept.. Specification and Dimensions as per I.S 5312 or equivalent codes. -Swing check valve, required size not mentioned in the specification	150 mm dia to be considered
57	2.096	Manufacture, Supply and delivery of DI D/F Swing Check Valves Slanted/Straight seated with metallic, corrosion proof and wear resistant seat faces resilient seat, Body and Disc of ductile cast iron GGG 40/SG 400/15 or GGG-50/SG-500/7 or equivalent grade as per IS 3896(part2)-1985 and subsequent revisions. All the inside and outside of the body is to be coated with double coating of epoxy liquid. Drilled as per requirement of dept.. Specification and Dimensions as per I.S 5312 or equivalent codes. -Swing check valve, required size not mentioned in the specification	400mm dia to be considered
58	2.089	"Manufacture, Supply and delivery of DI D/F Butterfly Valves with GGG-40/SG-400/15 or GGG-50/SG 500/7 or equivalent grade as per I.S.3896-part 2-1985 and subsequent revisions, Double eccentrically Disc., with renewable soft seal on the disc and Body seat face of stainless steel / nickel weld overlay,with powder or liquid Epoxy coating with minimum thickness of 250 microns applied on both body and disc inside and outside. Face to face dimensions as per AWWA C 504 or BS 5155 or IS:13095.Drilled as per requirement of dept." - Butterfly Valve required size not mentioned in the specification	150 mm dia to be considered
59	5.050	At CETP-1 recycled Treated Water - Water Supply; Centrifugal Monoblock End Suction Pump Coupled Pump along with IE2 Efficiency Motor; -Pump Specification not mentioned	Centrifugal End suction Horizontal Pump, Flow - 1848 lpm, Head - 55 Mtr
60	5.051	At CETP-2 recycled Treated Water - Water Supply; Centrifugal Monoblock Pump Short Coupled Pump along with IE3 Efficiency Motor; - Pump Specification not mentioned	Centrifugal End suction Horizontal Pump , Flow - 820 lpm, Head - 28 Mtr
61	4.090	Pump With a Capacity of 246.30 Cum/hr and with a head of 7 mtrs - Pump specification not mentioned	submersible pump with mentioned discharge and head should be considered
62	4.091	Pump With a Capacity of 109.30 Cum/hr and with a head of 8 mtrs - Pump specification not mentioned	submersible pump with mentioned discharge and head should be considered
63	4.092	Pump With a Capacity of 135.70 Cum/hr and with a head of 16 mtrs - Pump specification not mentioned	submersible pump with mentioned discharge and head should be considered
64	4.093	Pump With a Capacity of 73 Cum/hr and with a head of 4 mtrs - Pump specification not mentioned	submersible pump with mentioned discharge and head should be considered

Technical Queries			
Sl.No	BOQ No.	Specification	Reply
65	4.094	Pump With a Capacity of 47.70 Cum/hr and with a head of 27 mtrs - Pump specification not mentioned	submersible pump with mentioned discharge and head should be considered
66	4.095	Pump With a Capacity of 44.10 Cum/hr and with a head of 14 mtrs - Pump specification not mentioned	submersible pump with mentioned discharge and head should be considered
67	4.096	Pump With a Capacity of 56.90 Cum/hr and with a head of 20 mtrs - Pump specification not mentioned	submersible pump with mentioned discharge and head should be considered
68		Item Numbers 7.353,7.354,7.221,7.22 HDPE pipe is misspelled as HOPE - Clarify	Items to be taken as H D P E
69		Item No. 6.175, 7.344,7.266 , 7.212	<p>The quantities in BOQ for the item numbers 6.175, 7.344,7.266 may be read as 0 (Zero) and 7.212 may be read as 1 (One).</p> <p>The item 7.212 in BOQ may be read as - Preparation of all documents & submitting and getting initial and final approvals from ElectricalInspectorate/KSEB/PWD/ Irrigation/ Fire Department/any other departments as per requirement. All statutory payments will be reimbursed on production of the original receipts.</p>

Technical Queries

Sl.No	BOQ No.	Specification	Reply
70		Item No. 3.061	<p>Item No. 3.061 in BOQ may be read as "Supplying, installation, testing and commissioning of Diesel driven main fire pump suitable for automatic operation and consisting of following complete in all respect as required a) Horizontal type, multistage, centrifugal, split casing pump of cast iron body & bronze impeller with stainless steel shaft, mechanical seal to ensure a minimum pressure of 3.5 Kg / sq.cm. at highest and farthest outlet at specified flow of 1488 lpm at 110 Mtr. head conforming to IS 1520 b) Suitable HP, 1500 RPM water cooled with radiator, diesel engine conforming to relevant BS & IS standard complete with auto starting mechanism, 12 Volts / 24 Volts electric starting equipment, Diesel Tank, exhaust pipe extended upto 1 m. outside pump house duly insulated with 50mm thick glass wool with 1.0mm thick aluminium sheet cladding, residential silencer, instruments and protection as per specification, stop solenoid for auto stop in the event of fault with audio indications, painted with post office red colour etc as required.c) M.S. Fabricated common base plate, coupling, coupling guard, foundation bolts etc as required."d) Suitable cement concrete foundation duly plastered with antivibration pads. Makes of Pumps: Kirloskar /Mather&Platt. Makes of Motors: Siemens/ ABB/ Kirloskar Including OH & Contractors profit</p>
71		Technical specification of Compact Substation	Attached as annexure
72		The report on soil investigation and CBR surveys	Attached as annexure
73		Any Revised Drawings	The revised drawings of electrification in Admin Building is attached as annexure

Annexure 2
Technical Specification of Compact Sub Station

EQUIPMENTS AND ACCESSORIES

1.0 SPECIFICATIONS FOR SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF CAST RESIN DRY TYPE COMPACT SUBSTATION (CSS).

1.01 Scope

The scope of work include Supply, Installation, testing and commissioning of outdoor type dry cast resin power transformer (Compact substation) manufactured to IS specification, delivery to site installation, testing and commissioning as per IS specifications.

1.02 Data for Compact Substation

Details relating to the transformers are furnished under Data for CSS forming part of these documents.

1.03 Inspection on Receipt

Immediately on receipt of the CSS at the site, it shall be unpacked and examined for any defect/damage/discrepancy/shortage. Particular attention shall be given to the following:

- a. Core and windings
- b. Enclosure and doors
- c. Protruding fixtures
- d. Bushings and terminals
- e. Winding temperature relay
- f. Auxiliary parts packed separately
- g. Marshalling box
- h. Safety interlocks
- i. Insulation resistances

If the equipment has suffered any defect / damage / discrepancy/ shortage; the details shall be reported in writing to the Client and corrective action to be taken. In case the supply of the transformer is by the Client, they will initiate necessary action on receiving the report. It is highly imperative that such a report is given within seven days of receipt of the equipment at site so that timely action can be taken to lodge the necessary insurance claim. If the Client is not able to arrange for the necessary insurance due to non-receipt of timely report from the contractor, the Contractor shall be liable to reimburse the expenditure incurred by the Client for the necessary repair/ replacement/ supply.

1.04 Assembly and Erection

Manufacturer's instructions shall be followed in assembling and installing the transformer and its parts. Where no such instructions are available, the work shall be carried out in conformity with the best engineering practice.

All the separately dispatched parts of the transformer are to be correctly assembled. The accuracy of the temperature indicator shall be checked. Danger notice as per relevant standards shall be affixed in a conspicuous place on the transformer.

Whenever the conductor materials of the terminals and those of the cable lugs to be connected to the terminals differ, suitable bimetallic connectors shall be used.

Neutral and non-current carrying metal parts of the transformer shall be connected to earth in accordance with relevant standards.

The marshaling box with all its contents shall be installed and wiring of all alarm, trip and other circuits completed.

1.05 Codes and Standards

The design, materials, construction, manufacture, inspection and performance of power transformer shall comply with all currently applicable standards, regulations and safety codes in the locality where the equipment shall be installed. The equipment shall also conform to the latest applicable standards and codes and practices. The transformer shall generally conform to IS: 2026 latest edition and duty cycle as per IS: 11171/1985, 2026/1977.

1.06 Earthing

After completing the assembly and erection the body and LV side neutral of the transformer shall be earthed in accordance with the approved drawings and in compliance with the Kerala State Electrical Inspectorate (KSEI) guidelines.

Earthing conductors shall be of copper and the sizes shall be as approved by the Electrical Inspectorate. Disconnect able link shall be provided in the neutral earthing circuit.

1.07 Internal Earthing

Internal metal parts of the transformer, with the exception of the individual lamination, core bolts and their individual clamping plates shall be earthed.

1.08 External Earthing

The size of earth flats/wires shall be chosen from the tabulation shown in earthing system

The metallic parts of the transformer viz. cable glands shall be earthed by two separate and distinct connections with earth of suitable size of earth wires as per table shown in the clause for earthing system.

1.09 Neutral Earth

- a. The neutral of the transformer shall be earthed by not less than two separate and distinct connections with earth pits.
- b. The neutral earth lead should be kept away from the body of the transformer tank.

1.10 Pre-Commissioning Checks and Tests

The following pre-commissioning preparation, checks and tests shall be carried out by contractor in addition to the checks and tests which may be prescribed in the manufacturer's instructions:

- a. Visual inspection for complete and correct assembly and erection of the equipment and its parts.
- b. Inspection and checking of bushings, terminals and connections.
- c. Inspection of clearances.
- d. Testing of the functioning of the following and the associated protective circuitry:
 - i. Winding temperature indicator
 - ii. Winding temperature relay
 - iii. Safety interlocks
- e. Ratio test at all tap.
- f. Check alarm and trip functions.
- g. Insulation Resistance Values.
- h. Earth resistance of neutral and body.

All tests and commissioning procedures shall be carried out in the presence of Manufacturer's commissioning engineer and the authorized representative of Engineer / Consultant and the results of all the tests shall be furnished. The Contractor shall give at least thirty (30) days' advance notice of the date when the tests are to be carried out.

1.11 Assistance by Manufacturer's Engineer

The manufacturer of the equipment should provide assistance of their engineer to the contractor in testing and commissioning of the equipment. It shall be the responsibility of the Contractor to ensure that problems, if any, are got rectified by the manufacturer's engineer during this period.

To facilitate expeditious commissioning of the board, the contractor shall take the following precautions:

- a. The Contractor shall ensure that all the defects/damages/ shortages/discrepancies are promptly reported immediately on receipt of the equipment at site and that these are promptly attended to by the manufacturer.
- b. The Contractor shall carry out pre-commissioning checks and tests on the equipment and furnish a list of all points which require repairs/supplies/replacements to the Client at least 30 days before the anticipated date of commissioning.

1.12 General Features

All the materials used shall be of the best quality and suitable for working under the condition specified to withstand the variation of temperature and atmospheric condition without distortion, deterioration or setting up of undue stresses in any part.

The fittings, screws, studs, nuts and bolts used for external connection shall be as per the relevant standards. The steel bolts and nuts exposed to atmosphere shall be either galvanized or zinc passivated.

Diagram and rating plate shall be of stainless steel and shall indicate the details of transformer capacity, voltage ratio transformer connection diagram, vector group, tap changing diagram, % Impedance etc. All label plates shall be of non-corrosive materials.

Transformer shall be capable of delivering the rated current at a voltage equal to 110% of the rated voltage without exceeding the temperature rise limits.

All rated quantities such as ratios, impedance, regulation, load losses, temperature rise and no load losses shall be within the tolerance limits given in applicable standards.

Inspection covers with bolted arrangement shall be provided in the top or sides of transformer for easy access to the lower ends of bushing, tap changers and to permit replacement of auxiliaries without removing tank covers.

The transformer shall have winding temperature indicator with two independent contacts: one for alarm and another for trip.

All threaded connections shall be locked. Leads from the winding to the terminal block and bushing shall be rigidly supported to prevent injury from vibration.

Terminals of all windings shall be brought out through bushing for external connection.

The noise level shall be 60db + / - 5 at a distance of 2m during load operation.

1.13 Protection

All protection for the primary and secondary of the transformer as per rules of KSEI/ KSEB should be provided.

1.14 Drawings and Leaflets

The copies of manuals of complete instruction for the installation, operation, maintenance and repairs, circuit diagram, foundation and trenching details shall be provided with the transformer.

1.15 Warranty

Manufacturer shall provide warranty of the equipment to be free from defects in materials and workmanship for 1 year from the date of installation or 18 months from the date of purchase, whichever occurs first. Replacement of faulty equipment within the warranty period is under the scope of contractor.

1.16 Installation

Transformer shall be fitted with HT cable termination box on HT side and LT Cable termination on LT side. HT and LT shall be terminated with suitable cable socket / lug and cable terminal lugs contact surface pressure is maintained permanently by suitable bolts and nuts. A suitable protective device to protect the transformer from over voltage, under voltage, and earth fault must be provided.

Minimum 1.25 meter clearance shall be given to the transformer from all sides.

Electrical and Performance Requirements

Shall be operated at rated kVA at any voltage within + / - 10% of the rated voltage of that particular tap position.

Shall be designed for 110% continuous over fluxing withstanding capacity.

The neutral terminals of the winding shall be designed for the highest current that can flow through the winding.

Connections and vector group Delta on HT side and star connection on LT side with neutral terminal brought out for solid earthing.

System of Supply 3 phase, 50 cycle, and 11kV supply as specified in the technical data.

Rating as shown in schematic diagrams .Suitable for continuous rating.

1.17 Terminals

Shall be suitable for 3 core XLPE armoured aluminum conductor cable on HT side and cable entry from the top/bottom as per the schematic and other drawings provided. L.T side shall be suitable for connecting aluminum bus ducting/cable as per drawings and KSEI regulations.

1.18 Testing Certificates

The following test certificates must be submitted

- a. No load loss test
- b. Load loss test
- c. Insulation resistance test
- d. Polarity test
- e. Load test from 25% to 125% of its full load in steps of 25%
- f. Turns ratio test on all tap positions on all the three phases.
- g. Winding resistance measurement test.
- h. High voltage Impulse withstand test

1.19 Operation And Maintenance Instructions

One set of following documents relating to all switchgear, protective devices and meters shall be supplied along with the equipment:

Technical details including wiring diagrams Installation, testing and commissioning manuals Operation and maintenance instructions Spare parts catalogue.

Data sheet for transformer, to be read in conjunction with the clauses following it:(Annexure – A)

1	Type	Cast Resin, Double Wound, Core Type
2	Winding Material	Copper
3	Applicable Standard	IS: 11171/1985, 2026/1977
4	kVA	250kVA
5	Voltage Ratio	11kV/433V

6	Rated Frequency	50 Hz
7	No. of Phases (HV) No. of Phases (LV)	Three Three
8	Type of Cooling	AN
9	Vector Group	Dyn11
10	Voltage Between Phases	
	a. HV	11000V
	b. LV	433V
11	Connection on HV Side	DELTA
12	Connection on LV Side	STAR
13	Type of Terminals	
	a. HV side	Connected to LBS Panel
	b. LV side	Cable Box with LTCT for LTTOD
14	Whether Neutral brought out on LV Side	Yes
15	Tapping on HV Side	+5% to -10% in steps of 2.5% Changeable by off circuit tap links
16	Temperature Rise at Ambient Temperature a. Winding by Resistance	90° C
17	Impedance at normal voltage ratio 75 degree Celsius	4.5 % with IS Tolerance
18	Type of Installation	Outdoor
19	Type of Insulation	CLASS F

20	Maximum Guaranteed Losses at 75°C	
	a. At 100% load	3935 watts with IS Tolerance
	b. At 50% load	1595 watts with IS Tolerance
20	Details of Core	CRGO as per IS 3024/2015
21	Impulse Voltage Withstand at HV side	75 kV (P)
22	Power Frequency Withstand Voltage	
	HV Side	28 kV (rms)
	LV Side	3 kV (rms)
	LTCT's	400/5A, 10VA, 0.5S

Annexure – 3

REPORT ON SOIL INVESTIGATION AND CBR SURVEYS

CONTENTS

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ANNEXURE

1. BORELOG
2. N VALUE CURVES
3. LAB REPORT
4. COMPACTION AND CBR GRAPHS
5. ROCK TEST RESULT
6. SITE PLAN

1. INTRODUCTION

a. Kerala Industrial Infrastructure Development Corporation (KINFRA) intends to develop Petrochemical Industrial Park at Ambalamughal, Ernakulum District, Kerala. As part of this development, various new structures need to be constructed at different locations. KINFRA has appointed Voyants Solutions Private Limited (VSPL) for preparation of Detailed Project Report (DPR) for the development of Petrochemical Industrial Park over an area of 500 acres at Ambalamughal. The geotechnical investigation work for the proposed project was entrusted VSPL to M/s Engineers Diagnostic Centre (P) Ltd, Cochin. Five numbers of boreholes were taken for the proposed project. BH1 was taken for the proposed single storied building, BH2 and BH3 was taken for proposed G+2 storied building, BH4 and BH5A was taken for the proposed Treatment Plant. BH1 was taken at Truck Terminal Warehouse adjacent to entry/ exit gate, BH2 at Water Works and MRSS adjacent to emergency exit, BH3 at R&D lab, BH4 near Sewage Pond, and BH5A near Truck Terminal Warehouse adjacent to Chithra Puzha River. The field works for the geotechnical investigation were carried out from 4th to 18th of May 2018 and boring was done upto a maximum depth of 21.50m.

b. The scope of work for this investigation included performing site reconnaissance, drilling and sampling of five boreholes, conducting geotechnical field and laboratory testing, and preparing this report. The primary purpose of these activities was to collect subsurface information at the site for subsequent preparation of geotechnical recommendations for the design of foundations for the proposed project.

c. The results of various tests conducted to determine the physical and engineering properties of soil samples collected from the bore holes are also appended in this report.

2. SCOPE OF WORK

Scope of work for the geotechnical investigations consists of:

- a) Drilling bore holes at five locations at the site.
- b) Conducting standard penetration tests (SPT) in the bore holes at regular intervals and collection of disturbed samples.
- c) Conducting laboratory tests on disturbed samples for physical and engineering properties of soil.
- d) Submitting a geotechnical report providing foundation design and recommendation for the proposed project.

3. FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION AND METHODOLOGY

Boring was done in accordance with the provisions of IS 1892-1979, using rotary calyx rig technique which is mechanically operated. Boreholes was penetrated through the sandy and clayey layers and the boreholes was terminated at 13.50m, 21.50m, 8.80m, 11.30m, 12.00m in areas of BH1 to BH5A respectively.

While drilling through the top soil layers sodium bentonite slurry was circulated in order to prevent the sides from caving. Standard penetration tests (SPT), were taken at various depth using standard split spoon sampler, the sets being driven by 63.5Kg hammer as per IS 2131-1981 giving a free fall of 750mm. The number of blows required to penetrate the first 15cm is for seating and is not considered for assessing strength characteristics. The summation of the number of second and third sets of 15cm each are termed as SPT value and designated as 'N'. Results were recorded and graphically represented in the log of bore holes. Soil samples were collected in plastic bags for visual inspection and classification of strata from all the layers as recorded in log sheets of bore holes.

3.2 ANALYSIS OF VARIOUS LABORATORY TESTS

Disturbed samples (SPT Samples) obtained from specified sampler were tested for the following index properties as well as strength properties to classify the strata to various soil group as per unified soil classification IS: 1498-1970 and IS: 2720.

3.2.1 Moisture Content {IS: 2720 (Part II) - 1973}

The natural moisture content of all the soil samples brought from the site was determined as prescribed in IS: 2720. For many soils, the water content will be an extremely important index used for establishing the relationship between the way a soil behaves and its properties. The consistency of a fine-grained soil largely depends on its water content. The water content is also used in expressing the phase relationships of air, water, and solids in a given volume of soil.

3.2.2 Grain Size Distribution {IS: 2720 (Part IV) - 1985}

Both sieve analysis and Hydrometer analysis were conducted on different samples and the findings are tabulated. Since particle diameters typically span many orders of magnitude for natural sediments, in order to conveniently describe wide ranging data sets, the base to logarithmic (ϕ) scale was used to represent grain size information for sediment distribution. A tabular classification of grain sizes in terms of units and other commonly used measurement scales is included for purposes of comparison.

3.2.3 Specific Gravity {IS: 2720 (Part III)- 1980}

The specific gravity of soil particles was determined by using pycnometer or density bottle. Specific gravity is the ratio of the mass of unit volume of soil at a stated temperature to the mass of the same volume of gas-free distilled water at the same stated temperature. The specific gravity of a soil is used in the phase relationship of air, water, and solids in a given volume of the soil.

4. FINDINGS

4.1 FIELD OBSERVATIONS

- **BOREHOLE NO: 1 (13.50m) (X=653039.8350, Y=1104094.3524) (RL:28.97m)**

In BH-1, the top 3.70m comprise of dense to very dense silty clayey sand with lateritic gravel (reddish brown) having S.P.T value of 47 to 56. Below this medium dense clayey sand with lateritic gravel (yellowish and reddish) having S.P.T value of 18 was noted extending up to a depth of 5.00m. This was followed by very stiff sandy silty clay with gravel (reddish and yellow) having S.P.T value of 21 extending up to a depth of 6.60m. From 6.60m to 9.40m medium dense to dense clayey silty sand (yellowish brown) having S.P.T value of 23 to 36 was noted. At 9.40m SPT rebound was noted. Below this soft weathered rock was noted extending up to a depth of 10.50m. This was followed by jointed hard rock (white) extending up to a depth of 12.00m. From 12.00m to 13.50m jointed granitic hard rock (white) was noted and the borehole BH1 was terminated at 13.50m. In the 1st lift of rock cutting a core recovery of 29% and RQD of 15% was noted from 10.50m to 12.00m in the jointed hard rock strata. In the 2nd lift of rock cutting a core recovery of 54% and RQD of 30% was noted from 12.00m to 13.50m in the jointed hard

granitic rock strata. Water table was noted at a depth of 4.00m from ground level in the borehole during the time of investigation.

- **BOREHOLE NO: 2 (21.50m) (X=652039.3274, Y=1105121.6943) (RL:34.552m)**

In BH-2, the top 3.70m comprise of gravel (reddish brown) and white gypsum having S.P.T value of greater than 100. Below this clayey gypsum (white) having S.P.T value of 88 was noted extending up to a depth of 5.00m. This was followed by very stiff sandy silty clay (yellowish) with white gypsum having S.P.T value of 20 to 30 extending up to a depth of 11.00m. From 11.00m to 12.60m hard sandy silty clay (yellowish) having S.P.T value of 34 was noted. Below this hard sandy clay (yellowish) having S.P.T value of 34 to 51 was noted extending up to a depth of 15.70m. This was followed by very dense silty sand (yellowish) having S.P.T value of greater than 100 extending up to a depth of 17.00m. From 17.00m to 18.60m very stiff clayey sandy silt (yellowish) having S.P.T value of 28 was noted. Below this hard clayey sandy silt (yellowish) having S.P.T value of 33 was noted extending up to a depth of 20.50m. At 20.50m SPT rebound was noted. This was followed by hard granitic rock (greyish) extending up to depth of termination of borehole BH2 at 21.50m. In the 1st lift of rock cutting a core recovery of 83% and RQD of 83% was noted from 20.50m to 21.50m in the granitic jointed rock strata. Water table was noted at a depth of 4.00m from ground level in the borehole during the time of investigation.

- **BOREHOLE NO: 3 (8.80m) (X=651831.8123, Y=1104863.1139) (RL:24.534m)**

In BH-3, the top 2.00m comprise of very dense silty clayey sand with lateritic gravel (reddish brown) having S.P.T value of greater than 100. Below this hard sandy silty clay with lateritic gravel and white gypsum (reddish brown) having S.P.T value of 33 was noted extending up to a depth of 3.60m. This was followed by very stiff sandy silty clay with lateritic gravel and white gypsum (reddish brown) having S.P.T value of 22 extending up to a depth of 5.00m. From 5.00m to 6.80m very stiff sandy clayey silt with white gypsum (reddish brown) having S.P.T value of 29 was noted. At 6.80m SPT rebound was noted. Below this weathered soft rock was noted extending up to a depth of 7.80m. This was followed by hard granitic rock (light greyish) extending up to depth of termination of borehole BH3 at 8.80m. In the 1st lift of rock cutting a core recovery of 61% and RQD of 34% was noted from 7.80m to 8.80m in the granitic jointed rock strata. Water

table was noted at a depth of 6.00m from ground level in the borehole during the time of investigation.

- **BOREHOLE NO: 4 (11.30m) (X=651309.19, Y=1105192.35) (RL:5.148m)**

In BH-4, the top 2.00m comprise of very dense clayey silty sand with lateritic gravel and white gypsum (reddish brown) having S.P.T value of 53. Below this hard sandy silty clay with lateritic gravel and gypsum (reddish brown) having S.P.T value of 60 was noted extending up to a depth of 3.60m. This was followed by stiff sandy silty clay with lateritic gravel and gypsum (reddish brown) having S.P.T value of 12 extending up to a depth of 5.00m. From 5.00m to 6.60m stiff sandy silty clay with gravel (yellowish brown) having S.P.T value of 13 was noted. Below this medium dense silty clayey sand with gravel and gypsum (reddish brown) having S.P.T value of 11 was noted extending up to a depth of 8.00m. This was followed by medium dense silty clayey sand with weathered rock and gypsum (reddish brown) having S.P.T value of 10 extending up to a depth of 9.00m. From 9.00m to 10.30m weathered rock (greyish brown) was noted. Below this granitic jointed hard rock (light grey) was noted extending up to a depth of termination of borehole BH4 at 11.30m. In the 1st lift of rock cutting a core recovery of 92% and RQD of 66% was noted from 10.30m to 11.30m in the granitic jointed hard rock strata. Water table was noted at a depth of 7.50m from ground level in the borehole during the time of investigation.

- **BOREHOLE NO: 5A (12.00m) (X=649145.07, Y=1103570.74) (RL:2.582m)**

In BH-5A, the top 3.70m comprise of soft sandy silty clay with white gypsum (greyish) having S.P.T value of 2 to 3. Below this medium stiff silty clay with organic matter (dark grey) having S.P.T value of 5 was noted extending up to a depth of 6.70m. This was followed by very loose to loose silty clayey sand (light grey and brown) having S.P.T value of 3 to 6 extending up to a depth of 9.80m. At 9.80m SPT rebound was noted. From 9.80m to 10.50m soft weathered rock (greyish brown) was noted. Below this jointed granitic rock (light grey and white) was noted extending up to a depth of termination of borehole BH 5A at 12.00m. In the 1st lift of rock cutting a core recovery of 35% and RQD of 35% was noted from 10.50m to 12.00m in the granitic jointed rock strata. Water table was noted at a depth of 4.00m from ground level in the borehole during the time of investigation.

5. DESIGN CONSIDERATION FOR FOUNDATION SYSTEM

From the study of the boreholes, it was noted that, in areas of BH2, BH3 & BH4 the top 2.00m and 3.70m comprise of very dense sand and gravel & gypsum. Below this hard clay and clayey gypsum was noted extending up to a depth of 3.60m and 5.00m. In area of BH1 the top 3.70m comprise of dense to very dense sand. This was followed by medium dense sand extending up to a depth of 5.00m. In area of BH5A the top 3.70m comprise of soft clay. Below this medium stiff clay was noted extending up to a depth of 6.70m. Since the top strata comprise of soil mixed with gypsum, shallow foundation if adopted as such in this strata will undergo differential settlements.

- **BOREHOLE 1:**

For light structures, shallow foundation may be provided in the dense to very dense sand strata at a depth of about 1.00m from the ground level. The bearing capacity of the strata will be controlled by the settlement characteristics of medium dense sand layer beneath. Depending upon the intensity of loading either wall footing, Isolated foundation, strip footing or raft foundation may be adopted.

Width = 2.0 m

A typical calculation is given below for BH-1, Depth-1.00m and Width of footing-2.00m

(A) Bearing capacity from shear criteria:

Average S.P.T. value of 33 is noted in the zone of influence,

As per IS 6403-1981 clause 5.1.2 the Ultimate net Bearing Capacity in general shear failure

$$q_u = c N_c s_c d_{c_i} + q (N_q - 1) s_q d_{q_i} + \frac{1}{2} B \gamma N_\gamma s_\gamma d_{\gamma_i} W'$$

Neglecting the cohesive component

$$q = 1.00 \times (1.9 - 0.981) = 0.919 \text{ t/m}^3$$

For $\phi = 34^\circ$ $N_q = 41.06$ and $N_\gamma = 29.44$, Considering 2.00m square footing and depth of foundation to be 1.00m,

$$\begin{aligned} q_u &= q (N_q - 1) s_q d_{q_i} + \frac{1}{2} B \gamma N_\gamma s_\gamma d_{\gamma_i} W' \\ &= (0.919 \times 40.06 \times 1.2 \times 1 \times 1) + (\frac{1}{2} \times 2 \times 1.9 \times 29.44 \times 0.8 \times 1 \times 1 \times 0.5) \end{aligned}$$

$$= 44.18 + 22.37$$

$$= 66.55$$

$$q_{\text{safe}} = q_u / 4 = 66.55 / 4 \\ = 16.64 = 16 \text{ Tonnes/m}^2$$

(B) Bearing capacity from settlement criteria:

Average S.P.T. value of 33 is noted in the zone of influence of pressure (considering a footing of width 2m), From IS-8009-1976 bearing capacity for settlement of 25mm works out to be **15 T/m²**

Hence a safe bearing capacity of 15T/ m² may be taken for a footing of width 2.00m at a depth of 1.00 m in area of BH1 from ground level.

For medium heavy to heavy structures, bored cast in situ DMC pile terminating in the hard rock strata noted from a depth of 10.50m can be adopted. If any weathered rock is noted during the boring operations then the piles should fully penetrate the weathered rock and should be seated on hard rock.

- **BOREHOLE 2, 3 and 4:**

In areas of BH2, BH3 and BH4, for the G+2 Storied Building/ Treatment Plant, for heavy structures, bored cast in situ DMC pile terminating in the hard rock strata can be adopted. If any weathered rock is noted during the boring operations then the piles should fully penetrate the weathered rock and should be seated on hard rock.

Based on the crushing strength of the rock samples done at laboratory, the least uniaxial compressive strength of rock samples is obtained as 4388 T/m² at a depth of 20.50m-21.50m.

A typical calculation is given below for BH-2

I) AXIAL LOAD CAPACITY:

(a) Capacity from Rock Strength Criteria:

The Vertical capacity of pile, as per IS 14593-1998 can be taken as

$$Q_s = q_c \times N_j \times N_d \times A_p + q_c \times \pi \times D \times l_s \times \alpha \times \beta$$

Where,

Q = Safe load Capacity of pile in tonnes

q = Uniaxial compressive strength of rock t/m²

N_d = Depth factor = 0.8+0.2(l_s/D), but limited to 2

N_j = Bearing Pressure Coefficient

A_p = Area of pile toe

D = Dia of pile

l_s = Socketed length into pile

α = Rock socket side resistance reduction factor

β = Rock socket correction factor

TYPICAL CAPACITY CALCULATION FOR PILE CAPACITY - BH2

Considering 700mm dia pile socketed in to the granitic jointed rock strata by 0.5 times the dia.

Assume the Uniaxial compressive strength of rock for shaft as 400 t/m².

$$q_c = 400 \text{ t/m}^2 \quad (\text{Uniaxial Compressive strength of rock for shaft})$$

$$q_c = 4388 \text{ t/m}^2 \quad (\text{Uniaxial Compressive strength of rock at pile tip})$$

$$D = 0.70\text{m}, l_s = 0.5 \times 0.7 = 0.35\text{m}$$

$$N_d = 0.8 + 0.2(0.70/1.20) = 0.9$$

$$N_j = 0.25$$

$$A_p = \pi d^2/4 = \pi/4 \times (0.7)^2 = 0.384\text{m}^2$$

$$\alpha = 0.01$$

$$\beta = 1$$

$$Q_s = q_c \times N_j \times N_d \times A_p + q_c \times \pi \times D \times l_s \times \alpha \times \beta$$

$$= 4388 \times 0.25 \times 0.9 \times 0.384 + 400 \times \pi \times 0.70 \times 0.35 \times 0.01 \times 1$$

$$= 379.76 + 3.07$$

$$= 382.84 \text{ Tonnes, Say } 380 \text{ Tonnes.}$$

As per IRC-78 2014 guide lines, practical aspects and considering, the strength of end bearing limited to 5MPa. Hence the load of 700mm diameter pile can be assessed as 190 tonnes

(B) Capacity from Structural Strength Criteria:

1. Considering grade of Concrete to be used = M30
2. Permissible stress in direct compression = 8 N/mm^2
3. Considering concreting is to be done in underwater, take only 75% capacities
4. Hence permissible stress in direct compression = 6 N/mm^2
5. Qsafe of pile of 700mm dia from structural strength criteria

$$= 3.14/4 \times 0.70 \times 0.70 \times 600 = 230.79 \text{ Tonnes, Say } 230 \text{ Tonnes}$$

Hence the safe carrying capacity of the pile end bearing on the rock strata will be governed by the rock strength criteria and the safe capacity of 700mm dia pile can be taken as 190 Tonnes.

- **BOREHOLE 5:**

For light structures, shallow foundations may be provided after densifying the very loose to loose sand layer by using suitable methods of ground engineering techniques such as sand piling, dynamic compaction, vibro flotation etc.

Sand piles of 100mm diameter may be provided at 45cm spacing using displacement method extending up to 6m or refusal for improvement of the weak strata. The improved soil can take a safe bearing capacity of 7t/m² for a footing of width 1.00m commencing from the improved strata at a depth of 1.50m from the ground level. Depending upon the intensity of loading either wall footing, Isolated foundation, strip footing or raft foundation may be adopted.

For medium heavy structures, bored cast in situ under reamed piles may be adopted terminating in the loose sand strata at a depth of 9.00m. Suitable precaution has to be adopted in order to prevent the sides from caving while boring through the loose/medium dense sand layer.

For heavy structures, bored cast in situ DMC pile terminating in the hard rock strata noted from a depth of 10.50m can be adopted. If any weathered rock is noted during the boring operations then the piles should fully penetrate the weathered rock and should be seated on hard rock.

6. SUMMARY & RECOMMENDATIONS:

Recommendations are based on the assumption that the soil profile found in the boreholes tested is indicative of the entire area of the project. Any deviation in soil profile other than that observed in the boreholes tested should immediately be referred to the consultant and proper modification should be implemented.

6.1 RECOMMENDATIONS

From the study of the boreholes, it was noted that, in areas of BH2, BH3 & BH4 the top 2.00m and 3.70m comprise of very dense sand and gravel & gypsum. Below this hard clay and clayey gypsum was noted extending up to a depth of 3.60m and 5.00m. In area of BH1

the top 3.70m comprise of dense to very dense sand. This was followed by medium dense sand extending up to a depth of 5.00m. In area of BH5A the top 3.70m comprise of soft clay. Below this medium stiff clay was noted extending up to a depth of 6.70m. Since the top strata comprise of soil mixed with gypsum, shallow foundation if adopted as such in this strata will undergo differential settlements.

- **BOREHOLE 1:**

For light structures, shallow foundation may be provided in the dense to very dense sand strata at a depth of about 1.00m from the ground level. The bearing capacity of the strata will be controlled by the settlement characteristics of medium dense sand layer beneath. A safe bearing capacity of 15t/m² may be adopted for a footing of 2m width commencing from the dense to very dense sand strata at a depth of 1.00m from ground level. Depending upon the intensity of loading either wall footing, Isolated foundation, strip footing or raft foundation may be adopted.

For medium heavy to heavy structures, bored cast in situ DMC pile terminating in the hard rock strata noted from a depth of 10.50m can be adopted. If any weathered rock is noted during the boring operations then the piles should fully penetrate the weathered rock and should be seated on hard rock.

Load test are essential for accurate determination of pile capacity.

Safe vertical load carrying capacity of D.M.C. piles end bearing with adequate anchorage into hard rock strata may roughly be assessed as

Pile Diameter	Tonnage Capacity
50cm	80t
60cm	110t
70cm	150t

- **BOREHOLE 2, 3 and 4:**

In areas of BH2, BH3 and BH4, for the G+2 Storied Building/ Treatment Plant, bored cast in situ DMC pile terminating in the hard rock strata noted from a depth of 20.50m can be adopted. If any weathered rock is noted during the boring operations then the piles should fully penetrate the weathered rock and should be seated on hard rock.

Load test are essential for accurate determination of pile capacity.

Safe vertical load carrying capacity of D.M.C. piles end bearing with adequate anchorage into hard rock strata may roughly be assessed as

Pile Diameter	Tonnage Capacity
50cm	95t
60cm	140t
70cm	190t

- **BOREHOLE 5:**

For light structures, shallow foundations may be provided after densifying the very loose to loose sand layer by using suitable methods of ground engineering techniques such as sand piling, dynamic compaction, vibro flotation etc.

Sand piles of 100mm diameter may be provided at 45cm spacing using displacement method extending up to 6m or refusal for improvement of the weak strata. The improved soil can take a safe bearing capacity of 7t/m² for a footing of width 1.00m commencing from the improved strata at a depth of 1.50m from the ground level. Depending upon the intensity of loading either wall footing, Isolated foundation, strip footing or raft foundation may be adopted.

For medium heavy structures, bored cast in situ under reamed piles may be adopted terminating in the loose sand strata at a depth of 9.00m. Suitable precaution has to

be adopted in order to prevent the sides from caving while boring through the loose/medium dense sand layer.

Load test are essential for accurate determination of pile capacity.

Safe carrying capacity of under reamed piles extending up to 9.00m, terminating in the loose sand strata and with single bulb may roughly be assessed as

Pile Diameter	Tonnage Capacity
40cm	18t
50 cm	24t

For heavy structures, bored cast in situ DMC pile terminating in the hard rock strata noted from a depth of 10.50m can be adopted. If any weathered rock is noted during the boring operations then the piles should fully penetrate the weathered rock and should be seated on hard rock.

Load test are essential for accurate determination of pile capacity.

Safe vertical load carrying capacity of D.M.C. piles end bearing with adequate anchorage into hard rock strata may roughly be assessed as

Pile Diameter	Tonnage Capacity
50cm	80t
60cm	110t
70cm	150t

For design consideration the horizontal load carrying capacity can be taken as 5% of the axial capacity and the uplift capacity can be taken as 15% of the axial load capacity.



CLIENT:



Initial Pile load tests shall be conducted to verify the pile capacities recommended.

The foundation execution is recommended under strict technical supervision.

If during piling it is observed that the soil profiles from piling operations are not consistent with the bore logs, it may be immediately reported and designs revised if necessary.

The foundation execution is recommended under strict technical supervision.

For ENGINEERS DIAGNOSTIC CENTRE (P)LTD.,

**Dr. ANIL JOSEPH M.E. (S.M.F.E.), M.I.G.S., Ph.D.
GEOTECHNICAL CONSULTANT**

7. REFERENCES

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- 3) Soil Mechanics in Engineering Practice, 2nd Edition, Terzaghi K and Peck R.B, John Willey and Sons,1967.
- 4) IS:6403-1981, Code of Practice for Determination of Bearing Capacity of Shallow Foundation.
- 5) Foundation Manual, N.V Nayak,1996.
- 6) Foundation Design and Construction, M.J Tomlinson, Viewpoint Publishers.
- 7) IS12070-1987, Code of Practice for Design of Shallow Foundation on Rock.
- 8) IS 2911 (PART1/SECTION 2)-1979, Code of Practice for Design and Construction of Pile Foundation.
- 9) Pile Design, Poulos & Davis.

Annexure

Borelog

GEOTECHNICAL INVESTIGATION FOR THE PROPOSED SINGLE STORIED BUILDING AT FACT AMBALAMUGAL, ERNAKULAM



ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client : VOYANTS SOUTIONS PVT. LTD.
 Bore Hole No : BH 1
 Type of Boring : ROTARY
 Termination Depth : 13.50 m (RL:28.97m)

Boring Started : 04.05.2018
 Boring Completed : 08.05.2018
 Ground Water Table: 4.00m
 Location : AMBALAMUGAL

DEPTH	PROFILE	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm			SPT "N"	Remarks
						15cm	15cm	15cm		
3.70		DENSE TO VERY DENSE SILTY CLAYEY SAND WITH LATERITIC GRAVEL (REDDISH BROWN)	3.70	1.50	1.50 - 1.95	15	19	28	47	
				3.00	3.00 - 3.45	21	26	30	56	
5.00		MEDIUM DENSE CLAYEY SAND WITH LATERITIC GRAVEL (YELLOWISH AND REDDISH)	1.30	4.50	4.50 - 4.95	3	7	11	18	
6.60		VERY STIFF SANDY SILTY CLAY WITH GRAVEL (REDDISH AND YELLOW)	1.60	6.00	6.00 - 6.45	3	8	13	21	
9.40		MEDIUM DENSE TO DENSE CLAYEY SILTY SAND (YELLOWISH BROWN)	2.80	7.50	7.50 - 7.95	5	9	14	23	
				9.00	9.00 - 9.45	4	11	25	36	
				9.40	SPT rebound					
10.50		SOFT WEATHERED ROCK	1.10	10.50						
12.00		JOINTED HARD ROCK (WHITE)	1.50	12.00		1st Lift: 10.00m -12.00m CORE RECOVERY = 43%, RQD = 22%				
13.50		JOINTED GRANITIC HARD ROCK (WHITE)	1.50	13.50		2nd Lift: 12.00m -13.50m CORE RECOVERY = 81%, RQD = 45%				

THE BOREHOLE WAS TERMINATED AT 13.50m DEPTH

NOTE: UNDISTURBED SAMPLE

SPT "N"- STANDARD PENETRATION TEST "N"

GEOTECHNICAL INVESTIGATION FOR THE PROPOSED G+2 STORIED BUILDING AT FACT AMBALAMUGAL, ERNAKULAM



ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client : VOYANTS SOLUTIONS PVT. LTD.
 Bore Hole No : BH 2
 Type of Boring : ROTARY
 Termination Depth : 21.50 m , (RL:34.552m)


Boring Started : 08.05.2018
 Boring Completed : 11.05.2018
 Ground Water Table: 4.00m
 Location : AMBALAMUGAL


DEPTH	PROFILE	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm			SPT "N"	Remarks	
						15cm	15cm	15cm			
3.70		GRAVEL (REDDISH BROWN) AND WHITE GYPSUM	3.70	1.50	1.50 - 1.95	48	-	-	>100	PENETRATION=5cm	
				3.00	3.00 - 3.45	51	-	-	>100	PENETRATION=6cm	
5.00		HARD CLAYEY GYPSUM (WHITE)	1.30	4.50	4.50 - 4.95	16	30	58	88		
11.00		VERY STIFF SANDY SILTY CLAY WITH WHITE GYPSUM (YELLOWISH)	6.00	6.00	6.00 - 6.45	8	12	11	23		
				7.50	7.50 - 7.95	5	9	11	20		
				9.00	9.00 - 9.45	4	8	16	24		
				10.50	10.50 - 10.95	7	12	18	30		
12.60		HARD SANDY SILTY CLAY (YELLOWISH)	1.60	12.00	12.00 - 12.45	6	13	21	34		
15.70		HARD SANDY CLAY (YELLOWISH)	3.10	13.50	13.50 - 13.95	7	14	20	34		
				15.00	15.00 - 15.45	11	19	32	51		
17.00		VERY DENSE SILTY SAND (YELLOWISH)	1.30	16.50	16.50 - 16.95	42	-	-	>100		
18.60		VERY STIFF CLAYEY SANDY SILT (YELLOWISH)	1.60	18.00	18.00 - 18.45	8	9	19	28		
				19.50	19.50 - 19.95	10	12	21	33		
20.50		HARD CLAYEY SANDY SILT (YELLOWISH)	1.90	SPT REBOUND							

NOTE: UNDISTURBED SAMPLE

SPT "N"- STANDARD PENETRATION TEST "N"

**GEOTECHNICAL INVESTIGATION FOR THE PROPOSED G+2 STORIED BUILDING AT FACT AMBALAMUGAL,
ERNAKULAM**

	ENGINEERS DIAGNOSTIC CENTRE (P) LTD	Client : VOYANTS SOLUTIONS PVT. LTD.	Boring Started : 08.05.2018
		Bore Hole No : BH 2	Boring Completed : 11.05.2018
		Type of Boring : ROTARY	Ground Water Table: 4.00m
		Termination Depth : 21.50 m, (RL:34.552m)	Location : AMBALAMUGAL

DEPTH	PROFILE	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm			SPT "N"	Remarks
						15cm	15cm	15cm		
		HARD GRANITIC ROCK (GREYISH)		21.50	1st LIFT:20.50m- 21.50m CORE RECOVERY = 83%, RQD = 83%					

THE BOREHOLE WAS TERMINATED AT 21.50m DEPTH

NOTE: UNDISTURBED SAMPLE

SPT "N"- STANDARD PENETRATION TEST "N"

GEOTECHNICAL INVESTIGATION FOR THE PROPOSED G+2 STORIED BUILDING AT FACT AMBALAMUGAL, ERNAKULAM



ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client : VOYANTS SOLUTIONS PVT. LTD.
 Bore Hole No : BH 3
 Type of Boring : ROTARY
 Termination Depth : 8.80 m , (RL:24.534m)

Boring Started : 12.05.2018
 Boring Completed : 15.05.2018
 Ground Water Table: 6.00m
 Location : AMBALAMUGAL

DEPTH	PROFILE	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm			SPT " N "	Remarks
						15cm	15cm	15cm		
2.00		SILTY CLAYEY SAND WITH LATERITIC GRAVEL (REDDISH BROWN)	2.00	1.50	1.50 - 1.95	45	-	-	100	
3.60		HARD SILTY CLAYEY SAND WITH LATERITIC GRAVEL AND WHITE GYPSUM (REDDISH BROWN)	1.60	3.00	3.00 - 3.45	11	15	18	33	
5.00		VERY STIFF SILTY CLAYEY SAND WITH LATERITIC GRAVEL AND WHITE GYPSUM (REDDISH BROWN)	1.40	4.50	4.50 - 4.95	7	8	14	22	
6.80		VERY STIFF SANDY CLAYEY SILT WITH WHITE GYPSUM (REDDISH BROWN)		6.00	6.00 - 6.45	6	13	16	29	
				6.80	SPT rebound					
7.80		WEATHERED SOFT ROCK		7.80						
8.80		HARD GRANITIC ROCK (LIGHT GREYISH)		8.80	1st LIFT : 7.80m - 8.80m CORE RECOVERY = 61%, RQD = 34%					

THE BOREHOLE WAS TERMINATED AT 8.80m DEPTH

NOTE: UNDISTURBED SAMPLE

SPT "N"- STANDARD PENETRATION TEST "N"

**GEOTECHNICAL INVESTIGATION FOR THE PROPOSED TREATMENT PLANT AT FACT AMBALAMUGAL,
ERNAKULAM**



**ENGINEERS DIAGNOSTIC
CENTRE (P) LTD**

Client : VOYANTS SOLUTIONS PVT. LTD.
Bore Hole No : BH 4
Type of Boring : ROTARY
Termination Depth : 11.30 m , (RL:5.148m)

Boring Started : 19.05.2018
Boring Completed : 22.05.2018
Ground Water Table: 7.50m
Location : AMBALAMUGAL

DEPTH	PROFILE	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm			SPT "N"	Remarks
						15cm	15cm	15cm		
2.00		VERY DENSE CLAYEY SILTY SAND WITH LATERITIC GRAVEL AND WHITE GYPSUM (REDDISH BROWN)	2.00	1.50	1.50 - 1.95	16	23	30	53	
3.60		HARD SANDY SILTY CLAY WITH LATERITIC GRAVEL AND GYPSUM (REDDISH BROWN)	1.60	3.00	3.00 - 3.45	15	26	34	60	
5.00		STIFF SANDY SILTY CLAY WITH LATERITIC GRAVEL AND GYPSUM (REDDISH BROWN)	1.40	4.50	4.50 - 4.95	4	6	6	12	
6.60		STIFF SANDY SILTY CLAY WITH GRAVEL (YELLOWISH BROWN)	1.60	6.00	6.00 - 6.45	4	6	7	13	
8.00		MEDIUM DENSE SILTY CLAYEY SAND WITH GRAVEL AND GYPSUM (REDDISH BROWN)	1.40	7.50	7.50 - 7.95	3	4	7	11	
9.00		MEDIUM STIFF SILTY CLAYEY SAND WITH WEATHERED GRAVEL AND GYPSUM (REDDISH BROWN)	1.00	9.00	9.00 - 9.45	2	4	6	10	
10.30		WEATHERED ROCK (GREYISH BROWN)	1.30	10.30	10.30 - 10.75					
11.30		GRANITIC JOINTED HARD ROCK (LIGHT GREY)	1.00	11.30	1st Lift: 10.30m -11.30m CORE RECOVERY = 92%, RQD = 66%					

THE BOREHOLE WAS TERMINATED AT 11.30m DEPTH

NOTE: UNDISTURBED SAMPLE

SPT "N"- STANDARD PENETRATION TEST "N"

**GEOTECHNICAL INVESTIGATION FOR THE PROPOSED TREATMENT PLANT AT FACT AMBALAMUGAL,
ERNAKULAM**



**ENGINEERS DIAGNOSTIC
CENTRE (P) LTD**

Client : VOYANTS SOLUTIONS PVT. LTD.
Bore Hole No : BH 5A
Type of Boring : ROTARY
Termination Depth : 12.00 m ,(RL:2.582m)

Boring Started : 15.05.2018
Boring Completed : 18.05.2018
Ground Water Table: 4.00m
Location : AMBALAMUGAL

DEPTH	PROFILE	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm			SPT "N"	Remarks
						15cm	15cm	15cm		
3.70		SOFT SANDY SILTY CLAY WITH WHITE GYPSUM (GREYISH)	3.70	1.50	1.50 - 1.95	0	1	1	2	
				3.00	3.00 - 3.45	1	1	2	3	
6.70		MEDIUM STIFF SILTY CLAY WITH ORGANIC MATTER (DARK GREY)	3.00	4.50	4.50 - 4.95	2	2	3	5	
				6.00	6.00 - 6.45	1	2	3	5	
9.80		VERY LOOSE TO LOOSE SILTY CLAYEY SAND (LIGHT GREY AND BROWN)	3.10	7.50	7.50 - 7.95	2	1	2	3	
				9.00	9.00 - 9.45	2	3	3	6	
				9.80	SPT REBOUND					
10.50		SOFT WEATHERED ROCK (GREYISH BROWN)	0.70	10.50						
12.00		JOINTED GRANITIC ROCK (LIGHT GREY AND WHITE)	1.50	12.00	1st LIFT: 10.50m -12.00m CORE RECOVERY = 52%, RQD = 52%					

THE BOREHOLE WAS TERMINATED AT 12.00m DEPTH

NOTE: UNDISTURBED SAMPLE

SPT "N"- STANDARD PENETRATION TEST "N"

N Value Curves

PROJECT : GEOTECHNICAL INVESTIGATION FOR THE PROPOSED SINGLE STORIED BUILDING AT FACT AMBALAMUGAL, ERNAKULAM

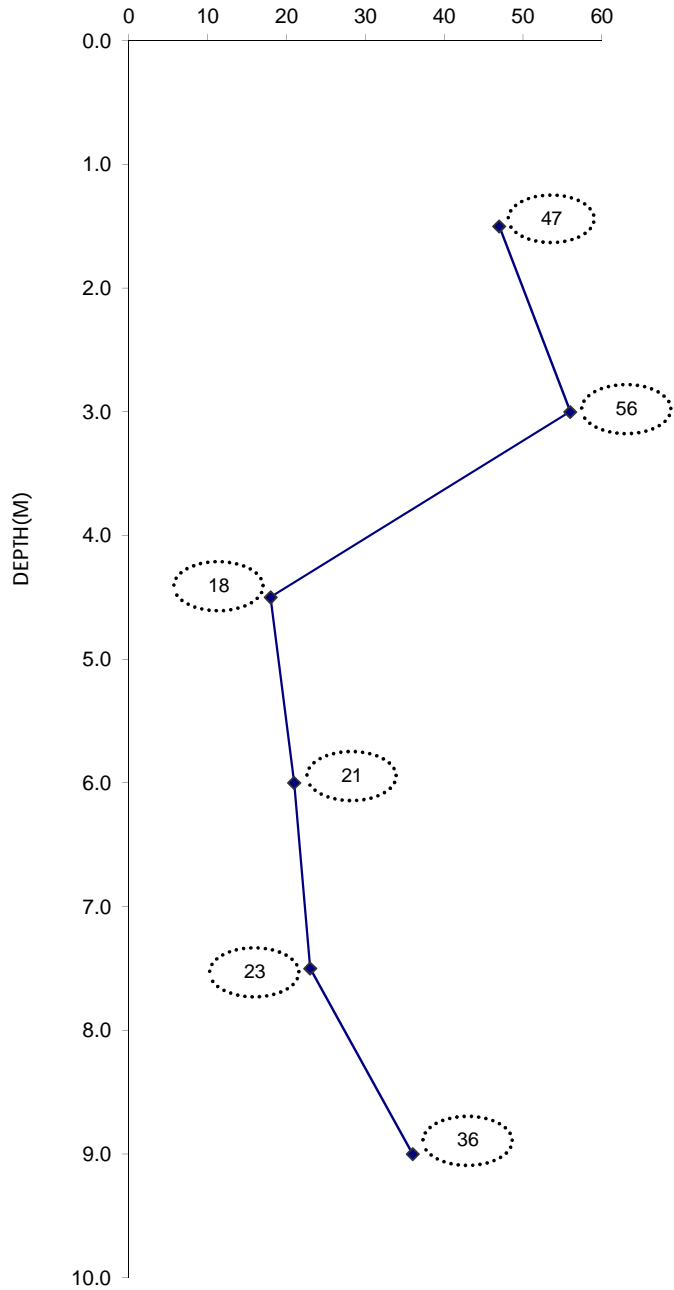


ENGINEERS
DIAGNOSTIC
CENTRE (P) LTD

Bore Hole No : 01
Type of Boring : Rotary
Termination Depth : 13.50m

Boring Started : 04.05.2018
Boring Completed : 08.05.2018
Ground water table : 4.00m

GRAPHICAL REPRESENTATION OF N VALUE
N- VALUE(BLOWS)



BORE HOLE TERMINATED AT 13.50M
FIG. 1

PROJECT : GEOTECHNICAL INVESTIGATION FOR THE PROPOSED G+2 STORIED BUILDING AT FACT AMBALAMUGAL,
ERNAKULAM

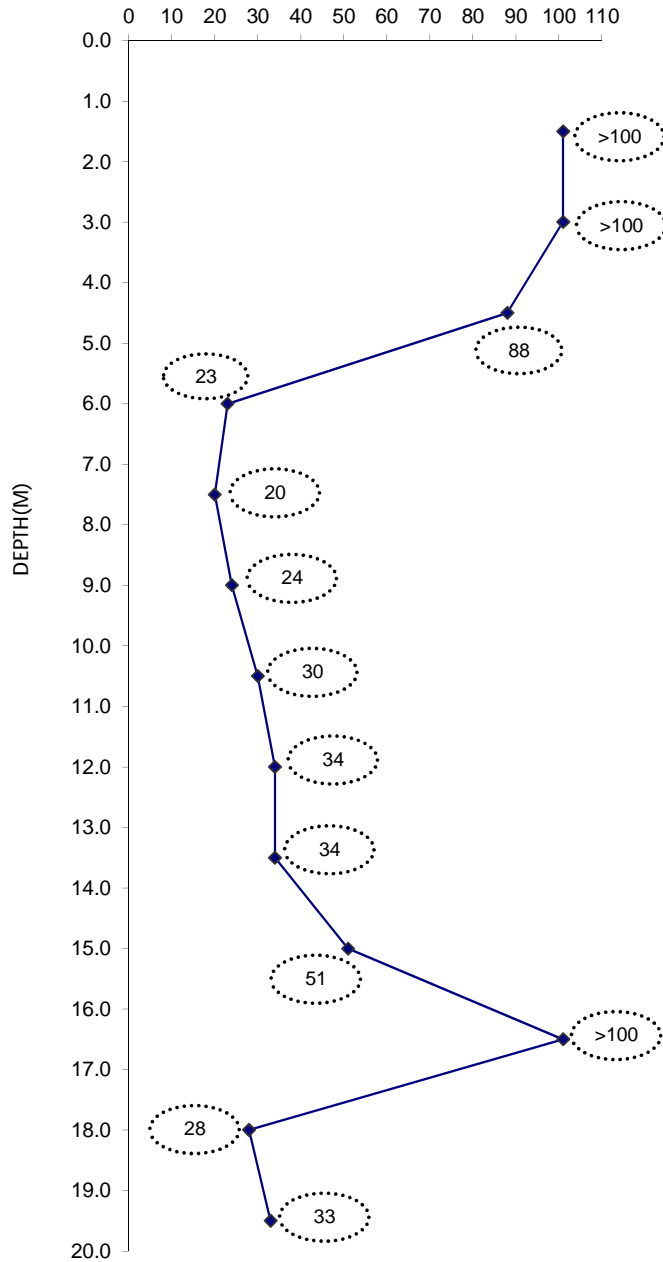


ENGINEERS
DIAGNOSTIC
CENTRE (P) LTD

Bore Hole No : 02
Type of Boring : Rotary
Termination Depth : 21.50m

Boring Started : 08.05.2018
Boring Completed : 11.05.2018
Ground water table : 4.00m

GRAPHICAL REPRESENTATION OF N VALUE
N- VALUE(BLOWS)



BORE HOLE TERMINATED AT 21.50M

FIG. 2

PROJECT : GEOTECHNICAL INVESTIGATION FOR THE PROPOSED G+2 STORIED BUILDING AT FACT AMBALAMUGAL,
ERNAKULAM

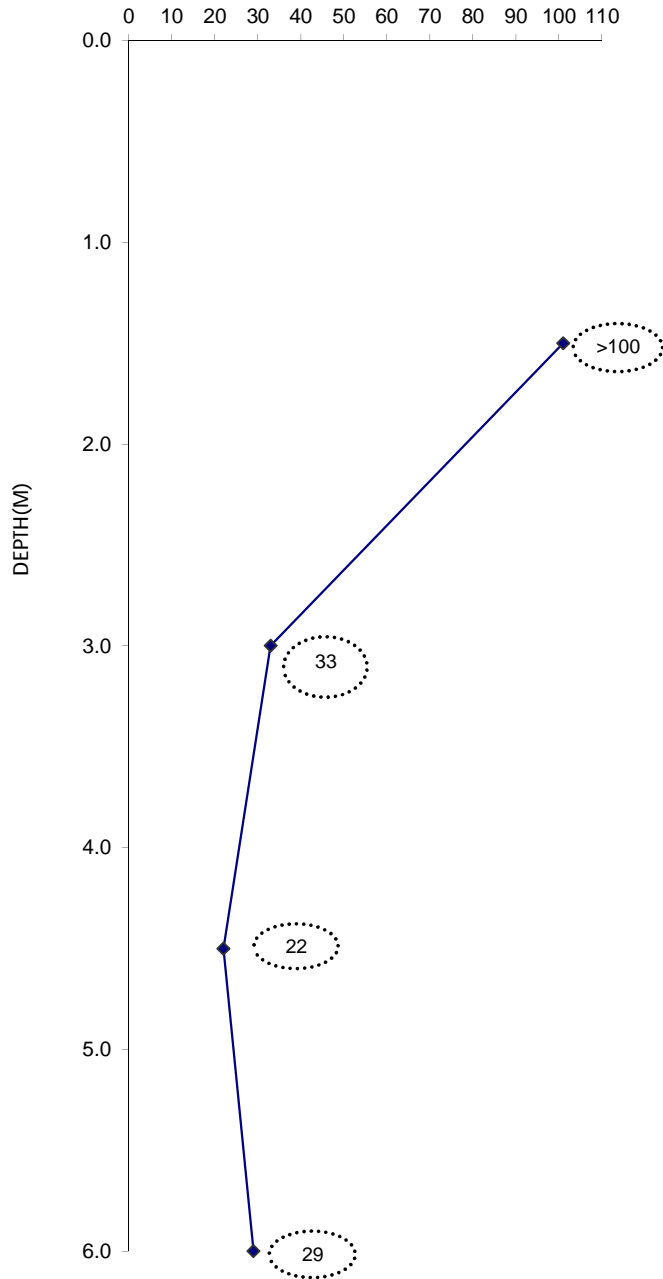


ENGINEERS
DIAGNOSTIC
CENTRE (P) LTD

Bore Hole No : 03
Type of Boring : Rotary
Termination Depth : 8.80m

Boring Started : 12.04.2018
Boring Completed : 15.05.2018
Ground water table : 6.00m

GRAPHICAL REPRESENTATION OF N VALUE
N- VALUE(BLOWS)



BORE HOLE TERMINATED AT 8.80M

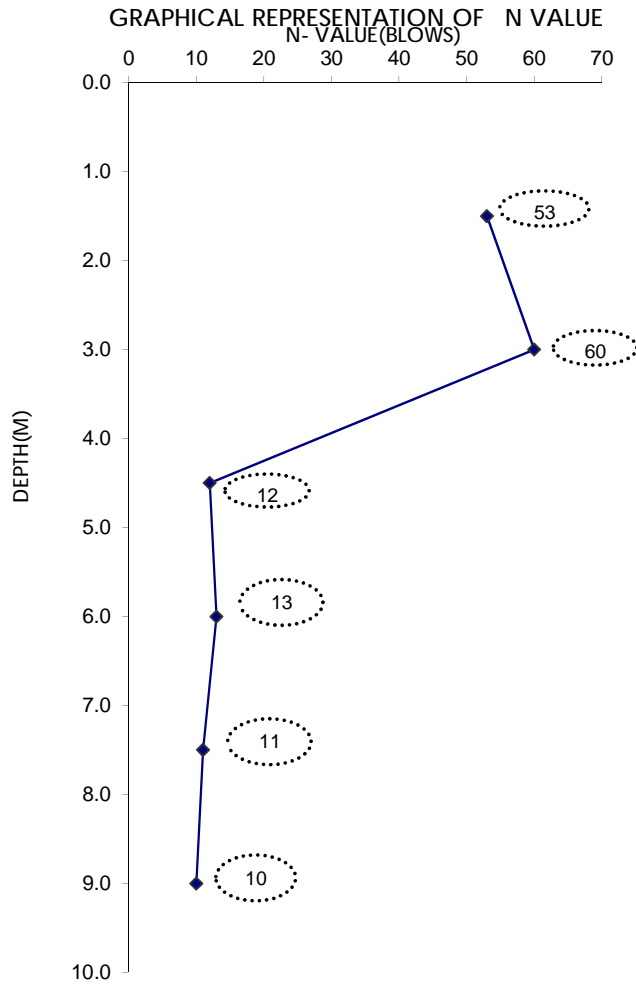
FIG. 3



ENGINEERS
DIAGNOSTIC
CENTRE (P) LTD

Bore Hole No : 4
Type of Boring : Rotary
Termination Depth : 11.30m

Boring Started : 19.05.2018
Boring Completed : 22.05.2018
Ground water table : 7.50m



BORE HOLE TERMINATED AT 11.30M

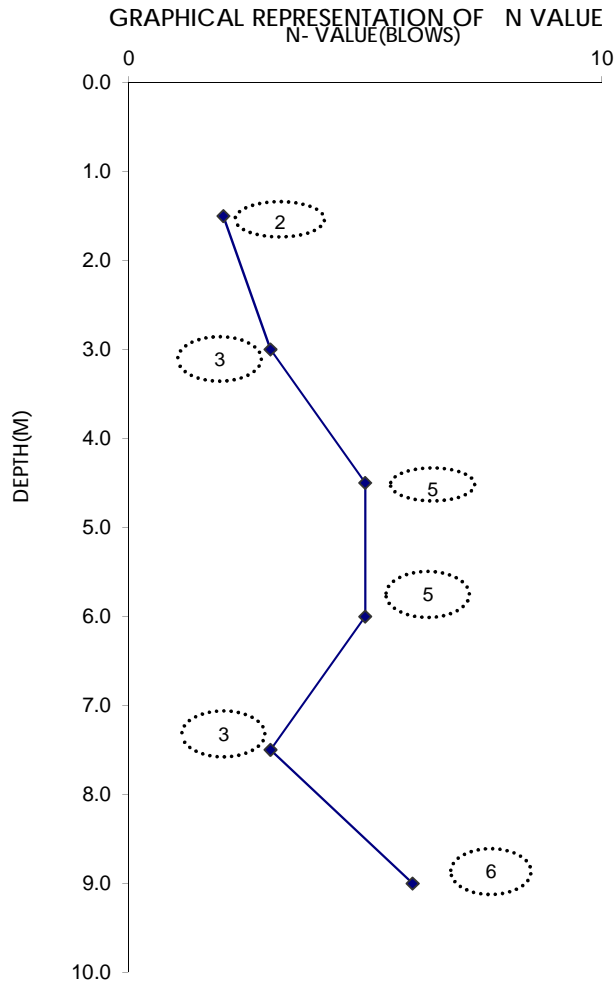
FIG. 4



ENGINEERS
DIAGNOSTIC
CENTRE (P) LTD

Bore Hole No : 5A
Type of Boring : Rotary
Termination Depth : 12.00m

Boring Started : 15.04.2018
Boring Completed : 18.05.2018
Ground water table : 4.00m



BORE HOLE TERMINATED AT 12.00M

FIG. 5

Lab Result



ENGINEERS DIAGNOSTIC CENTRE (P) LTD

41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

PROJECT: INVESTIGATION FOR THE PROPOSED SINGLESTORIED BUILDING AT FACT AMBALAMUGAL,ERNAKULAM			CLIENT: VOYANTS SOLUTIONS PRIVATE LIMITED										JOB NO: A1810						
													DATE: 06.06.2018						
TYPE OF BORING: ROTARY DRILLING 150mm DIA			BORE HOLE NO: 1										NOTE: SAMPLES SUPPLIED BY CLIENT						
WATER LEVEL : 4.00m													DATE OF BORING: 04.05.2018-08.05.2018						
							DEPTH IN METRE: 13.50m												
N	DEPTH	SAMPLE	SOIL DESCRIPTION	I.S CLASIFI CATION	GRAIN SIZE ANALYSIS				NMC %	ATTERBERGS LIMIT(%)			FSI %	SPECIFIC GRAVITY	UNIT WEIGHT (gm/cc)		SHEAR PARAMETERS		
					GRAVE L%	SAND %	SILT %	CLAY %		LL	PL	PI			WET	DRY	TEST METHOD	C kg/cm ²	Ø DEGREE
VALUE	(M)	TYPE																	
47	1.50	SPT-1	Reddish brown silty clayey sand with lateritic gravel	GM-SM	34	36	11	19	26					2.64					
56	3.00	SPT-2	Reddish brown silty clayey sand with lateritic gravel	GM-SM	29	35	14	22	33										
18	4.50	SPT-3	Yellowish and reddish clayey sand with lateritic gravel	SC	13	47	13	27	48	38	20	18		2.62					
21	6.00	SPT-4	Reddish and yellow sandy silty clay with gravel	CL	10	38	19	33	41	40	23	17		2.60					
23	7.50	SPT-5	Yellowish brown clayey silty sand	SC	0	60	16	24	38	34	18	16		2.65					
36	9.00	SPT-6	Yellowish brown clayey silty sand	SC															
	9.40	SPT-7	SPT Rebound																
	9.4-10.50		Soft weathered rock																
	10.50-12.0		White jointed hard rock																
	12.0-13.5		White jointed granitic hard rock																
LAB DONE BY: ALEXANDER K J			LAB IN CHARGE: VIJEESH P RAVI			ENGINEER IN CHARGE: Er. AISWARYA RAJEEV						APPROVED BY: BINEX KUNJUMLN M.TECH.(GEOTECHNICAL)							



ENGINEERS DIAGNOSTIC CENTRE (P) LTD

41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

PROJECT:	INVESTIGATION FOR THE PROPOSED G+2 STORIED BUILDING AT FACT AMBALAMUGAL, ERNAKULAM				CLIENT: VOYANTS SOLUTIONS PRIVATE LIMITED								JOB NO: A1810						
													DATE: 06.06.2018						
													NOTE: SAMPLES SUPPLIED BY CLIENT						
TYPE OF BORING: ROTARY DRILLING 150mm DIA					BORE HOLE NO: 2								DATE OF BORING: 08.05.2018-11.05.2018						
WATER LEVEL : 4.00m													DEPTH IN METRE: 21.50m						
N VALUE	DEPTH (M)	SAMPLE TYPE	SOIL DESCRIPTION	I.S CLASIFI CATION	GRAIN SIZE ANALYSIS				NMC %	ATTERBERGS LIMIT(%)			FSI %	SPECIFIC GRAVITY	UNIT WEIGHT (gm/cc)		SHEAR PARAMETERS		
					GRAVE L%	SAND %	SILT %	CLAY %		LL	PL	PI			WET	DRY	TEST METHOD	C kg/cm ²	φ DEGREE
>100	1.50	SPT-1	Reddish brown gravel and white gypsum	GM-SM					27										
>100	3.00	SPT-2	Reddish brown gravel and white gypsum	GM-SM					29										
88	4.50	SPT-3	White clayey gypsum	SC	18	33	22	27	35										
23	6.00	SPT-4	Yellowish sandy silty clay with white gypsum	CH	0	28	32	40	37	53	27	26	2.60						
20	7.50	SPT-5	Yellowish sandy silty clay with white gypsum	CH					36										
24	9.00	SPT-6	Yellowish sandy silty clay with white gypsum	CI	0	38	26	36	35	42	23	19	2.62						
30	10.50	SPT-7	Yellowish sandy silty clay with white gypsum	CI					40										
34	12.00	SPT-8	Yellowish sandy silty clay	CI	0	40	27	33	34										
LAB DONE BY:			LAB IN CHARGE:			ENGINEER IN CHARGE:					APPROVED BY:								
ALEXANDER K J			VIJEESH P RAVI			Er. AISWARYA RAJEEV					BINEX KUNJUMLN M.TECH.(GEOTECHNICAL)								



ENGINEERS DIAGNOSTIC CENTRE (P) LTD

41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

PROJECT:	INVESTIGATION FOR THE PROPOSED G+2 STORIED BUILDING AT FACT AMBALAMUGAL, ERNAKULAM			CLIENT: VOYANTS SOLUTIONS PRIVATE LIMITED								JOB NO: A1810							
												DATE: 06.06.2018							
TYPE OF BORING: ROTARY DRILLING 150mm DIA WATER LEVEL : 4.00m.				BORE HOLE NO: 2								NOTE: SAMPLES SUPPLIED BY CLIENT DATE OF BORING: 08.05.2018-11.05.2018 DEPTH IN METRE: 21.50m							
N VALUE	DEPTH (M)	SAMPLE TYPE	SOIL DESCRIPTION	I.S CLASIFI CATION	GRAIN SIZE ANALYSIS				NMC %	ATTERBERGS LIMIT(%)			FSI %	SPECIFIC GRAVITY	UNIT WEIGHT (gm/cc)		SHEAR PARAMETERS		
					GRAVE L%	SAND %	SILT %	CLAY %		LL	PL	PI			WET	DRY	TEST METHOD	C kg/cm ²	Ø DEGREE
34	13.50	SPT-9	Yellowish sandy clay	CI	0	36	19	45	35	44	22	22		2.61					
51	15.00	SPT-10	Yellowish sandy clay	CI	0	46	20	34	33										
>100	16.50	SPT-11	Yellowish silty sand	SM	0	78	12	10	20					2.66					
28	18.00	SPT-12	Yellowish clayey sandy silt	SM-ML	0	38	41	21	25					2.63					
33	19.50	SPT-13	Yellowish clayey sandy silt	SM-ML															
	20.50	SPT-14	SPT Rebound																
	20.5-21.5		Greyish hard granitic rock																
LAB DONE BY: ALEXANDER K J			LAB IN CHARGE: VIJEESH P RAVI			ENGINEER IN CHARGE: Er. AISWARYA RAJEEV					APPROVED BY: BINEX KUNJUMLN M.TECH.(GEOTECHNICAL)								



ENGINEERS DIAGNOSTIC CENTRE (P) LTD

41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

PROJECT:	INVESTIGATION FOR THE PROPOSED G+2 STORIED BUILDING AT FACT AMBALAMUGAL, ERNAKULAM			CLIENT: VOYANTS SOLUTIONS PRIVATE LIMITED								JOB NO: A1810							
												DATE: 30.05.2018							
TYPE OF BORING: ROTARY DRILLING 150mm DIA			BORE HOLE NO: 3								NOTE: SAMPLES SUPPLIED BY CLIENT								
WATER LEVEL : 6.0m											DATE OF BORING: 12.05.2018-15.05.2018				DEPTH IN METRE: 8.80m				
N	DEPTH	SAMPLE	SOIL DESCRIPTION	I.S CLASIFI CATION	GRAIN SIZE ANALYSIS				NMC %	ATTERBERGS LIMIT(%)			FSI %	SPECIFIC GRAVITY	UNIT WEIGHT		SHEAR PARAMETERS		
VALUE	(M)	TYPE			GRAVE L%	SAND %	SILT %	CLAY %		LL	PL	PI			WET	DRY	TEST METHOD	C kg/cm ²	Ø DEGREE
>100	1.50	SPT-1	Reddish brown silty clayey sand with lateritic gravel	GM-SM	24	40	16	20	31					2.67					
33	3.00	SPT-2	Reddish brown sandy silty clay with lateritic gravel and white gypsum	SC-CI	0	38	29	33	27	42	26	16		2.59					
22	4.50	SPT-3	Reddish brown sandy silty clay with lateritic gravel and white gypsum	SC-CI					28										
29	6.00	SPT-4	Reddish brown sandy clayey silt with white gypsum	SM-ML	3	39	41	17	27					2.65					
	6.80	SPT-5	SPT Rebound																
	6.8-7.8		Weathered soft rock																
	7.8-8.8		Light greyish hard granitic rock																
LAB DONE BY:			LAB IN CHARGE:			ENGINEER IN CHARGE:						APPROVED BY:							
ALEXANDER K J			VIJEESH P RAVI			Er. AISWARYA RAJEEV						BINEX KUNJUMLN M.TECH.(GEOTECHNICAL)							



ENGINEERS DIAGNOSTIC CENTRE (P) LTD

41/1210, VADAKUMTHALA BUILDING,
PULLEPADDY, COCHIN-682018 PHONE: 0484 2371643

PROJECT:	INVESTIGATION FOR THE PROPOSED TREATMENT PLANT AT FACT AMBALAMUGAL, ERNAKULAM			CLIENT: VOYANTS SOLUTIONS PRIVATE LIMITED								JOB NO: A1810							
												DATE: 30.05.2018							
TYPE OF BORING: ROTARY DRILLING 150mm DIA				BORE HOLE NO: 4								NOTE: SAMPLES SUPPLIED BY CLIENT							
WATER LEVEL : 7.5m												DATE OF BORING: 19.05.2018-22.05.2018				DEPTH IN METRE: 11.30m			
				I.S CLASIFI CATION	GRAIN SIZE ANALYSIS				NMC %	ATTERBERGS LIMIT(%)			FSI %	SPECIFIC GRAVITY	UNIT WEIGHT (gm/cc)		SHEAR PARAMETERS		
N VALUE	DEPTH (M)	SAMPLE TYPE	SOIL DESCRIPTION		GRAVE L%	SAND %	SILT %	CLAY %		LL	PL	PI			WET	DRY	METHOD	C kg/cm ²	Ø DEGREE
53	1.50	SPT-1	Reddish brown clayey silty sand with lateritic gravel and white gypsum	SC	16	38	26	20	38	36	19	17	2.64						
60	3.00	SPT-2	Reddish brown sandy silty clay with lateritic gravel and gypsum	SC-CI	4	32	29	35	30	44	23	21	2.61						
12	4.50	SPT-3	Reddish brown sandy silty clay with lateritic gravel and gypsum	SC-CI					45										
13	6.00	SPT-4	Yellowish brown sandy silty clay with stones	SC-CH	0	38	30	32	41	59	28	31	2.59						
11	7.50	SPT-5	Reddish brown silty clayey sand with gravel and gypsum	SM	8	52	18	22	39										
10	9.00	SPT-6	Reddish brown silty clayey sand with weathered stones and gypsum	SM															
	9.0-10.3	SPT-7	Greyish brown weathered rock																
	10.3-11.3	SPT-7	Light grey granitic jointed hard rock																
LAB DONE BY:			LAB IN CHARGE:			ENGINEER IN CHARGE:						APPROVED BY:							
ALEXANDER K J			VIJEEESH P RAVI			Er. AISWARYA RAJEEV						BINEX KUNJUMLN M.TECH.(GEOTECHNICAL)							



ENGINEERS DIAGNOSTIC CENTRE (P) LTD

41/1210, VADAKUMTHALA BUILDING,
PULLEPADDY, COCHIN-682018 PHONE: 0484 2371643

PROJECT:	INVESTIGATION FOR THE PROPOSED TREATMENT PLANT AT FACT AMBALAMUGAL, ERNAKULAM			CLIENT: VOYANTS SOLUTIONS PRIVATE LIMITED									JOB NO: A1810						
													DATE: 30.05.2018						
													NOTE: SAMPLES SUPPLIED BY CLIENT						
TYPE OF BORING: ROTARY DRILLING 150mm DIA				BORE HOLE NO: 5A									DATE OF BORING: 15.05.2018-18.05.2018						
WATER LEVEL : 4.00m													DEPTH IN METRE: 12.00m						
N	DEPTH	SAMPLE	SOIL DESCRIPTION	I.S CLASIFI CATION	GRAIN SIZE ANALYSIS				NMC %	ATTERBERGS LIMIT(%)			FSI %	SPECIFIC GRAVITY	UNIT WEIGHT		SHEAR PARAMETERS		
					GRAVE L%	SAND %	SILT %	CLAY %		LL	PL	PI			(gm/cc)		TEST METHOD	C kg/cm ²	φ DEGREE
VALUE	(M)	TYPE												WET	DRY				
2	1.50	SPT-1	Greyish sandy silty clay with white gypsum	SC-CI	0	33	32	35	29	43	23	20		2.57					
3	3.00	SPT-2	Greyish sandy silty clay with white gypsum	SC-CI					22										
5	4.50	SPT-3	Dark grey silty clay with organic matter	CH	0	12	46	42	61	76	33	43		2.56					
5	6.00	SPT-4	Dark grey silty clay with organic matter	CH					68										
3	7.50	SPT-5	Light grey and brown silty clayey sand	SC	0	57	19	24	27	36	20	16		2.65					
6	9.00	SPT-6	Light grey and brown silty clayey sand	SC					25										
	9.80	SPT-7	SPT Rebound																
	9.8-10.5	SPT-7	Greyish brown soft weathered rock																
	10.5-12.0		Light grey and white jointed granitic rock																
LAB DONE BY:			LAB IN CHARGE:			ENGINEER IN CHARGE:						APPROVED BY:							
ALEXANDER K J			VIJEESH P RAVI			Er. AISWARYA RAJEEV						BINEX KUNJUMLN M.TECH.(GEOTECHNICAL)							

Compaction and CBR Results

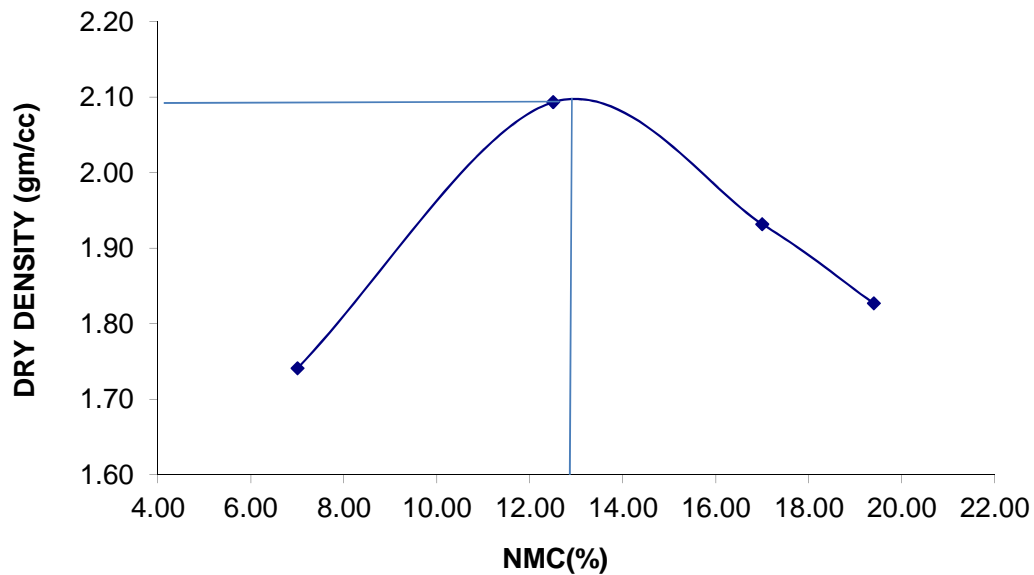


ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT : GEOTECHNICAL INVESTIGATION WORK FOR PROPOSED PETROCHEMICAL CLIENT PARK
AT FACT AMBALAMUGAL, ERNAKULAM**

MODIFIED PROCTOR DENSITY IS 2720 (PART-8)1983

TRIAL PIT (TP-1)



SR NO-TP1				
REDDISH BROWN CLAYEY SAND WITH GRAVEL				
GRAVEL%	SAND%	SILT%	CLAY%	IS CLASS
45	31	10	14	GM-SM
MDD			: 2.09gm/cc	
OMC			: 12.8%	

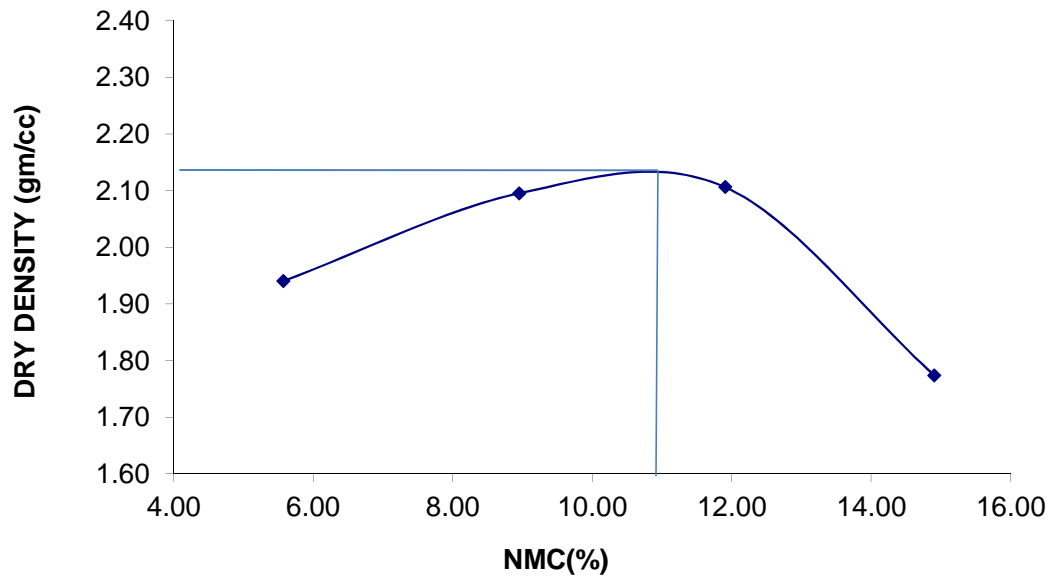


ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT : GEOTECHNICAL INVESTIGATION WORK FOR PROPOSED PETROCHEMICAL CLIENT PARK
AT FACT AMBALAMUGAL, ERNAKULAM**

MODIFIED PROCTOR DENSITY IS 2720 (PART-8)1983

TRIAL PIT (TP-2)



SR NO-TP2				
REDDISH BROWN SILTY SAND WITH GRAVEL				
GRAVEL%	SAND%	SILT%	CLAY%	IS CLAS
33	47	10	10	GM-SM
MDD			: 2.12gm/cc	
OMC			: 10.9%	

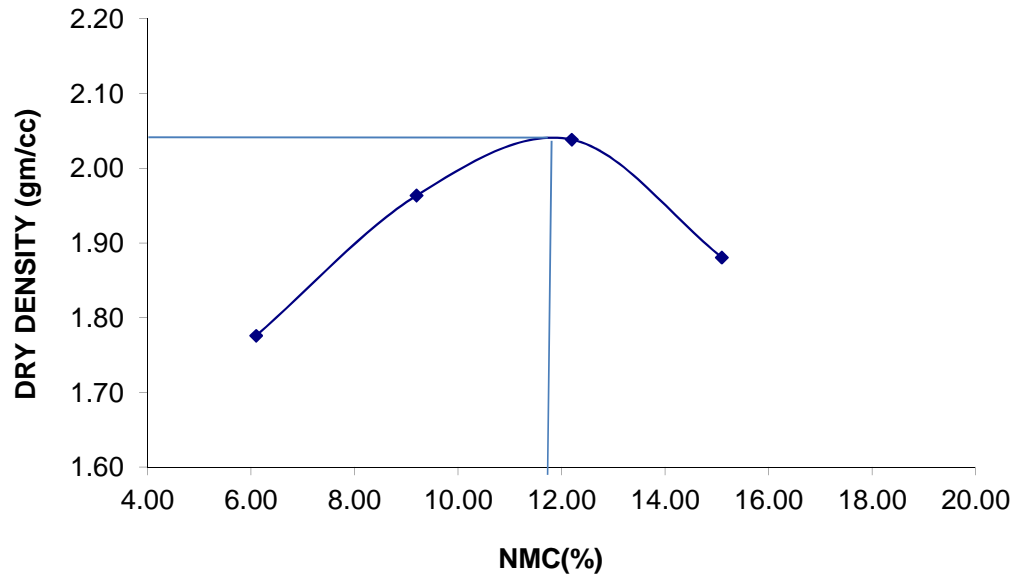


ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT : GEOTECHNICAL INVESTIGATION WORK FOR PROPOSED PETROCHEMICAL CLIENT PARK
AT FACT AMBALAMUGAL, ERNAKULAM**

MODIFIED PROCTOR DENSITY IS 2720 (PART-8)1983

TRIAL PIT (TP-3)



SR NO-TP3				
REDDISH BROWN SILTY SAND WITH GRAVEL				
GRAVEL%	SAND%	SILT%	CLAY%	IS CLAS
34	41	14	11	GM-SM
MDD			: 2.03gm/cc	
OMC			: 11.9%	

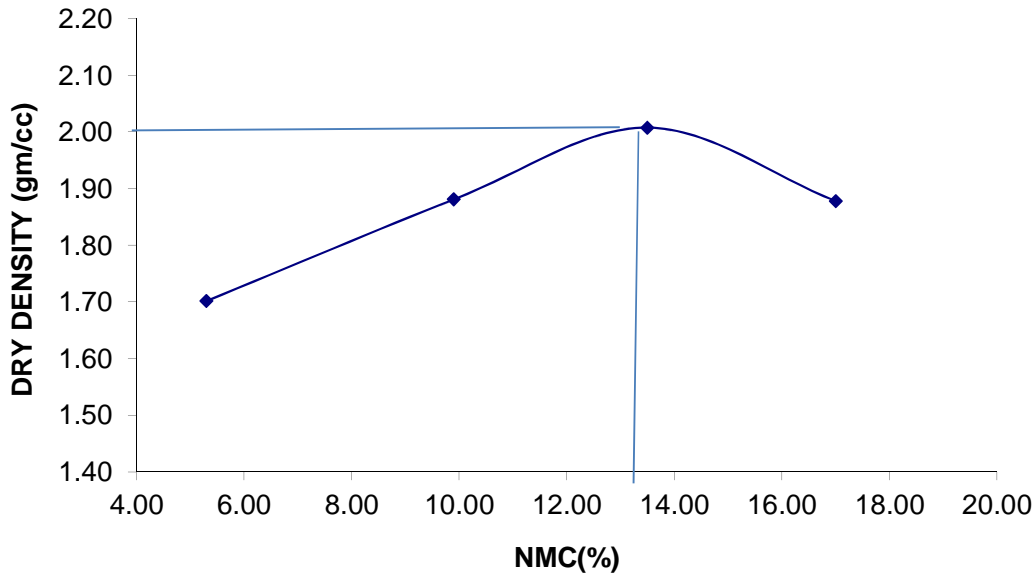


ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT : GEOTECHNICAL INVESTIGATION WORK FOR PROPOSED PETROCHEMICAL CLIENT PARK AT
 FACT AMBALAMUGAL, ERNAKULAM**

MODIFIED PROCTOR DENSITY IS 2720 (PART-8)1983

TRIAL PIT (TP-4)



SR NO-TP4				
REDDISH BROWN SILTY CLAYEY SAND WITH GRAVEL				
GRAVEL%	SAND%	SILT%	CLAY%	IS CLAS
26	44	13	17	GM-SM
MDD			: 2.00gm/cc	
OMC			: 13.5%	

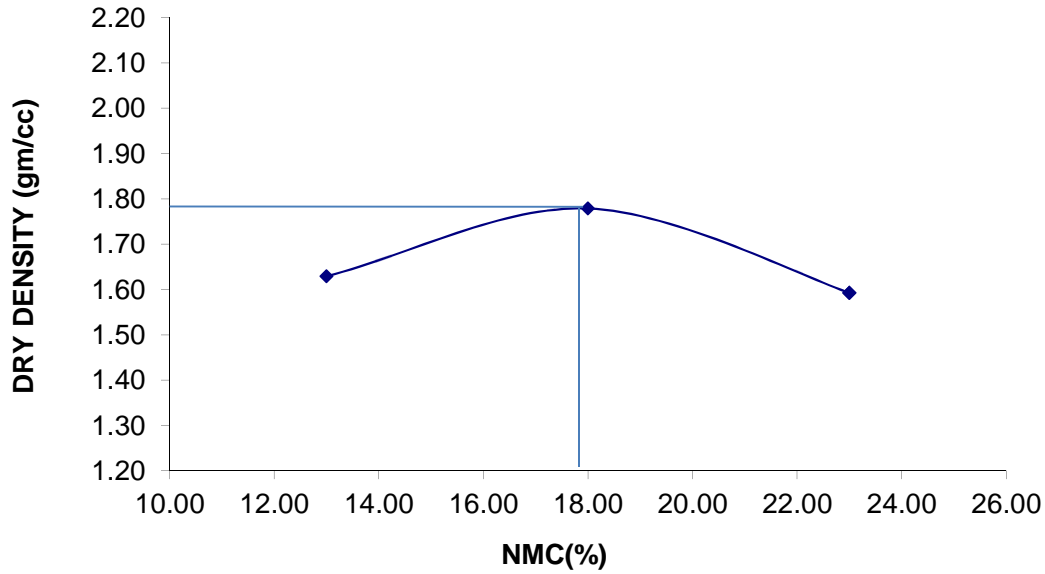


ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT : GEOTECHNICAL INVESTIGATION WORK FOR PROPOSED PETROCHEMICAL CLIENT PARK
 AT FACT AMBALAMUGAL, ERNAKULAM**

MODIFIED PROCTOR DENSITY IS 2720 (PART-8)1983

TRIAL PIT (TP-5)



SR NO-TP5				
BROWNISH SILTY CLAYEY SAND WITH GRAVEL				
GRAVEL%	SAND%	SILT%	CLAY%	IS CLASS
15	40	17	28	SC-CL
MDD			: 1.78gm/cc	
OMC			: 17.9%	

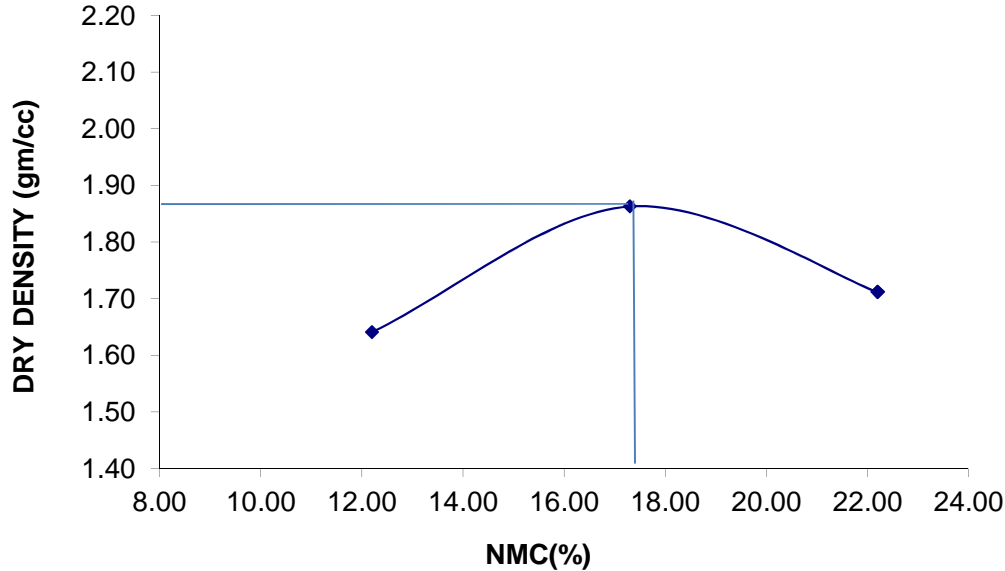


ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT : GEOTECHNICAL INVESTIGATION WORK FOR PROPOSED PETROCHEMICAL CLIENT PARK AT FACT
 AMBALAMUGAL, ERNAKULAM**

MODIFIED PROCTOR DENSITY IS 2720 (PART-8)1983

TRIAL PIT (TP-6)



SR NO-TP6				
REDDISH BROWN CLAYEY SAND WITH GRAVEL				
GRAVEL%	SAND%	SILT%	CLAY%	ISS CLASSIFICATION
22	41	12	25	SC
MDD			: 1.86gm/cc	
OMC			: 17.3%	

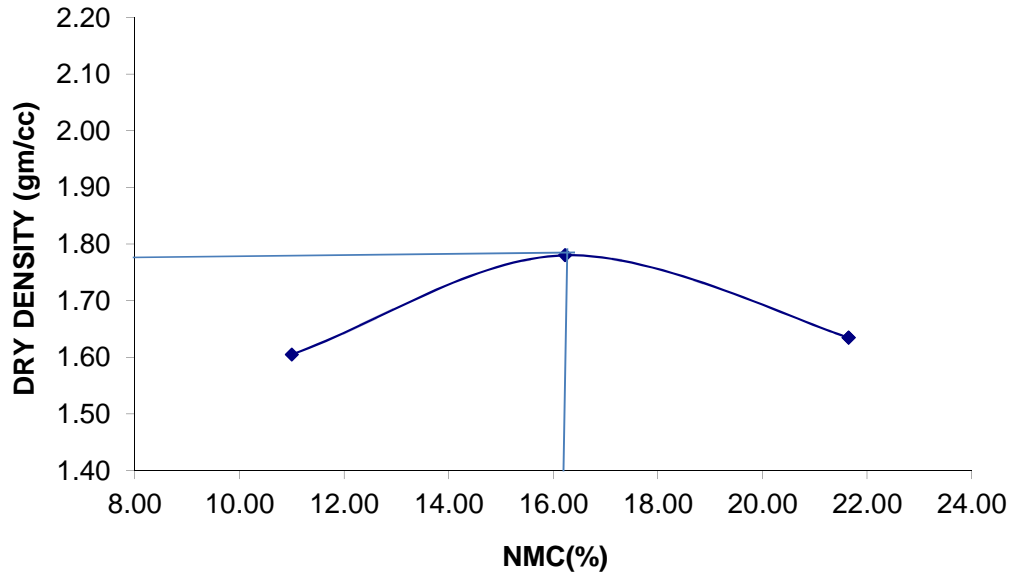


ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT : GEOTECHNICAL INVESTIGATION WORK FOR PROPOSED PETROCHEMICAL CLIENT PARK AT FACT
 AMBALAMUGAL, ERNAKULAM**

MODIFIED PROCTOR DENSITY IS 2720 (PART-8)1983

TRIAL PIT (TP-7)



SR NO-TP7				
REDDISH BROWN CLAYEY SAND WITH GRAVEL				
GRAVEL%	SAND%	SILT%	CLAY%	IS CLASS
17	44	16	23	SC
MDD			: 1.78gm/cc	
OMC			: 16.1%	

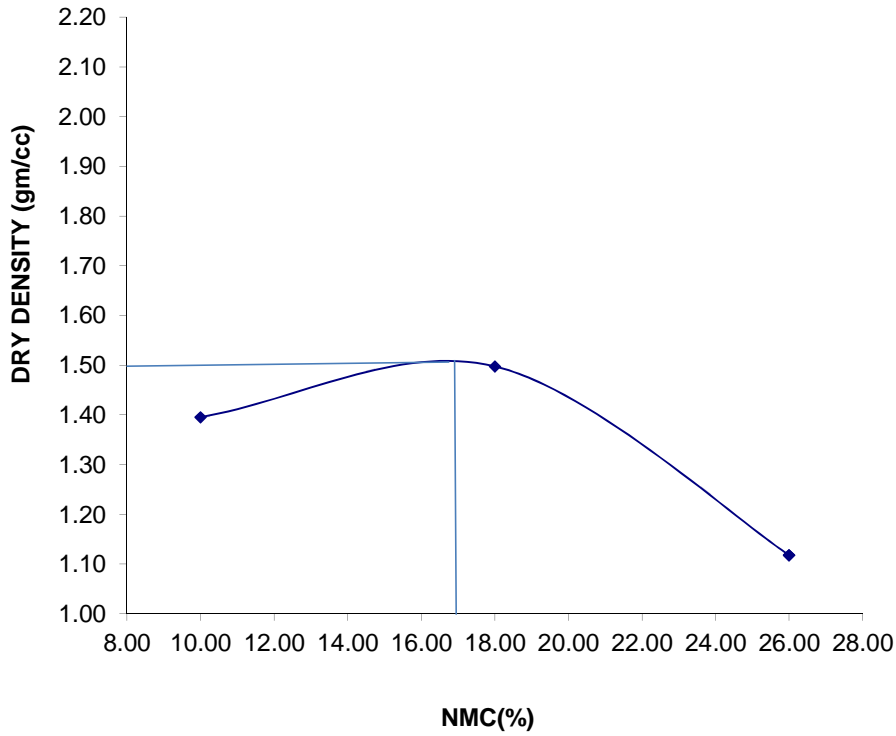


ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADDY, COCHIN-682018 PHONE: 0484 2371643

PROJECT : GEOTECHNICAL INVESTIGATION WORK FOR FACT

MODIFIED PROCTOR DENSITY IS 2720 (PART-8)1983

TRIAL PIT (TP-8,9,10)



SR NO-TP8,9,10				
WHITISH GYPSUM				
GRAVEL%	SAND%	SILT%	CLAY%	IS CLASS
MDD			: 1.50gm/cc	
OMC			: 17.0%	



ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADDY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT :GEOTECHNICAL INVESTIGATION FOR THE PROPOSED PETROCHEMICAL CLIENT PARK AT FACT
AMBALAMUGAL, ERNAKULAM**

LABORATORY CBR TEST RESULTS (REF :(IS2720-PART16)

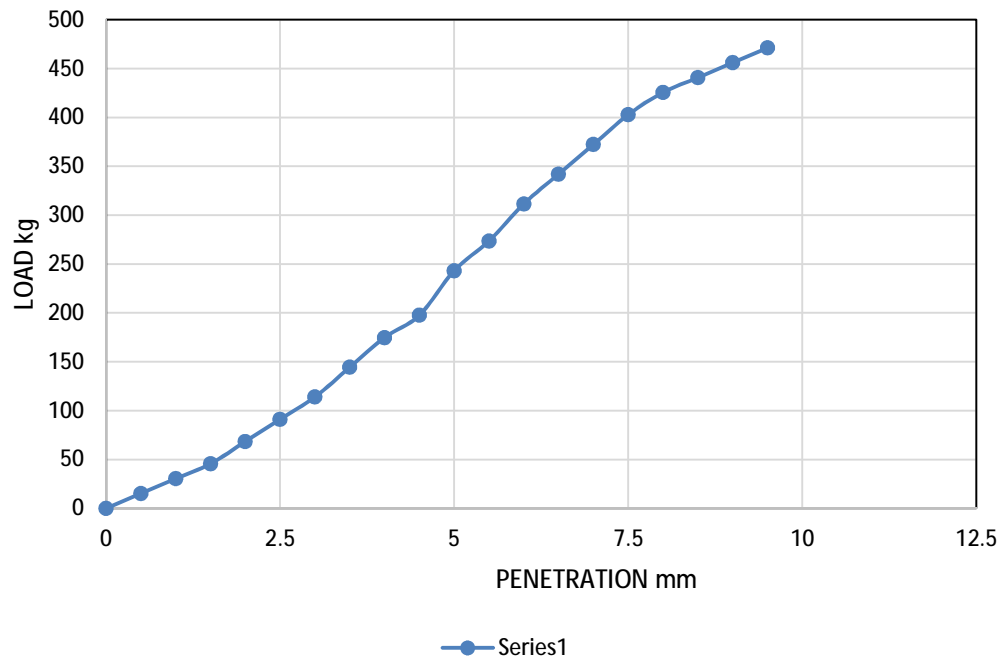
TRIAL PIT TP-1

Load at 2.5mm penetration	91.2
Load at 5mm penetration	243.2
CBR at 2.5mm penetration	6.6569343
CBR at 5mm penetration	11.83455
Reccomended CBR value	6.7%

REDDISH BROWN CLAYEY SAND WITH GRAVEL, (LATERITE)				
CLASS	GRAVEL	SAND	SILT	CLAY
GM-SM	45	31	10	14

TEST CONDITION	Soaked
DRY DENSITY (g/cc)	2.09
WATER CONTENT (%)	12.80%
WET DENSITY AFTER SOAKING (g/cc)	2.13

LOAD V/S PENETRATION





ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT :GEOTECHNICAL INVESTIGATION FOR THE PROPOSED PETROCHEMICAL CLIENT PARK AT FACT
AMBALAMUGAL, ERNAKULAM**

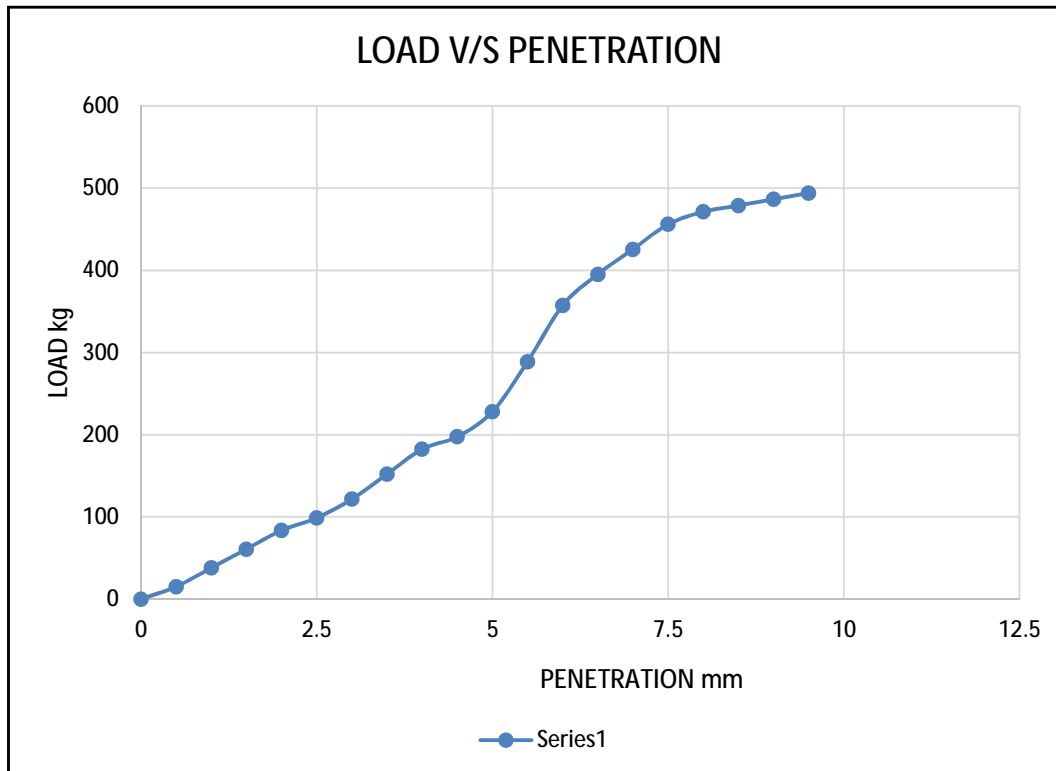
LABORATORY CBR TEST RESULTS (REF :(IS2720-PART16)

TRIAL PIT TP-2

Load at 2.5mm penetration	98.8
Load at 5mm penetration	228
CBR at 2.5mm penetration	7.2116788
CBR at 5mm penetration	11.094891
Recommened CBR value	7.2%

REDDISH BROWN SILTY SAND WITH GRAVEL (LATERITE)				
CLASS	GRAVEL	SAND	SILT	CLAY
GM-SM	33	47	10	10

TEST CONDITION	Soaked
DRY DENSITY (g/cc)	2.12
WATER CONTENT (%)	10.90%
WET DENSITY AFTER SOAKING (g/cc)	2.16





ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADDY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT :GEOTECHNICAL INVESTIGATION FOR THE PROPOSED PETROCHEMICAL CLIENT PARK AT FACT
AMBALAMUGAL, ERNAKULAM**

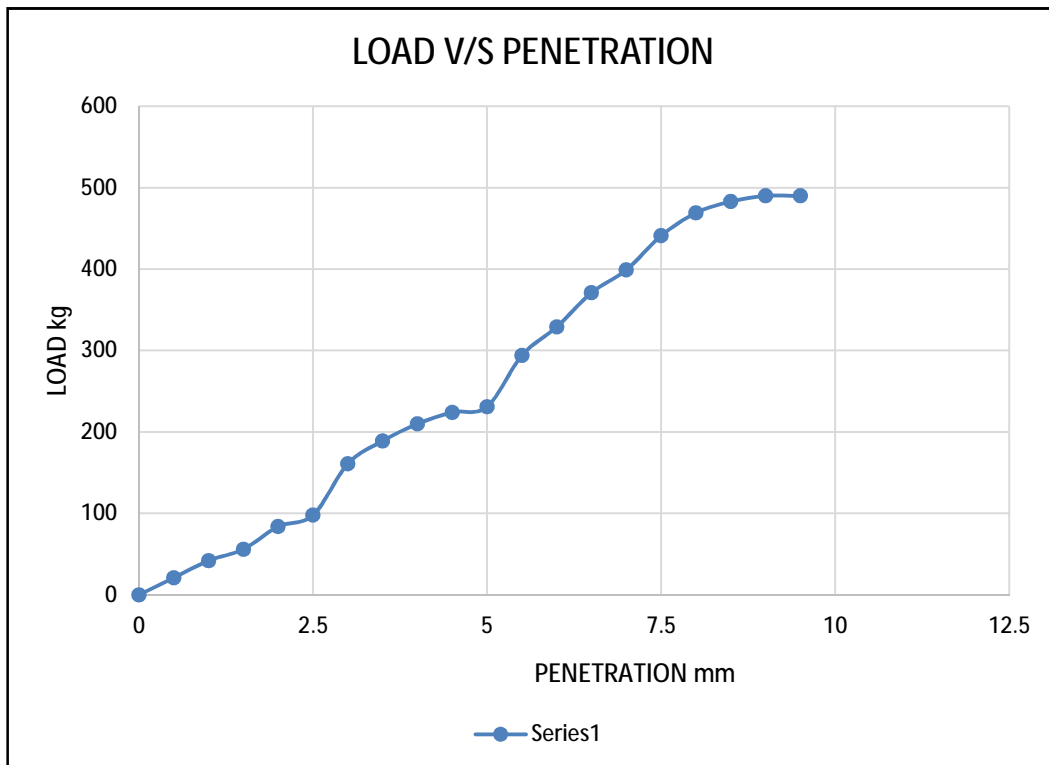
LABORATORY CBR TEST RESULTS (REF :(IS2720-PART16)

TRIAL PIT TP-3

Load at 2.5mm penetration	98
Load at 5mm penetration	231
CBR at 2.5mm penetration	7.1532847
CBR at 5mm penetration	11.240876
Recommened CBR value	7.0%

REDDISH BROWN SILTY SAND WITH GRAVEL (LATERITE)				
CLASS	GRAVEL	SAND	SILT	CLAY
GM-SM	34	41	14	11

TEST CONDITION	Soaked
DRY DENSITY (g/cc)	2.03
WATER CONTENT (%)	11.90%
WET DENSITY AFTER SOAKING (g/cc)	2.05





ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT :GEOTECHNICAL INVESTIGATION FOR THE PROPOSED PETROCHEMICAL CLIENT PARK AT FACT
AMBALAMUGAL, ERNAKULAM**

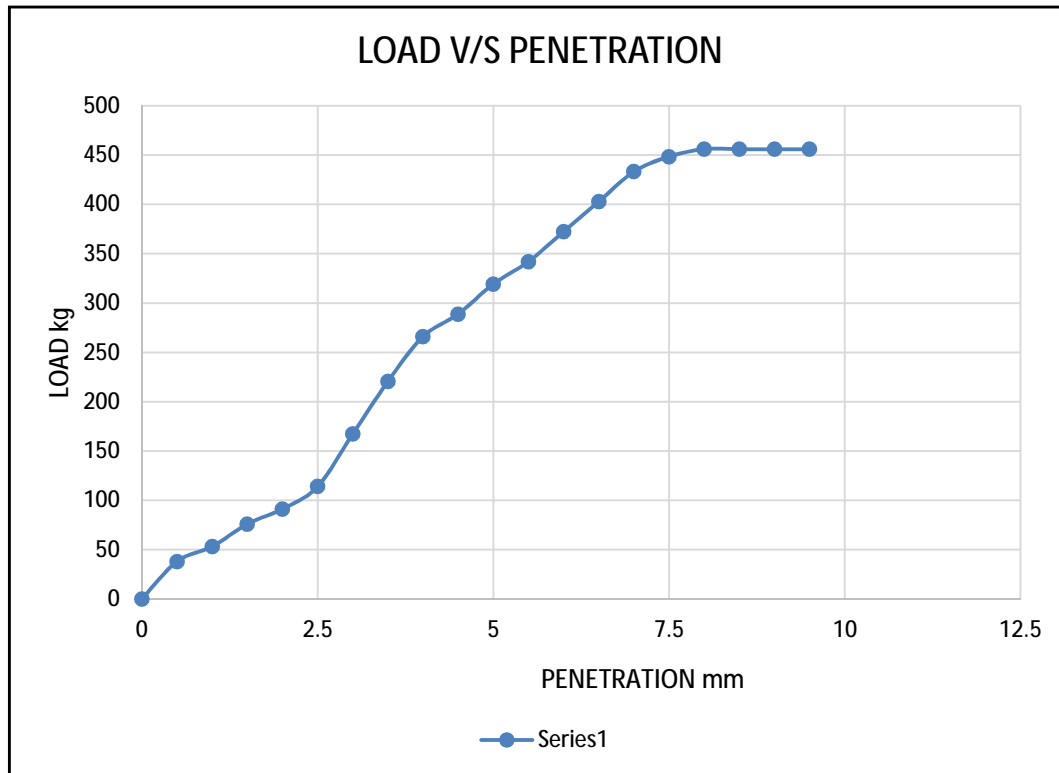
LABORATORY CBR TEST RESULTS (REF :(IS2720-PART16)

TRIAL PIT TP-4

Load at 2.5mm penetration	114
Load at 5mm penetration	319.2
CBR at 2.5mm penetration	8.3211679
CBR at 5mm penetration	15.532847
Recommened CBR value	8.3%

REDDISH BROWN CLAYEY SAND WITH GRAVEL (LATERITE)				
CLASS	GRAVEL	SAND	SILT	CLAY
GM-SM	26	44	13	17

TEST CONDITION	Soaked
DRY DENSITY (g/cc)	2
WATER CONTENT (%)	13.50%
WET DENSITY AFTER SOAKING (g/cc)	2.06





ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT :GEOTECHNICAL INVESTIGATION FOR THE PROPOSED PETROCHEMICAL CLIENT PARK AT FACT
AMBALAMUGAL, ERNAKULAM**

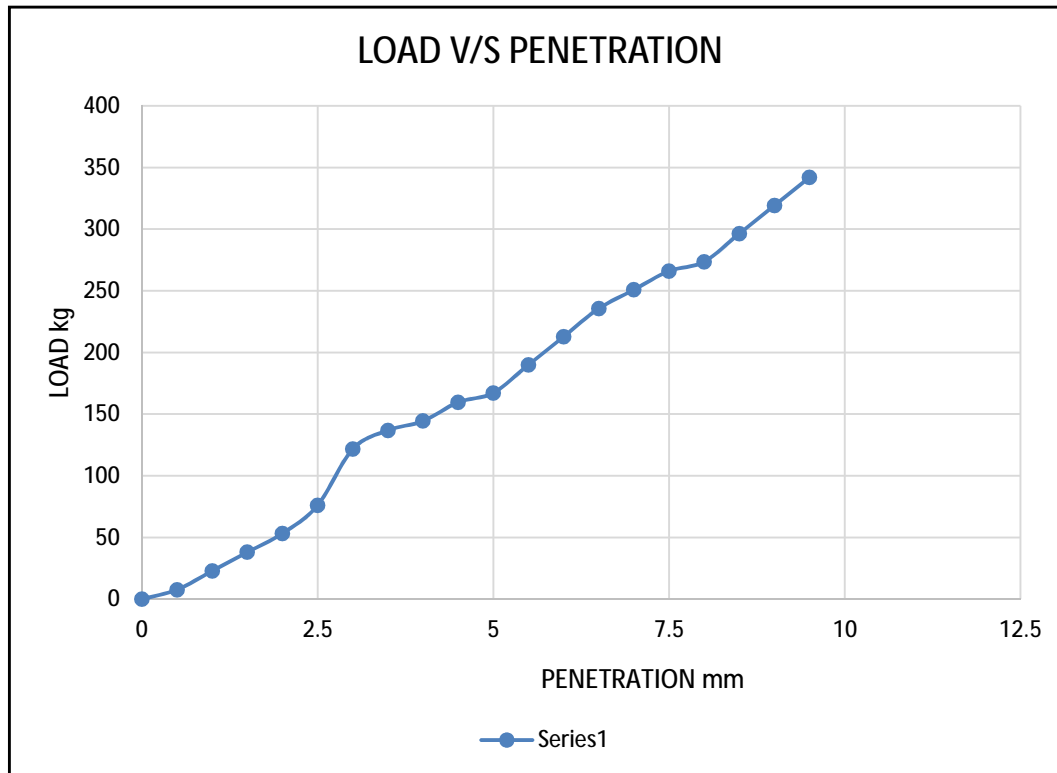
LABORATORY CBR TEST RESULTS (REF :(IS2720-PART16)

TRIAL PIT TP-5

Load at 2.5mm penetration	76
Load at 5mm penetration	167.2
CBR at 2.5mm penetration	5.5474453
CBR at 5mm penetration	8.136253
Recommened CBR value	5.5%

BROWNISH SILTY CLAYEY SAND WITH GRAVEL				
CLASS	GRAVEL	SAND	SILT	CLAY
SC-CL	15	40	17	28

TEST CONDITION	Soaked
DRY DENSITY (g/cc)	1.78
WATER CONTENT (%)	17.90%
WET DENSITY AFTER SOAKING (g/cc)	1.81





ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT :GEOTECHNICAL INVESTIGATION FOR THE PROPOSED PETROCHEMICAL CLIENT PARK AT FACT
AMBALAMUGAL, ERNAKULAM**

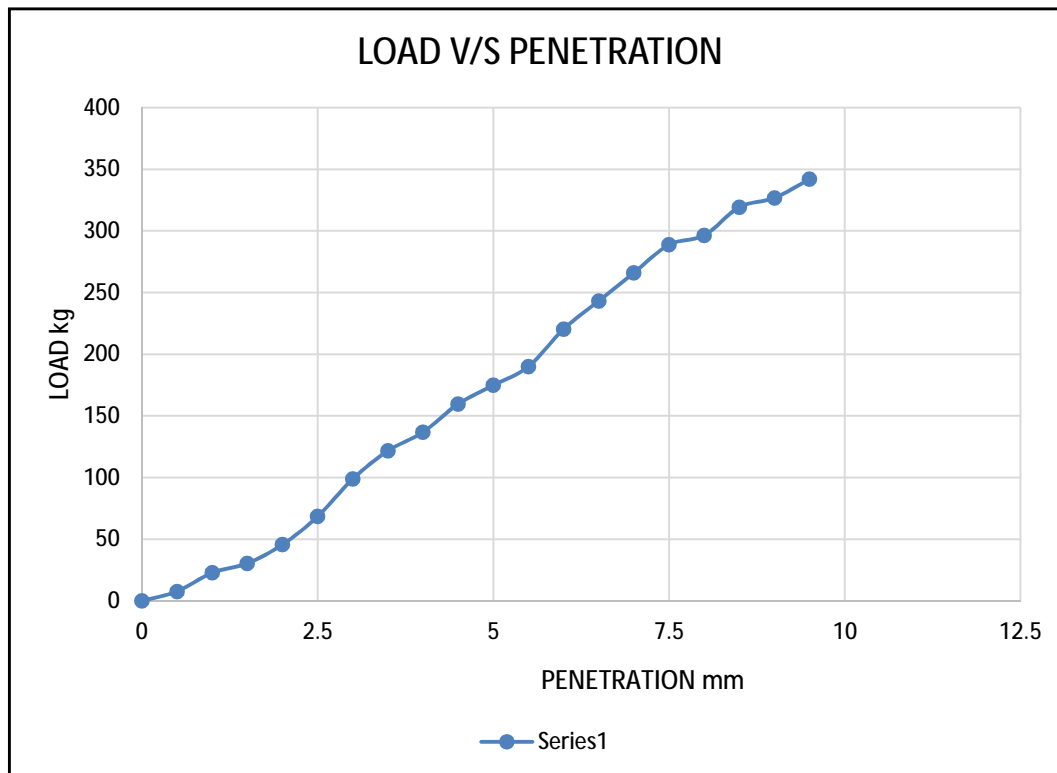
LABORATORY CBR TEST RESULTS (REF :(IS2720-PART16)

TRIAL PIT TP-6

Load at 2.5mm penetration	68.4
Load at 5mm penetration	174.8
CBR at 2.5mm penetration	4.9927007
CBR at 5mm penetration	8.5060827
Recommened CBR value	5.0%

REDDISH BROWN CLAYEY SAND WITH GRAVEL				
CLASS	GRAVEL	SAND	SILT	CLAY
SC	22	41	12	25

TEST CONDITION	Soaked
DRY DENSITY (g/cc)	1.86
WATER CONTENT (%)	17.30%
WET DENSITY AFTER SOAKING (g/cc)	1.91





ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

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AMBALAMUGAL, ERNAKULAM**

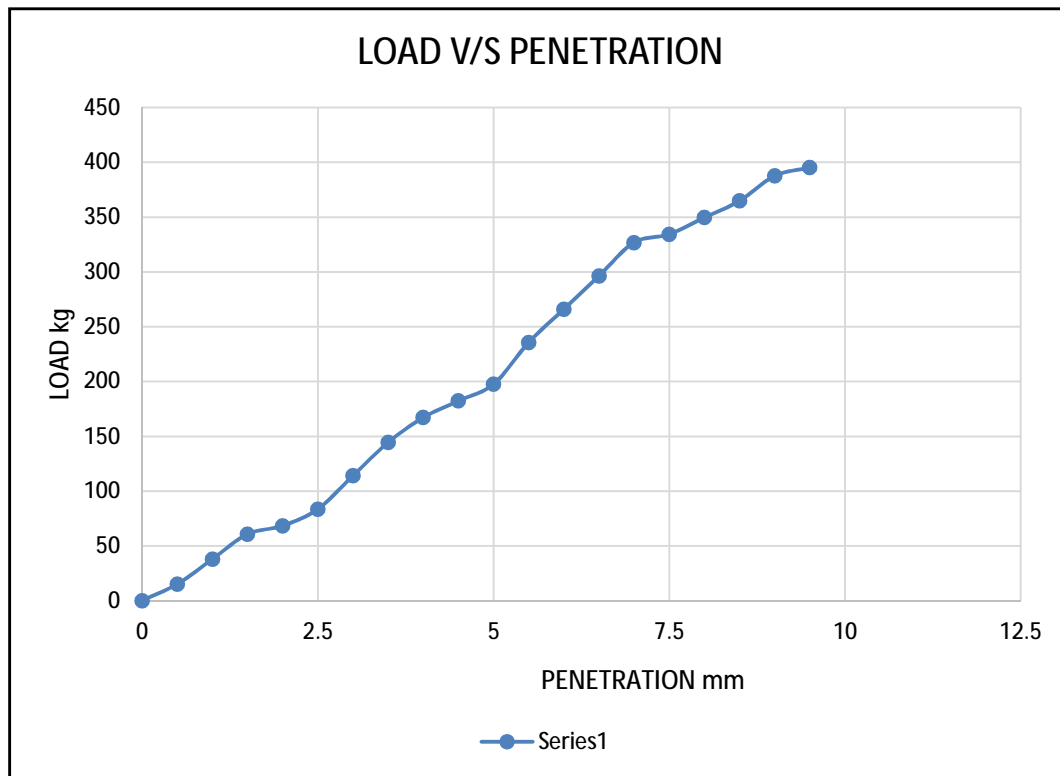
LABORATORY CBR TEST RESULTS (REF :(IS2720-PART16)

TRIAL PIT TP-7

Load at 2.5mm penetration	83.6
Load at 5mm penetration	197.6
CBR at 2.5mm penetration	6.1021898
CBR at 5mm penetration	9.6155718
Reccomended CBR value	6.1%

REDDISH BROWN CLAYEY SAND WITH GRAVEL				
CLASS	GRAVEL	SAND	SILT	CLAY
SC	17	44	16	23

TEST CONDITION	Soaked
WET DENSITY (g/cc)	1.78
WATER CONTENT (%)	16.10%
WET DENSITY AFTER SOAKING (g/cc)	1.8





ENGINEERS DIAGNOSTIC CENTRE (P) LTD
41/1210, VADAKUMTHALA BUILDING,
PULLEPADY, COCHIN-682018 PHONE: 0484 2371643

**PROJECT :GEOTECHNICAL INVESTIGATION FOR THE PROPOSED PETROCHEMICAL CLIENT PARK AT FACT
AMBALAMUGAL, ERNAKULAM**

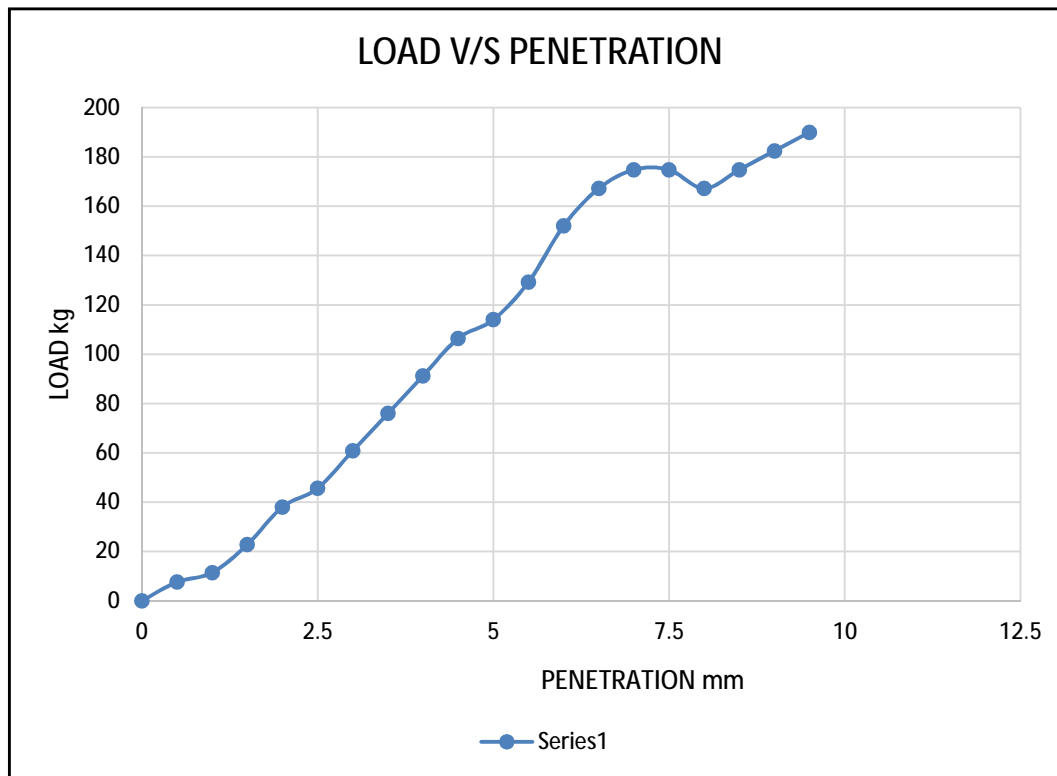
LABORATORY CBR TEST RESULTS (REF :(IS2720-PART16)

TRIAL PIT TP-8,9,10

Load at 2.5mm penetration	45.6
Load at 5mm penetration	114
CBR at 2.5mm penetration	3.3284672
CBR at 5mm penetration	5.5474453
Recommened CBR value	3.3%

WHITISH GYPSUM				
CLASS	GRAVEL	SAND	SILT	CLAY

TEST CONDITION	Soaked
DRY DENSITY (g/cc)	1.5
WATER CONTENT (%)	17.0%
WET DENSITY AFTER SOAKING (g/cc)	1.56



Rock Test Result



EDC

ENGINEERS DIAGNOSTIC CENTRE (P) LTD

GEO TECHNICAL CONSULTANTS / SOIL INVESTIGATION / CIVIL ENGINEERING MATERIAL TESTING

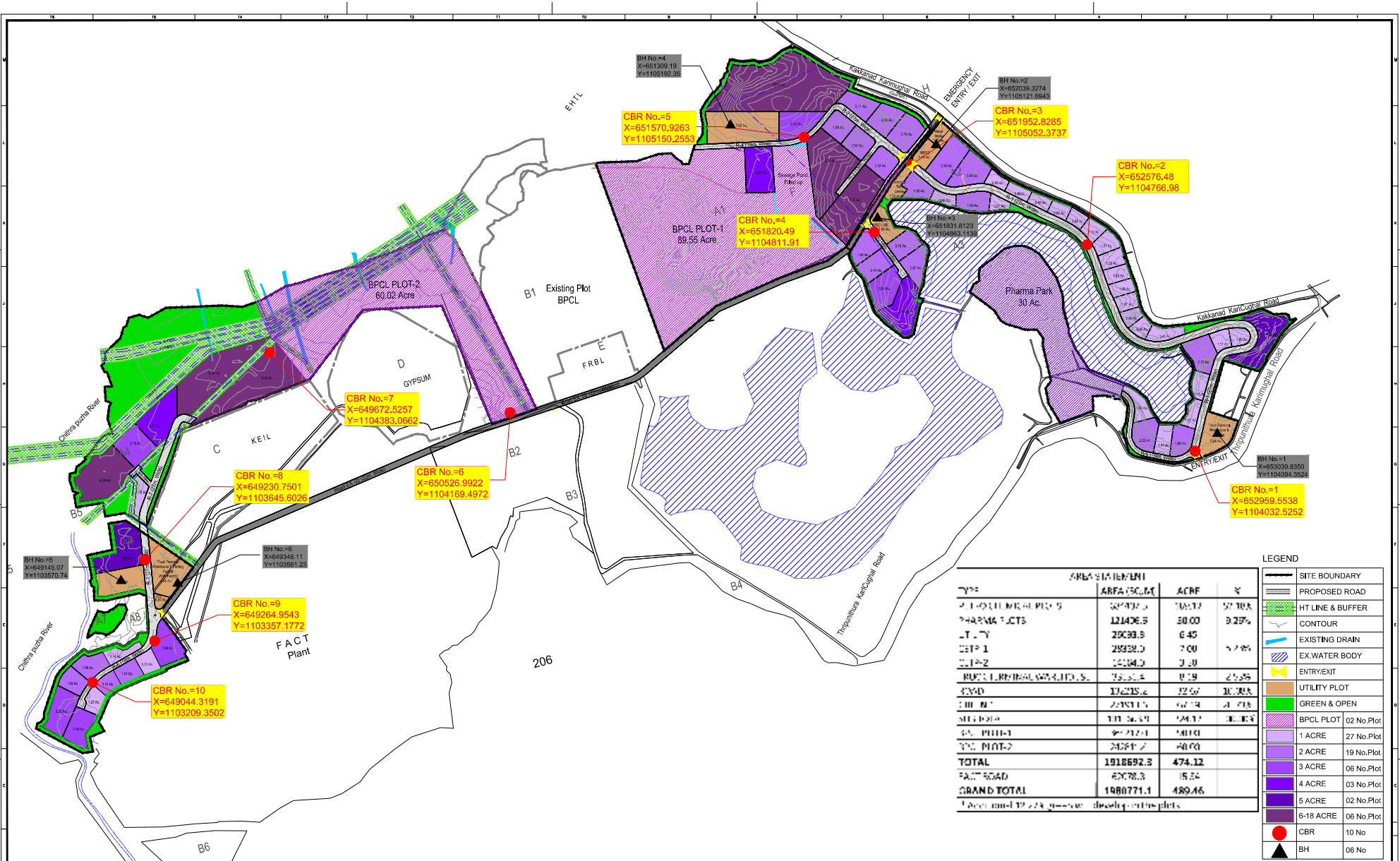
ROCK TEST REPORT

PROJECT : THE PROPOSED CONSTRUCTION OF SINGLE STORIED BUILDING AT FACT
CLIENT : VOYANTS SOLUTIONS PRIVATE LIMITED
SOURCE OF SAMPLE : COLLECTED FROM SITE
SAMPLE TESTED ON : 09.06.2018
METHOD : IS - 9143

UNIAXIAL COMPRESSIVE STRENGTH TEST ON ROCK SAMPLES

SL NO	MARK ON SPECIMEN	DEPTH(m)	AREA (m ²)	LOAD (T)	COMPRESSIVE STRENGTH (T/m ²)	CORRECTED COMPRESSIVE STRENGTH (T/m ²)
1	BH 1	10.50m-12.00m	0.00221	11	4989	4989
2		12.00m-13.50m	0.00221	9.8	4444	4444
3	BH 2	20.50m-21.50m	0.00221	9.7	4399	4388
4	BH 3	7.80m-8.80m	0.00221	9.8	4444	4439
5	BH 4	10.30m-11.30m	0.00221	11.5	5215	5240
6	BH 5	10.50m-12.00m	0.00221	4.8	2177	2190

Site Plan



TYPE	AREA (SQ.M)	ACRF	%
BPCL PLOTS	121406.5	30.00	3.25%
UTILITY PLOTS	29039.3	6.45	0.7%
BPCL PLOT-1	28938.0	7.00	0.7%
BPCL PLOT-2	10104.0	2.50	0.3%
ROADS	7500.0	1.89	0.2%
DRAIN	10000.0	2.50	0.3%
OPEN AREA	22000.0	5.50	0.6%
SHEDS	10000.0	2.50	0.3%
FACT PLANT	20000.0	5.00	0.5%
BPCL PLOT-2	20000.0	5.00	0.5%
TOTAL	1918692.3	474.12	
FACT ROAD	60000.0	15.00	1.6%
GRAND TOTAL	1980771.1	489.16	

LEGEND	
	SITE BOUNDARY
	PROPOSED ROAD
	HT LINE & BUFFER
	CONTOUR
	EXISTING DRAIN
	EX-WATER BODY
	ENTRY/EXIT
	UTILITY PLOT
	GREEN & OPEN
	BPCL PLOT
	1 ACRE 02 No.Plot
	2 ACRE 19 No.Plot
	3 ACRE 06 No.Plot
	4 ACRE 03 No.Plot
	5 ACRE 02 No.Plot
	6-18 ACRE 06 No.Plot
	CBR 10 No
	BH 08 No

REV	DATE	BY	DESCRIPTION	DES.	APP.	DRAWN BY	DESIGNED BY	CHECKED/APPROVED BY
0	16-May-2018	IRF	LOCATION OF BOREHOLES AND CBR POINTS	LPN	A.S			

QUALITY ASSURANCE		
The responsibility of control, check and verification of accuracy, correctness, completeness, integration and full compliance of contract provisions in respect of design analysis and drawings rests with the approving agency		
Sig.	Sig.	Sig.
Date	Date	Date
Name	Name	Name
IRF	LPN	A.S

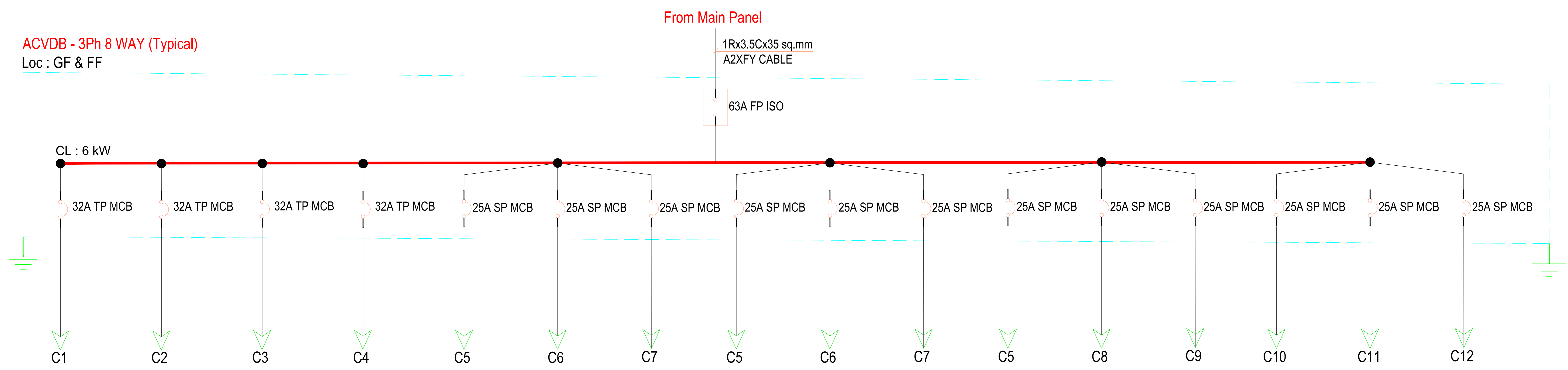
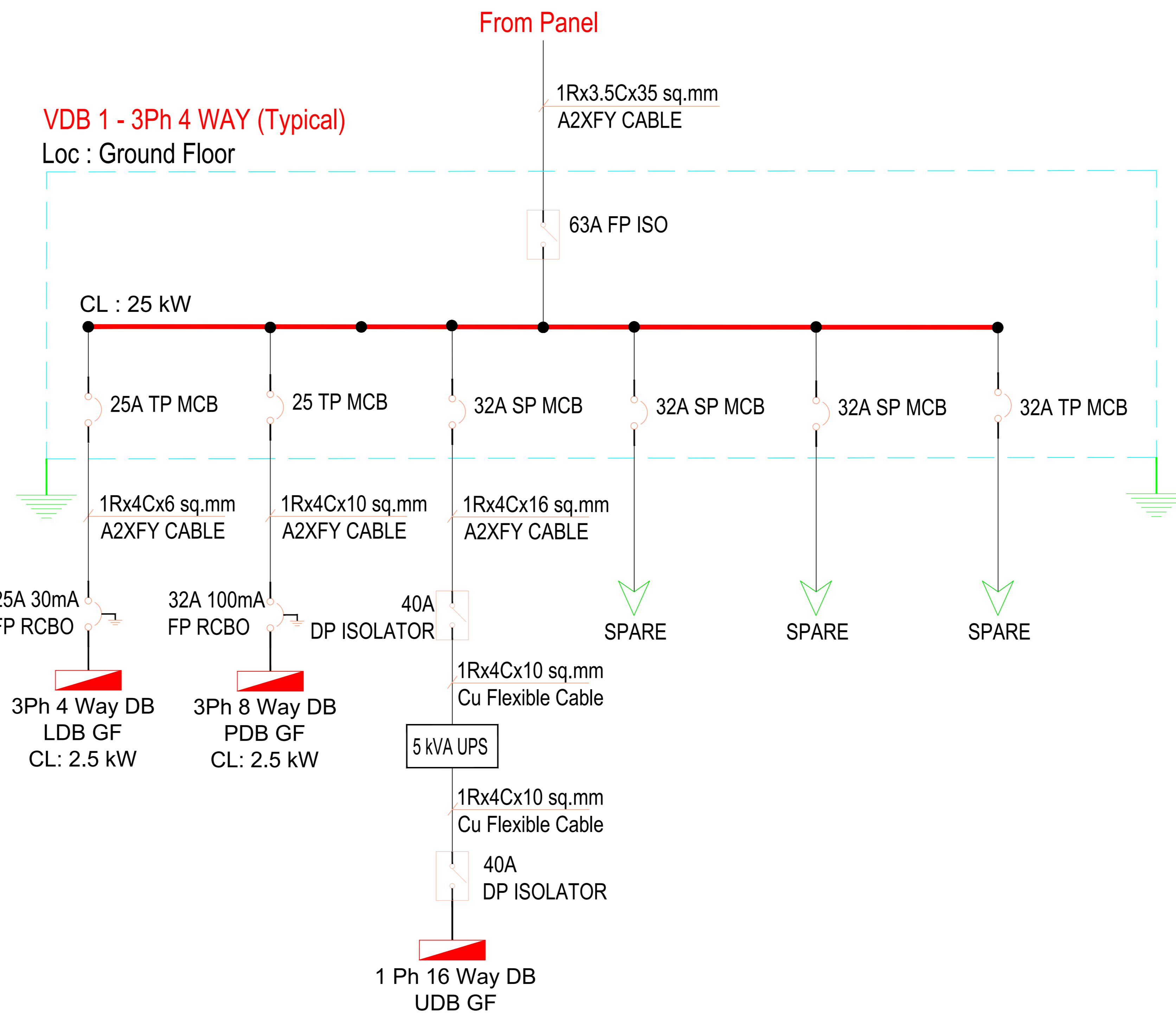
PRELIMINARY ENGINEERING	
CLIENT	KERALA INDUSTRIAL INFRASTRUCTURE DEVELOPMENT CORPORATION (KINFRA)
CONSULTANT	Voyants Solutions PVT. LTD. 403, 4th Floor, Park Centra, Sec-30 NH-8, Gurgaon - 122001, India.

PROJECT TITLE :		
PREPARATION OF FORM 1 & TOR FOR DEVELOPMENT OF PETROCHEMICAL PARK AT AMBALAMUGHAL, ERNAKULAM DISTRICT, KOCHI, KERALA		
DRAWING TITLE : ANNEXURE 3 - LOCATION OF BOREHOLES AND CBR POINTS		
DWG. NUMBER : VSP/KINFRA/1718_064/IPD/MP/01		
GRAPHIC SCALE : 1:1000		

Issue Record	Approved for Issue
As Built	
GFC	
PER	✓
Tender Dwg.	
Preliminary Design	

Annexure 4

Revised Drawings of Electrification in Admin Building



TENDER PURPOSE

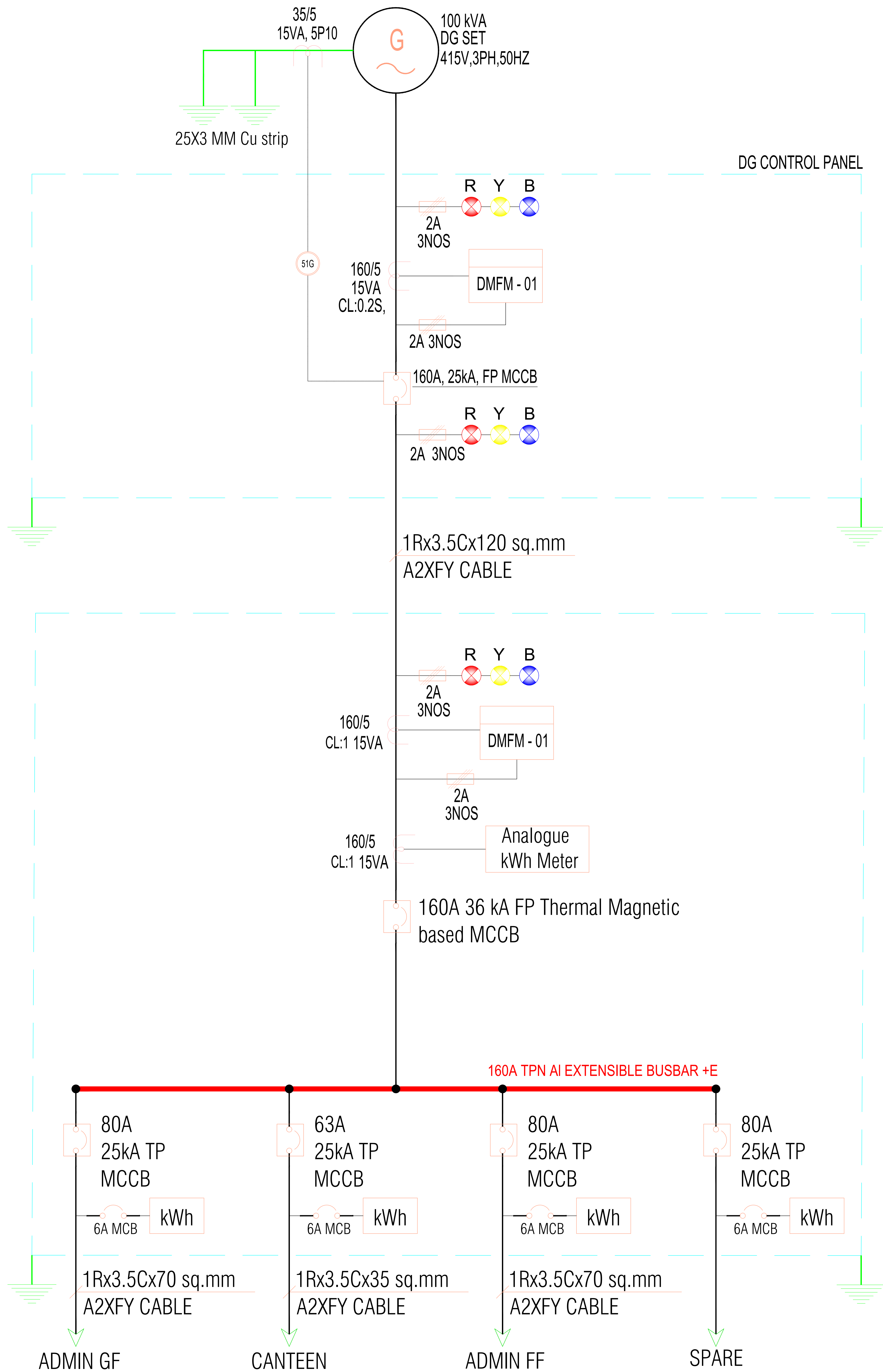
CLIENT	PROJECT
KERALA INDUSTRIAL INFRASTRUCTURE DEVELOPMENT CORPORATION	PROPOSED ADMIN BUILDING AT PETROCHEMICAL PARK AMBALAMUGAL, KOCHI, KERALA

PROJECT DETAILS		ISSUED TO		REVISIONS	
No	Description	Date	No	Description	Date
1	Client	16/06/2021	1	Initial layout	16/06/2021
2	Client	30/06/2021	2	Change in design	30/06/2021

TITLE	TYPE
SCHEMATIC DIAGRAM ADMIN BLOCK	ELECTRICAL SERVICE
	DRAWING NUMBER
	ADM SCH 002

ARCHITECT
SIGNATURE :
CONSULTANT
SIGNATURE :
CLIENT
SIGNATURE :

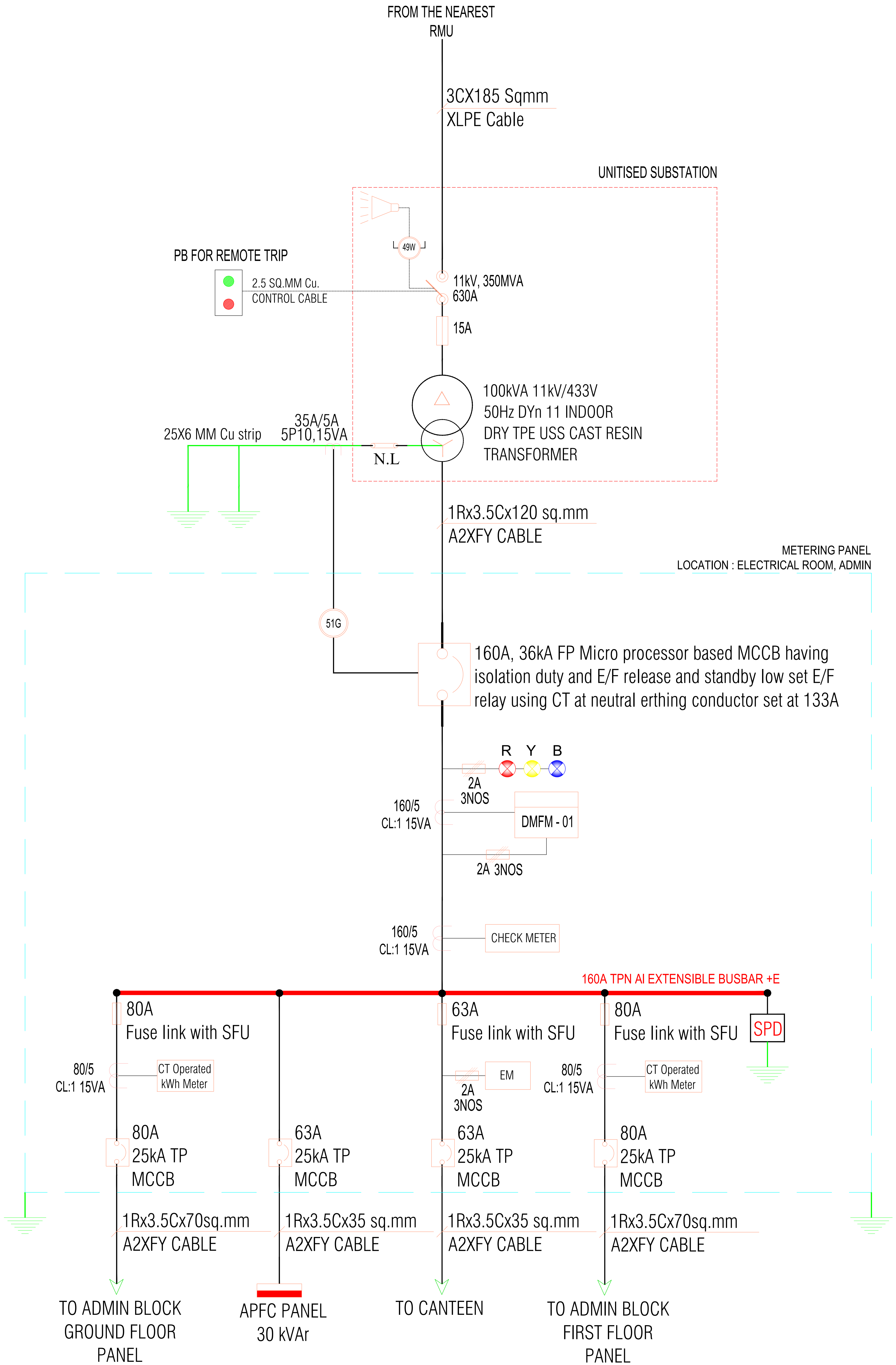




TENDER PURPOSE

CLIENT	PROJECT	PROJECT DETAILS	ISSUED TO	REVISIONS	TYPE				
KERALA INDUSTRIAL INFRASTRUCTURE DEVELOPMENT CORPORATION	PROPOSED ADMIN AND CANTEEN BUILDING AT PETROCHEMICAL PARK AMBALAMUGAL, KOCHI, KERALA	PROJECT NO : KINFRA/1500/01	No	Description	Date	No	Description	Date	ELECTRICAL SERVICE
		DATE : 16/06/2021	1	Client	16/06/2021	1	Tender Purpose	16/06/2021	
		DIMS : CM	2	Client	29/06/2021	2	Tender Purpose	29/06/2021	DRAWING NUMBER
		SCALE : NTS	3	Design Change	14/07/2021	2	Tender Purpose	14/07/2021	
		DRAWN BY : RPA							
CHECKED BY : SDP									





TENDER PURPOSE

CLIENT	PROJECT	PROJECT DETAILS	ISSUED TO	REVISIONS	TYPE				
KERALA INDUSTRIAL INFRASTRUCTURE DEVELOPMENT CORPORATION	PROPOSED ADMIN AND CANTEEN BUILDING AT PETROCHEMICAL PARK AMBALAMUGAL, KOCHI, KERALA	PROJECT NO : KINFRA/1500/01	No	Description	Date	No	Description	Date	ELECTRICAL SERVICE
		DATE : 16/06/2021	1	Client	16/06/2021	1	Tender Purpose	16/06/2021	
		DIMS : CM	2	Client	29/06/2021	2	Tender Purpose	29/06/2021	DRAWING NUMBER
		SCALE : NTS	3	Design Change	14/07/2021	2	Tender Purpose	14/07/2021	
		DRAWN BY : RPA							
CHECKED BY : SDP									

