



सत्यमेव जयते

भारत सरकार Government of India

पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय Ministry of Environment, Forest & Climate Change

सिविल निर्माण एकक Civil Construction Unit

No. 54(174)/CED-I/CCU/2025/ 181 (दि०)

Dated: 20/02/25

सेवा में,

The Inspector General of Forest (WL)
Ministry of Environment, Forest & Climate Change,
Indira Paryavaran Bhawan, Jor Bagh Road,
New Delhi – 110003.

विषय: Development of Civil Infrastructure for National Referral Centre – Wildlife at Junagarh, Gujarat (Phase – I) on EPC Mode – Reg.

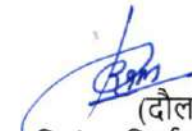
महोदय,

The Notice Inviting Tender for the work of "Development of Civil Infrastructure for National Referral Centre – Wildlife at Junagarh, Gujarat (Phase – I)" on EPC Mode has been published on the e-tendering website of CPWD on 19.02.2025 for call of tenders. In this regard, it is intimated that:

1. The copy of Notice Inviting Tender is enclosed for publishing on the web portal of the Ministry and the Central Zoo Authority. The soft copy of the NIT document is being sent by email.
2. The Pre-Bid meeting is scheduled to be held on 27.02.2025 at 11.00 AM under the Chairmanship of the Chief Engineer, CCU, MoEF&CC. The comments / suggestions, if any, in the NIT documents may kindly be conveyed to this office by 25.02.2025, for incorporating the same in the NIT documents before the Pre-Bid meeting.
3. It is also requested to nominate Director level officers of the concerned division and the user department i.e. CZA for the Tender Evaluation Committee. The MoEF&CC's OM No. ADMIN-65013/63/2023/P-II dated 24.06.2024 regarding "Formation of Tender Evaluation Committee" is enclosed herewith for ready reference.

भवदीय

- संलग्न: (i) Copy of NIT. (Soft Copy of NIT emailed on 20.02.2025)
(ii) OM No. ADMIN-65013/63/2023/P-II dated 24.06.2024.


(दौलत राम)
कार्यपालक अभियंता (सि ई डी – 1)
सिविल निर्माण एकक

प्रतिलिपि:

1. The Additional Director General of Forest (WL), MoEF&CC, Indira Paryavaran Bhawan, Jor Bagh Road, New Delhi for kind information please.
2. The Member Secretary, CZA, MoEF&CC, Pt. Deen Dayal Antyodaya Bhawan, CGO Complex, Lodhi Road, New Delhi for kind information please. Encl: Copy of NIT (Soft copy of NIT emailed on 20.02.2025)

कार्यपालक अभियंता (सि ई डी-1)
सिविल निर्माण एकक

IMMEDIATE

No. ADMIN-65013 63/2023-P-II
Government of India
Ministry of Environment, Forest & Climate Change
[Personnel-II]

मुख्य अभि. सि.मि.ए.
आयरी नं. 644
दिनांक 25/6/24

Indira Paryavaran Bhawan,
New Delhi-110003

Dated: 24th June, 2024

OFFICE MEMORANDUM

Subject: Formation of Tender Evaluation Committee for various works entrusted to CCU – regarding.

The proposal of formation of Tender Evaluation Committee (TEC) for various works entrusted to the Civil Construction Unit (CCU), having estimated cost of more than ₹30.00 crores, was initiated pursuant to the suggestion of the IFD, MoEFCC to put in place an institutional framework for evaluation of tenders and for issuing of work orders.

2. General Financial Rules (GFRs) 2017 norms for WORKS are contained in **Chapter '5' from Rule No. 130-141**. Rule 139 contains the procedure for execution of works. Rule 139(i) states that, "The detailed procedure relating to expenditure on such works shall be prescribed by departmental regulations framed in consultation with the Accounts Officer, generally based on the procedures and the principles underlying the financial and accounting rules prescribed for similar works carried out by the Central Public Works Department (CPWD)".

3. Para (i) of the Ministry of Environment and Forest's Office Order dated 23.05.1988 issued under File No. 36013/1/88-PGP-I(PSP) prescribes that the provisions of CPWD Code/CPWD Manual will apply to such works, unless modified by specific orders of the Government.

4. Though the GFRs provisions for WORKS contained in Chapter '5' from Rule No. 130-141 do not mention the evaluation of the tenders but the Manual for Procurement of Works (updated June, 2022) issued by the Department of Expenditure in **para 5.2 [Schedule of Procurement Powers (SoPP)]**, provides as follows:

"In procurements above such a threshold, evaluation is carried out by Tender Committee consisting of three or more members with requisite experience and competence. Members include a Financial Adviser or his representative and a representative of the user as per SoPP. Procuring Entity should lay down a SoPP specifying such thresholds."

"Competent authority, in direct acceptance case; and member secretary of the Tender Committee will receive the bids opened along with other documents from the tender opening officials and are responsible for safe-custody of the documents and for processing involved at all steps in finalising the Procurement."

श्री. अ. अ. अ. (अ. अ. अ.)
श्री. अ. अ. अ. (अ. अ. अ.)
दिनांक 25/06/2024

① We may send care for change of channel SE/PS also

② keep with handy over paper

③ circulate to all EEs for necessary action please

Page 1 of 4

24-06-2024

5. Further, in CPWD, the tenders are processed in multiple stages by designated officers instead of by Tender Evaluation Committee. Tenders upto ₹50.00 crores are called in Single Bid System and beyond this, the tenders are invited in Two Bid System, wherein technical bid is approved by Chief Engineer after processing at different levels (AE and EE of division, AE/EE(P) of Zone Circle) and financial bid of more than ₹50.00 crore is approved by Regional Works Board and Central Works Board headed by Special Director General and Director General, CPWD respectively as under:

Financial Power	Designation	Amount (In ₹)
Acceptance of lowest tender after call of tenders with or without negotiation for both original and maintenance work	AE / AFE	6 lakh
	EE	100 lakh
	SE	10 crore
	CE	30 crore
	ADG* / CPM	50 crore
	R W Board*	200 crore
	C W Board*	Full Powers
*The ADG/Regional Works Board/Central Works Board shall issue approval for acceptance of tender by CE/CPM/PM.		

6. The CPWD Works Manual and GFRs 2017 do not prescribe for formation of Tender Evaluation Committee. However, as per the Manual for Procurement of Works (updated June 2022) issued by the Department of Expenditure, a comprehensive proposal for Tender Evaluation Committee for works costing more than ₹100 lakhs (i.e. more than the financial powers delegated to EE of CPWD) entrusted to the CCU is constituted with the following composition (The below limits will be automatically modified corresponding to delegation of financial powers of officers of CPWD from time to time):

Table 1

Sl. No.	Composition of Tender Evaluation Committee	Designation of the Committee member	Authority for approval of bid
1.	Works having estimated/ tendered cost more than ₹1 crore but less than ₹10 crores	Executive Engineer	Chairman Superintending Engineer
		Under Secretary / S.O. of (IFD)	Member
		Under Secretary / S.O. of User Department	Member
		Assistant Accounts Officer of concerned EE	Member Secretary
2.	Works having estimated / tendered cost more than ₹10 crores but less than ₹30 crores	Superintending Engineer	Chairman Chief Engineer
		Under Secretary (IFD)	Member

Signature

	Under Secretary of concerned Division of Ministry	Member	
	Under Secretary of User Department	Member	
	Executive Engineer(P)	Member Secretary	
3.	Works having estimated / tendered cost more than Rs. ₹30 crores but less than Rs. ₹50 crores		
	Superintending Engineer	Chairman	Concurrence of FA and approval of Secretary, MoEF&CC
	Director (IFD)	Member	
	Director of concerned Division of Ministry	Member	
	Director of User Department	Member	
	Executive Engineer(P)	Member Secretary	

Table 2

1.	Composition of Tender Evaluation Committee	Designation of the Committee member	Approval of technical bid	Approval of financial bid
	Works having estimated / tendered cost more than ₹50 crores, tender will be called in two bid system (Tech. & Financial Bid)			
	Superintending Engineer	Chairman	Chief Engineer	Concurrence of FA and approval of Secretary, MoEF&CC
	Director (IFD)	Member		
	Director of concerned Division of Ministry	Member		
	Director of User Department	Member		
	Executive Engineer(P)	Member Secretary		

7. For works having tendered cost more than financial power of Chief Engineer (presently ₹30 crore), the following channel of submission shall be adopted:

- Chief Engineer, CCU will send file to the Programme Division.
- The Programme Division will send the file for concurrence of FA.
- After concurrence of FA, the file will be submitted to the Secretary, MoEF&CC by the Programme Division through Additional Secretary, Administration.



Note: The publicity of tender will be done on MoEF&CC's website. Tender will also be published on the website of the concerned Organization if that Organization has its own website.

8. This issues with the concurrence of AS & FA vide Note 34 dated 18.06.2024, and approval of the Secretary, MoEF&CC vide Note 36 dated 19.06.2024 of Computer File No. 237082.



(Satyajit Mishra)

Joint Secretary to the Government of India

Tel. No. 011-20819232

e-mail ID: satyajit.mishra@nic.in

Copy to:

1. The PSO to Secretary, MoEF&CC, New Delhi.
2. The PPS to DGF&SS, MoEF&CC, New Delhi.
3. The Sr. PPS to AS & FA, MoEF&CC, New Delhi.
4. The Sr. PPS to AS (Admn.), MoEF&CC, New Delhi.
5. The ADGs, MoEF&CC, MoEF&CC, New Delhi.
6. The DG, FSI, MoEF&CC, Dehradun.
7. The Chairman, CPCB, MoEF&CC, New Delhi.
8. The Director, IGNFA, Dehradun.
9. All Joint Secretaries, MoEF&CC, New Delhi.
10. The IGFs, MoEF&CC, New Delhi.
11. The Director, BSI/ZSI/NMNH/NZP/DFE
12. The Superintending Engineer, CCU, MoEF&CC, New Delhi.
13. All Executive Engineers, CCU, MoEF&CC.
14. Dir(GA)/ DS(P.II)/ DS(P.I)/HoD, EFCC/H/o Office, EFCC/AWSU/ Guard File.
15. The Sr. Consultant (IT), MoEF&CC, New Delhi for publication on e-office and Ministry's website.

Government Of India

Ministry Of Housing & Urban Affairs



Central Public Works Department

Excellence in Public Works

Tender Published

Current Tender Details

Tender ID	103401	NIT/RFP NO	02/2024- 25/CE/CCU/CED1/JUNAGARH
Name of Work	Development of Civil Infrastructure for National Referral Centre-Wildlife at Junagarh, Gujrat (Phase-1) on EPC Mode.		
Procurement Type	Works	Bid Type	EPC Percentage
Tender Type	OPEN	Estimated Cost	₹ 52,58,00,000 (Fifty Two Crore Fifty Eight Lakh Rupees)
Bid Submission Closing Date	17/03/2025 15:00	Competitive Bidding Type	NCB

Tender Published Successfully.

Share to :



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Government Of India

Ministry Of Housing & Urban Affairs



Central Public Works Department

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Tender Consolidation View

Print

Download As Pdf

Enquiry Particulars

Regional Office	EE - CED - I	Office Inviting Bids	Chandigarh - CE - E and F - EE - CED - I
Tender ID	103401	NIT/RFP NO	02/2024-25/CE/CCU/CED1/JUNAGARH
Name of Work	Development of Civil Infrastructure for National Referral Centre-Wildlife at Junagarh, Gujrat (Phase-1) on EPC Mode.	Subwork/Packages	
Time Allowed	18 months	Tender Type	OPEN
Procurement Type	WORKS	Bid Type	EPC Percentage
Type of Work	Civil Works - Buildings	Category of Tender	COMPOSITE
Estimated Cost(INR)	₹ 52,58,00,000	Competitive Bidding Type	NCB

Bid Submission Dates

Last Date & Time of receipt of Pre-Bid Queries	27/02/2025 10:55	Receipt of Queries through	Email
Email	eeced1ccu-mef@nic.in		
Pre Bid Meeting Date & Time	27/02/2025 11:00	Pre Bid Meeting Venue	Office of the Chief Engineer CCU MoEFCC 7th floor Pt. Deen Dayal Antodaya Bhawan CGO Complex Iodhi Road New Delhi 110003
Bid Submission Closing Date & Time	17/03/2025 15:00	Bid Validity Period (In Days)	75 After Technical cum Eligibility Bid Opening

Bid Validity Expiry Date	31/05/2025 15:30	Tender Notice Type	Standard Notice Tender
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Tender Inviting Authority Particulars

Office Inviting Bids	EE - CED - I	Designation	Executive Engineer
Address	Civil Construction Unit, 7th Floor, Pt. Deendayal Antyodaya Bhawan, CGO Complex, Lodhi Road, New Del	Contact Details	9953116700
Email	daulat.ram66@gov.in		

EMD Details

EMD (INR)	EMD in favour of	Mode of Payment
₹ 62,58,000	Executive Engineer, CED-I, CCU, MoEF&CC, New Delhi-110003	DD,FDR,BC,BG

Bid Openers

Department User Name	Region	Mobile Number	Email	Designation	Certificate serial No	Certificate Expiry
DAULAT RAM	EE - CED - I	9953116700	daulatram2508@gmail.com	Executive Engineer	188ea67	14/10/2026 02:47
Avinash Yadav	EE - CED - I	9873268737	yadav.avinash7@gmail.com	Assistant Engineer	18828ca	24/09/2026 04:23

Tender Documents

S.No	File Name	File Description	File Size (in Bytes)	Uploaded Date
1	NIT0201CECCU Junagarh.pdf	NIT0201CECCU JUNAGARH	21510486	19/02/2025 18:42
2	NIT0202CECCU Drawings for NIT of Junagarh.pdf	NIT0202CECCU JUNAGARH DRAWINGS	4140005	19/02/2025 18:43
3	Eligibility.pdf	Eligibility	808774	19/02/2025 18:45

Mandatory Documents Details

S.No	Documents Required from Vendor	Document Type
1	a) For CPWD enlisted Contractors	Mandatory
2	Copy of enlistment order in in appropriate class and category issued by CPWD	Mandatory
3	Copy of original EMD in proper form	Mandatory
4	Copy of receipt for deposition of original EMD to division office of any EE, CPWD/CCU	Mandatory
5	Certificate of work experience	Mandatory
6	GST registration Certificate, if already obtained by the bidder	Mandatory

S.No	Documents Required from Vendor	Document Type
7	Undertaking on structural stability and soundness of already completed building and infrastructure projects. (Form- I)	Mandatory
8	Certificate of Financial Turnover from CA (Form A)	Mandatory
9	List of projects under execution in Form C-1	Mandatory
10	Bidding Capacity as per Form- C-2	Mandatory
11	Affidavit for non-execution of eligible similar work(s) through another contractor on back-to-back basis or subletting basis furnished on Rs.100/- non-judicial stamp paper attested by Notary Undertaking for similar works in Form- H	Mandatory
12	Affidavit for Non-Black Listing should be furnished on Rs.100/- non-Judicial stamp paper attested by Notary in Form-J	Mandatory
13	Any other document as specified in NIT	Mandatory
14	b) For Non-CPWD Registered Contractors	Mandatory
15	Copy of original EMD in proper form as per NIT	Mandatory
16	Copy of receipt for deposition of original EMD to division office of any EE, CPWD or CCU	Mandatory
17	Letter of transmittal	Mandatory
18	Certificate of Financial Turnover from CA Form A	Mandatory
19	Bankers certificate or Networth (Form B and B-1)	Mandatory
20	List of eligible similar nature of works in Form C	Mandatory
21	List of projects under execution in Form C 1	Mandatory
22	Bidding Capacity as per Form- C 2	Mandatory
23	Performance report of works (mentioned in Form-C and C-1) in Form D	Mandatory
24	Structure and Organisation (Form E)	Mandatory
25	Undertaking for similar works in Form- H	Mandatory
26	Undertaking on structural stability and soundness of already completed building and infrastructure projects (Form- I)	Mandatory
27	GST registration Certificate if already obtained by the bidder	Mandatory
28	Any other Document as specified in the bid documents	Mandatory

Tender Covers

S.No	Cover Name	Bid Opening date	View Details
1	Technical cum Eligibility Bid	17/03/2025 15:30	View Action
2	Financial Bid	Financial Bid Date To be Decided Later	View Action

Technical cum Eligibility Bid

S.No	Documents Required from Vendor
1	Enlistment order copy of contractor
2	Work Experience Certificate
3	Certiifcate of financial turnover from CA

4	Net Worth
5	Details of works of similar class
6	Projects under execution or awarded
7	Performance reports of works
8	Structure and organisation
9	Affidavit for Non-Black Listing should be furnished on Rs.100/-non-Judicial stamp paper Form J
10	Affidavit for non-execution of eligible similar work
11	Bidding Capacity as per Form- C-2
12	Undertaking for similar works in Form- H
13	Undertaking on structural stability and soundness of already completed building and infrastructure
14	Letter of transmittal

Financial Bid

S.No	File Name	File Size(in Bytes)
1	103401-PercentageComposite1.xls	60928

Done

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Certified that this NIT contains Pages 1 to 415.

Executive Engineer, CED-I, CCU
(For and on behalf of the President of India)

PART A

GENERAL INFORMATION

INFORMATION & INSTRUCTIONS FOR BIDDERS FOR e-BIDDING

The Executive Engineer, CED-I, Civil Construction Unit (CCU), Ministry of Environment, Forest & Climate Change (MoEF&CC), CGO Complex, Lodhi Road, New Delhi -110003 (**email-eeecd1ccu-mef@nic.in**) on behalf of President of India invites online EPC Percentage rate bids from **CPWD enlisted contractors** of appropriate class in Buildings & Roads (erstwhile composite /Building/ Infrastructure) category and **Non-CPWD** enlisted firms/contractors of repute in two bid system for the following work:

NIT No.	02/2024-25/CE/CCU/CED1/JUNAGARH
Name of Work	Development of Civil Infrastructure for National Referral Centre-Wildlife at Junagarh, Gujarat (Phase-1) on EPC Mode on EPC Mode.
Location	Junagarh, Gujarat
Estimated cost put to bid	Rs. 52.58 Crore
Earnest Money	Rs. 62.58 Lakh
Period of Completion	18 Months
Last time & date of submission of online bid, copy of receipt of deposition of original EMD and other documents as specified in Notice Inviting e-Tender.	03:00 PM on 17.03.2025
Time date of opening of technical bid	03:30 PM on 17.03.2025
Pre-Bid Conference	Pre-bid conference shall be held on 27.02.2025 at 11 AM with the eligible and intending bidders in office of CE, CCU, 7th floor CGO Complex, Lodhi Road, New Delhi -110003.

***To be filled in by the Executive Engineer*

Enlistment of the contractors should be valid on the last date of submission of bids. In case, the last date of submission of bids is extended, the enlistment of contractor should be valid on the original date of submission of bids. **Joint ventures/Consortium and Special Purpose Vehicles are not allowed to tender.**

1. Non-CPWD Contractors who fulfill the following criteria shall be eligible to apply. [1(b), 1(c) & 1(d) are not applicable for CPWD enlisted contractors of appropriate class. 1(a)(i), (ii) and 1(e) are applicable for CPWD enlisted contractors also]:
 - a) Should have satisfactorily completed the works as mentioned below during the last Seven years ending last day of the month previous to the one in which tenders are invited-
 - (i) Three similar works each costing not less than **Rs. 21.10 Crores** or two similar works each costing not less than **Rs. 31.60 Crores** or one similar work costing not less than **Rs. 42.14 Crores.**

“Similar Work” shall mean construction of or completing balance construction work of RCC/Composite framed structure building including civil and electrical services and Development work of 20 acre all executed under one agreement.

Note-1: For this purpose, “Cost of work” shall mean gross value of the completed work including the cost of materials supplied by the Government/Client, but excluding those supplied free of cost. This should be certified by an officer not below the rank of Executive Engineer / Project Manager or equivalent.

In case the certificate of work experience has been issued by any Pvt. Firm / Agency / Builder, the bidders will have to submit the documentary proof of the TDS (Form - 26AS) with income tax department to ensure actual value of work done.

The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum; calculated from the date of completion to previous day of last date of submission of tenders.

- b) Should have had Average Annual Financial Turnover of Rs. 15.80 Crores on construction works during the last three years ending 31st March 2024 (Scanned copy of Certificate from CA with Unique Document Identification Number (UDIN) to be uploaded). The value of annual turnover figures shall be brought to the current value by enhancing the actual turnover figures at simple rate of 7% per annum.
- c) Should not have incurred any loss (profit after tax should be positive) in more than two years during the available last five consecutive balance sheets (standalone financial statement), ending 31st March 2024.
- d) Should have a Banker's Certificate from a commercial Bank for Rs. 21.10 Crores or Net Worth certificate of minimum 10 % amount of estimated cost put to tender issued by certified chartered accountant with UDIN (Scanned copy of original to be uploaded).
- e) Should have bidding capacity equal to or more than the estimated cost of the work put to tender. The bidding capacity shall be worked out by the following formula:

Bidding Capacity = {[AxNx1.5]-B} Where,

A = Maximum turnover in construction works executed in any one year during the last seven years taking into account the completed as well as works in progress. The value of completed works shall be brought to current costing level by enhancing at a simple rate of 7% per annum.

N = Number of years prescribed for completion of work for which bids have been invited.

B = Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited.

Notes:

1. The bidder should submit bidding capacity as per Form 'C-3'.
2. Bidding capacity is applicable for all the contractors including CPWD enlisted contractors.
3. Bidding capacity formula, for CPWD contractors who are enlisted based on rule 6.1.7 of Enlistment Rules-2022 i.e. government retired engineer/ architect for three years from the date of issue of enlistment order, is as follows: -

Bidding Capacity = {[AxNx1.5]-B}

Where,

A = Banker certificate figure as submitted by applicant (i.e. government retired engineer/ architect) at the time of enlistment for first year of enlistment and subsequent fresh bankers certificate for second and third year respectively. Value of A for first year will be mentioned in the enlistment order by the member secretary of advisory committee for enlisting authority.

N = Number of years prescribed for completion of work for which bids have been invited.

B = Value of existing commitments and on-going works to be completed during the period of completion of work for which bids have been invited. This value is for newly enlisted entity.

Within three years from the date of issue of enlistment order, the newly enlisted entity has to develop its own bidding capacity and thereafter the general bidding capacity formula being used for other entities shall be bidding capacity. Newly enlisted entity may like to follow general bidding capacity formula even before period of three years if it so chooses.

4. Bidding capacity, for CPWD contractors who are enlisted based on rules 9.6.3 & 9.6.4 of Enlistment Rules-2022 i.e. new entity based on previously enlisted entity for three years from date of issue of enlistment order, is as follows:

Annual turnover of newly enlisted entity shall be in proportion to the shareholding of partners/directors in the original enlisted entity at the time of enlistment of the newly enlisted entity.

Within three years from the date of issue of enlistment order, the newly enlisted entity has to develop its own bidding capacity and thereafter the general bidding capacity formula being used for other entities shall be applicable to it for calculation of bidding capacity. Newly enlisted entity may like to follow general bidding capacity formula even before period of three years, if it so chooses.

Bidding Capacity for newly enlisted entity based on rules 9.6.3 & 9.6.4 enlistment rules -2022 shall be as follows: -

$$\text{Bidding Capacity} = \{[A \times N \times 1.5] - B\}$$

Where,

A' = Proportionate share of newly enlisted director/partner in originally enlisted company/firm multiplied by the factor A, as given below. Value of A' will be mentioned in the enlistment order by member secretary of Advisory committee for Enlistment Authority, it will remain same for three years.

A = Maximum turnover in construction works executed in any one year during the last seven years taking into account the completed as well as works in progress. The value of completed works shall be brought to current costing level by enhancing

at a simple rate of 7% per annum. This value is of originally enlisted entity at the time of enlistment of newly enlisted entity.

N = Number of years prescribed for completion of work for which bids have been invited.

B = Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited. This value is for newly enlisted entity.

5. Enlisted entities based on rules 6.1.7, 9.6.3 or 9.6.4 of enlistment rules-2022 can submit MoU from agency having requisite experience for structural system technology if the enlisted entity does not have required experience.
2. The intending bidder must read the terms and conditions of CPWD-6 carefully. He should only submit his bid if he considers himself eligible and he is in possession of all the documents required.
3. This information and Instructions for bidders posted on website shall form part of bid document.
4. The bid document consisting of Plans, Specifications, Schedule of quantities of various types of items to be executed and the set of terms and conditions of the contract to be complied with and other necessary documents can be seen and downloaded from website <https://etender.cpwd.gov.in> or www.cpwd.gov.in or <https://moef.gov.in> or <https://eprocure.gov.in> free of cost.
5. The bid can only be submitted after deposition of original EMD either in the office of Executive Engineer inviting bids or division office of any Executive Engineer, CCU/CPWD within the period of bid submission and uploading the mandatory scanned documents such as Insurance Surety Bonds, Account Payee Demand draft or Banker's Cheque or Fixed Deposit Receipts or/ and Bank Guarantee including e-Bank Guarantee (for balance amount as prescribed) from any of the Commercial Bank towards EMD in favour of Executive Engineer as mentioned in NIT, receipt for deposition of original EMD to division office of any Executive Engineer (including NIT issuing EE), CCU/CPWD and other documents as specified.
6. Those contractors who are not registered or have not updated their profile on the website mentioned above, are required to get registered/update their profile beforehand. The necessary training materials including the videos with step to step process are available on download section of <https://etender.cpwd.gov.in>.
7. The intending bidder must have valid class-III digital signature certificate with encryption key (combo type) to perform any operations/transactions on the e-tendering portal / website and the bidder should download and install the eMsigner on their system as per instruction available on download section of <https://etender.cpwd.gov.in>.
8. On opening date, the contractor can login and see the bid opening process. After opening of bids he will receive the competitor bid sheets.
9. Contractor can upload documents in the form of JPG format and PDF format.

10. Certificate of Financial Turn Over: At the time of submission of bid contractor may upload Affidavit/Certificate from CA mentioning Financial Turnover of last 3 years ending 31st March 2024 or for the period as specified in the bid document and further details if required may be asked from the contractor after opening of technical bids. There is no need to upload entire voluminous balance sheet.
11. Contractor must ensure to quote rate of each item. The column meant for quoting rate in figures appears in yellow colour and the moment rate is entered, it turns sky blue.

In addition to this, while selecting any of the cells a warning appears that if any cell is left blank the same shall be treated as "0". Therefore, if any cell is left blank and no rate is quoted by the bidder, rate of such item shall be treated as "0" (ZERO).

However, If a tenderer quotes nil rates against each item in item rate tender or does not quote any percentage above/below on the total amount of the tender or any section / sub head in percentage rate tender, the tender shall be treated as invalid and will not be considered as lowest tenderer.

12. The Technical Bid shall be opened first on due date and time as mentioned above. The time and date of opening of financial bid of contractors qualifying the technical bid shall be communicated to them at a later date.
13. Pre-Bid conference shall be held on 27.02.2025 at 11.00 AM with the eligible and intending bidders in **office of CE, CCU, 7th floor CGO Complex, Lodhi Road, New Delhi -110003** to clear the doubt of intending bidders, if any.
14. The department reserves the right to reject any prospective application without assigning any reason and to restrict the list of qualified contractors to any number deemed suitable by it, if too many bids are received satisfying the laid down criterion.
15. Copy of enlistment order and certificate of work experience and other documents as specified in the tender documents for eligibility shall be scanned and uploaded to the e-tendering website within the period of bid submission.
16. Online bid documents submitted by intending bidders shall be opened only of those bidders, whose deposited EMD and other documents scanned and uploaded are found in order.
17. If any information furnished by the applicant is found incorrect at a later stage, he shall be liable to be debarred from tendering/taking up of works in department. The department reserves the right to verify the particulars furnished by the applicant independently.
18. **List of Documents (to be filled in by the tenderers in various forms), to be scanned and uploaded within the period of bid submission:**

For CPWD enlisted Contractors

- (i) Copy of enlistment order in in appropriate class and category issued by CPWD.
- (ii) Copy of original EMD in proper form.
- (iii) Copy of receipt for deposition of original EMD to division office of any EE, CPWD/CCU.

- (iv) Certificate of work experience.
- (v) GST registration Certificate, if already obtained by the bidder.

If the bidder has not obtained GST registration as applicable, then he shall scan and upload following undertaking along with bid documents.

"If work is awarded to me, I/we shall obtain GST registration certificate as applicable within one month from the date of receipt of award letter or before release of any payment by CCU, whichever is earlier, failing which I/we shall be responsible for any delay in payments which will be due towards me/us on account of the work executed and/or for any action taken by CCU or GST department in this regard".

- (vi) Undertaking on structural stability and soundness of already completed building and infrastructure projects. (Form- 'I').
- (vii) Certificate of Financial Turnover from CA (Form 'A').
- (viii) List of projects under execution in Form 'C-1'.
- (ix) Bidding Capacity as per Form- 'C-2'
- (x) Affidavit for non-execution of eligible similar work(s) through another contractor on back-to-back basis or subletting basis furnished on Rs.100/- non-judicial stamp paper attested by Notary. Undertaking for similar works in Form- 'H'.
- (xi) Affidavit for Non-Black Listing should be furnished on Rs.100/- non-Judicial stamp paper attested by Notary in Form- 'J'.
- (xii) Any other document as specified in NIT

For Non-CPWD Registered Contractors -

- a. Copy of original EMD in proper form.
- b. Copy of receipt for deposition of original EMD to division office of any EE, CPWD/CCU.
- c. Letter of transmittal.
- d. Certificate of Financial Turnover from CA (Form 'A').
- e. Bankers certificate or Networth (Form 'B' and 'B-1').
- f. List of eligible similar nature of works in Form –'C'.
- g. List of projects under execution in Form 'C-1'.
- h. Bidding Capacity as per Form- 'C-2'
- i. Performance report of works (mentioned in Form-C and C-1) in Form – 'D'.
- j. Structure & Organisation (Form 'E')
- k. Undertaking for similar works in Form- 'H'.
- l. Undertaking on structural stability and soundness of already completed building and infrastructure projects. (Form- 'I').

- m. GST registration Certificate, if already obtained by the bidder.

If the bidder has not obtained GST registration as applicable, then he shall scan and upload following undertaking along with bid documents.

"If work is awarded to me, I/we shall obtain GST registration certificate as applicable within one month from the date of receipt of award letter or before release of any payment by CCU, whichever is earlier, failing which I/we shall be responsible for any delay in payments which will be due towards me/us on account of the work executed and/or for any action taken by CCU or GST department in this regard".

- n. Any other Document as specified in the bid documents.

If any required document is not scanned and uploaded while submitting bid, the bid submitted shall become invalid and will not be considered in e-Tendering process and the bid shall be summarily rejected.

Executive Engineer, CED-I, CCU
(For and on behalf of President of India)

NOTICE INVITING TENDER

1. Percentage rate composite bids on Engineering, Procurement and Construction basis are invited on behalf of President of India from approved and eligible contractors of CPWD in appropriate composite category and **Non-CPWD enlisted** firms/contractor of repute in two bid system for the following work:

“Development of Civil Infrastructure for National Referral Centre-Wildlife at Junagarh, Gujarat (Phase-1) on EPC Mode.

The enlistment of the contractors should be valid on the last date of submission of bids. In case the last date of submission of bid is extended, the enlistment of contractor should be valid on the original date of submission of bids.

- 1.1. The work is estimated to cost **Rs. 52.58 Crores**. This estimate, however, is given merely as a rough guide.
- 1.2. Intending bidders are eligible to submit the bid provided he has definite proof from the appropriate authority, which shall be to the satisfaction of the competent authority, of having satisfactorily completed similar works of magnitude specified below: -

Criteria of eligibility for submission of bid documents:

[1.2.2, 1.2.3 and 1.2.4 are not applicable for CPWD enlisted contractors of appropriate class. 1.2.1, and 1.2.5 is applicable for CPWD enlisted contractors also]

- 1.2.1. Should have satisfactorily completed the works as mentioned below during the last 7 years ending last day of the month previous to the one in which tenders are invited –
 - (i) Three similar works each costing not less than **Rs. 21.10 Crores** or two similar works each costing not less than **Rs. 31.60 Crores** or one similar work costing not less than **Rs. 42.14 Crores**.

“Similar Work” shall mean construction of or completing balance construction work of RCC/Composite framed structure building including civil and electrical services and Development work of 20 acre all executed under one agreement.

Note-1: For this purpose, “Cost of work” shall mean gross value of the completed work including the cost of materials supplied by the Government/Client, but excluding those supplied free of cost. This should be certified by an officer not below the rank of Executive Engineer / Project Manager or equivalent.

In case the certificate of work experience has been issued by any Pvt. Firm / Agency / Builder, the bidders will have to submit the documentary proof of the TDS (Form -26AS) with income tax department to ensure actual value of work done.

The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum; calculated from the date

of completion to previous day of last date of submission of tenders.

To become eligible for issue of bid, the bidders shall have to furnish an affidavit as under: -

“I/We undertake and confirm that eligible similar works(s) has/have not been got executed through another contractor on back-to-back basis. Further that, if such a violation comes to the notice of Department, then I/we shall be debarred for bidding in CCU in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Earnest Money Deposit/Performance Guarantee. **(Scanned copy to be uploaded at the time of submission of bid)**”

- 1.2.2. Should have had Average Annual Financial Turnover of Rs. 15.80 Crores on construction works during the last three years ending 31st March 2024 (Scanned copy of Certificate from CA with Unique Document Identification Number (UDIN) to be uploaded). The value of annual turnover figures shall be brought to the current value by enhancing the actual turnover figures at simple rate of 7% per annum.
- 1.2.3. Should not have incurred any loss (profit after tax should be positive) in more than two years during the available last five consecutive balance sheets (standalone financial statement), ending 31st March 2024.
- 1.2.4. Should have a Banker's Certificate from a commercial Bank for Rs. 21.10 Crores or Net Worth certificate of minimum 10 % amount of estimated cost put to tender issued by certified chartered accountant with UDIN (Scanned copy of original to be uploaded).
- 1.2.5. Should have bidding capacity equal to or more than the estimated cost of the work put to tender. The bidding capacity shall be worked out by the following formula:

Bidding Capacity = {[AxNx1.5]-B} Where,

A = Maximum turnover in construction works executed in any one year during the last seven years taking into account the completed as well as works in progress. The value of completed works shall be brought to current costing level by enhancing at a simple rate of 7% per annum.

N = Number of years prescribed for completion of work for which bids have been invited.

B = Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited.

Notes:

1. The bidder should submit bidding capacity as per Form 'C-3'.
2. Bidding capacity is applicable for all the contractors including CPWD enlisted contractors.
3. Bidding capacity formula, for CPWD contractors who are enlisted based on rule 6.1.7 of Enlistment Rules-2022 i.e. government retired engineer/ architect for three years from the date of issue of enlistment order, is as follows: -

$$\text{Bidding Capacity} = \{[A \times N \times 1.5] - B\}$$

Where,

A = Banker certificate figure as submitted by applicant (i.e. government retired engineer/ architect) at the time of enlistment for first year of enlistment and subsequent fresh bankers certificate for second and third year respectively. Value of A for first year will be mentioned in the enlistment order by the member secretary of advisory committee for enlisting authority.

N = Number of years prescribed for completion of work for which bids have been invited.

B = Value of existing commitments and on-going works to be completed during the period of completion of work for which bids have been invited. This value is for newly enlisted entity.

Within three years from the date of issue of enlistment order, the newly enlisted entity has to develop its own bidding capacity and thereafter the general bidding capacity formula being used for other entities shall be bidding capacity. Newly enlisted entity may like to follow general bidding capacity formula even before period of three years if it so chooses.

4. Bidding capacity, for CPWD contractors who are enlisted based on rules 9.6.3 & 9.6.4 of Enlistment Rules-2022 i.e. new entity based on previously enlisted entity for three years from date of issue of enlistment order, is as follows:

Annual turnover of newly enlisted entity shall be in proportion to the shareholding of partners/directors in the original enlisted entity at the time of enlistment of the newly enlisted entity.

Within three years from the date of issue of enlistment order, the newly enlisted entity has to develop its own bidding capacity and thereafter the general bidding capacity formula being used for other entities shall be applicable to it for calculation of bidding capacity. Newly enlisted entity may like to follow general bidding capacity formula even before period of three years, if it so chooses.

Bidding Capacity for newly enlisted entity based on rules 9.6.3 & 9.6.4 enlistment rules -2022 shall be as follows: -

$$\text{Bidding Capacity} = \{[A' \times N \times 1.5] - B\}$$

Where,

A' = Proportionate share of newly enlisted director/partner in originally enlisted company/firm multiplied by the factor A, as given below. Value of A' will be mentioned in the enlistment order by member secretary of Advisory committee for Enlistment Authority, it will remain same for three years.

A = Maximum turnover in construction works executed in any one year during the last seven years taking into account the completed as well as works in progress. The value of completed works shall be brought to current costing level by enhancing at a simple rate of 7% per annum. This value is of originally enlisted entity at the time of enlistment of newly enlisted entity.

N = Number of years prescribed for completion of work for which bids have been invited.

B = Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited. This value is for newly enlisted entity.

5. Enlisted entities based on rules 6.1.7, 9.6.3 or 9.6.4 of enlistment rules-2022 can submit MoU from agency having requisite experience for structural system technology if the enlisted entity does not have required experience.
2. Agreement shall be drawn with the successful tenderer on prescribed Form No. CPWD 7 which is available as a Govt. of India Publication and also available on website **www.cpwd.gov.in**. Bidders shall quote his rates as per various terms and conditions of the said form which will form part of the agreement.
3. The time allowed for carrying out the work will be 18 months from the date of start as defined in schedule 'F' or from the first date of handing over of the site, whichever is later, in accordance with the phasing, if any, indicated in the bid documents.
4. The site for the work is available on "as it is where it is" basis. **The bidders have to quote their rates in view of the site conditions and other parameters.**
5. The working architectural, structural, and services drawings shall be prepared by the bidder.
6. The bid document consisting of plans, specifications, the schedule of quantities of various types of items to be executed and the set of terms and conditions of the contract to be complied with and other necessary documents except Standard General Conditions of Contract Form can be seen on website <https://etender.cpwd.gov.in> or www.cpwd.gov.in or <https://moef.gov.in> or <https://eprocure.gov.in> free of cost.
7. After submission of the bid the contractor can re-submit revised bid any number of times but before last time and date of submission of bid as notified.
8. While submitting the revised bid, contractor can revise the rate of one or more item(s) any number of times (he need not re-enter rate of all the items) but before last time and date of submission of bid as notified.
9. Earnest Money in the form of Insurance Surety Bonds, Account Payee Demand Draft, Fixed Deposit Receipt, Banker's Cheque or Bank Guarantee including e- Bank Guarantee (for balance amount as prescribed) from any of the Commercial Banks (drawn in favour of **Executive Engineer, CED-I, CCU, MoEF&CC, New Delhi**) shall be scanned and uploaded to the e-Tendering website within the period of bid submission. The original EMD should be deposited either in the office of Executive Engineer inviting bids or division office of any Executive Engineer, CCU/CPWD within the period of bid submission. The EMD receiving Executive Engineer (including NIT issuing EE/AE) shall issue a receipt of deposition of

earnest money deposit to the bidder in a prescribed format (enclosed) uploaded by tender inviting EE in the NIT.

A part of earnest money is acceptable in the form of bank guarantee also. In such case, minimum 50% of earnest money or Rs. 20 lac, whichever is less, shall have to be deposited in shape prescribed above, and balance may be deposited in shape of Bank Guarantee including e- Bank Guarantee of any Commercial bank having validity for a period of **180 days** or more from the last date of receipt of bids which is to be scanned and uploaded by the intending bidders.

Copy of Enlistment Order and certificate of work experience and other documents as specified in the notice inviting e- tender shall be scanned and uploaded on the e-Tendering website within the period of bid submission. However, certified copy of all the scanned and uploaded documents as specified in e- tender notice shall have to be submitted by the lowest bidder within a week physically in the office of tender opening authority. Online bid documents submitted by intending bidders shall be opened only of those bidders, whose original EMD deposited with any division of CPWD/CCU and other document scanned and uploaded are found in order.

10. The bid submitted shall become invalid and e-Tender processing **fee** (if applicable) shall not be refunded if:

- (i) The bidder is found ineligible.
- (ii) The bidder does not upload scanned copies of all the documents stipulated in the bid document.
- (iii) If any discrepancy is noticed between the documents as uploaded at the time of submission of bid and hard copies as submitted physically by the lowest bidder in the office of bid opening authority.
- (iv) If a tenderer quotes nil rates against each item in item rate tender or does not quote any percentage above/below on the total amount of the tender or any section / sub head in percentage rate tender, the tender shall be treated as invalid and will not be considered as lowest tenderer.

11. The contractor whose bid is accepted will be required to furnish performance guarantee at specified percentage of the tendered amount as mentioned in schedule E and within the period specified in Schedule F. This guarantee shall be in the form of Insurance Surety Bonds, Account Payee Demand Draft, Fixed Deposit Receipt or Bank Guarantee from any of the Commercial Banks in accordance with the prescribed form. In case the contractor fails to deposit the said performance guarantee within the period as indicated in Schedule 'F', including the extended period if any, the Earnest Money deposited by the contractor shall be forfeited automatically without any notice to the contractor. The earnest money deposited along with bid shall be returned after receiving the aforesaid performance guarantee. The contractor whose bid is accepted will also be required to furnish either copy of applicable licenses/ registrations or proof of applying for obtaining labour licenses, registration with EPFO, ESIC and BOCW Welfare Board including Provident Fund Code No. if applicable and also ensure the compliance of aforesaid provisions by the subcontractors, if any engaged by the contractor for the said work within the period specified in Schedule F.

12. The description of the work is as follows:

Intending Bidders are advised to inspect and examine the site and its surroundings and satisfy themselves before submitting their bids as to the nature of the ground and sub-soil (so far as is practicable), the form and nature of the site, the means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their bid. A bidder shall be deemed to have full knowledge of the site whether he inspects it or not and no extra charge consequent on any misunderstanding or otherwise shall be allowed. The bidder shall be responsible for arranging and maintaining at his own cost all materials, tools & plants, water, electricity access, facilities for workers and all other services required for executing the work unless otherwise specifically provided for in the contract documents. Submission of a bid by a bidder implies that he has read this notice and all other contract documents and has made himself aware of the scope and specifications of the work to be done and of conditions and rates at which stores, tools and plant, etc. will be issued to him by the Government and local conditions and other factors having a bearing on the execution of the work.

13. The competent authority on behalf of the President of India does not bind itself to accept the lowest or any other bid and reserves to itself the authority to reject any or all the bids received without the assignment of any reason. All bids in which any of the prescribed condition is not fulfilled or any condition including that of conditional rebate is put forth by the bidders shall be summarily rejected.
14. Canvassing whether directly or indirectly, in connection with bidders is strictly prohibited and the bids submitted by the contractors who resort to canvassing will be liable for rejection.
15. The competent authority on behalf of President of India reserves to himself the right of accepting the whole or any part of the bid and the bidders shall be bound to perform the same at the rate quoted.
16. The contractor/bidder shall not be permitted to bid for works in the CCU Circle responsible for award and execution of contracts, in which his near relative is posted as a Divisional Accountant or as an officer in any capacity between the grades of Superintending Engineer and Junior Engineer (both inclusive). He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any Gazetted officer in the Civil Construction Unit or in the Ministry of Environment, Forests and Climate Change. Any breach of this condition by the contractor would render him liable to be removed from the approved list of contractors of the Department.
17. No Engineer of Gazetted Rank or other Gazetted Officer employed in Engineering or Administrative duties in an Engineering Department of the Government of India is allowed to work as a contractor for a period of one year after his retirement from Government service, without the prior permission of the Government of India in writing. This contract is liable to be cancelled if either the contractor or any of his employees is found any time to be such a person who had not obtained the permission of the Government of India as aforesaid before submission of the bid or engagement in the contractor's service.
18. The bid for the works shall remain open for acceptance for a period of seventy five (75) days from the date of opening of Technical bids. Further,
 - I. If any tenderer withdraws his tender or makes any modification in the terms & conditions of the tender which is not acceptable to the department within 7 days after last date of submission of bids, then the Government shall without prejudice to any other

right or remedy, be at liberty to forfeit 50% of the earnest money absolutely irrespective of letter of acceptance for the work is issued or not.

II. If any tenderer withdraws his tender or makes any modification in the terms & conditions of the tender which is not acceptable to the department after expiry of 7 days after last date of submission of bids, then the Government shall without prejudice to any other right or remedy, be at liberty to forfeit 100% of the earnest money absolutely irrespective of letter of acceptance for the work is issued or not.

III. In case of forfeiture of earnest money as prescribed in para (i) and (ii) above, the bidders shall not be allowed to participate in the rebidding process of the same work.

19. The pre bid meeting will be held on 27.02.2025 at 11 AM with the eligible and intending bidders in **office of CE, CCU, 7th floor CGO Complex, Lodhi Road, New Delhi -110003** to clear the doubt of intending bidders if any.

20. This notice inviting Bid shall form a part of the contract document. The successful bidder/contractor, on acceptance of his bid by the Accepting Authority shall within 15 days from the stipulated date of start of the work, sign the contract consisting of:-

a) The Notice Inviting Bid, all the documents including additional conditions, special conditions, particular specification, and drawings, if any, forming part of the bid as uploaded at the time of invitation of bid and the rates quoted online at the time of submission of bid and acceptance thereof together with any correspondence leading thereto.

b) Standard CPWD Form '7' and other Standard CPWD Forms as applicable with amendment upto last date of submission of bid.

** to be filled by EE

21. **Specialized Agencies for E&M services:** The tenderer must associate himself with agencies of the appropriate eligibility for each of specialized nature of items / work. The work of Lifts shall be carried out by OEM of Lift only. Such works shall be got executed only through associated agencies specialized in these fields. Separate MOU has to be signed with each of the specialized works with either OEMs (Authorised channel partners) or with specialized agencies who have the credentials of executing either one work of 80% value or two work of 60% value or three works of 40% value of the corresponding component of the specialized work in last seven years. MOU should be submitted within three months of the award of work. It shall be the responsibility of main contractor to sort out any dispute / litigation with the Specialized Agencies without any time & cost overrun to the Department. The main contractor shall be solely responsible for settling any dispute / litigation arising out of his agreement with the Specialized Agencies. The contractor shall ensure that the work shall not suffer on account of litigation/ dispute between him and the specialized agencies / sub-contractor(s). No claim of hindrance in the work shall be entertained from the Contractor on this account. No extension of time shall be granted and no claim what so ever, of any kind, shall be entertained from the Contractor on account of delay attributable to the selection/rejection of the Specialized Agency.

22. The main contractor has to associate agency(s) for specialized component(s) conforming to eligibility criteria as defined in the bid document and has to submit detail of such agency(s) to Engineer-in-charge within prescribed time. Name of the agency(s) to be associated shall be approved by Engineer –in-Charge.

23. In case the main contractor intends to change any of the above agency/agencies during the operation of the contract, he shall obtain prior approval of Engineer-in-charge. The new agency/agencies shall also have to satisfy the laid down eligibility criteria. In case Engineer-in-charge is not satisfied with the performance of any agency, he can direct the contractor to change the agency executing such items of work and this shall be binding on the contractor.
24. The main contractor has to enter into MOU with agency(s) associated by him. Copy of such agreement shall be submitted to EE in charge. In case of change of associate contractor, the main agency(s) has to enter into MOU/agreement with the new contractor associated by him.
25. The intending bidders are required to update their profile in CPWD e- tender portal and to upload their bids well in advance of last date of submission of tender. Any issue related to updating profile/uploading tender can be resolved through ERP helpline no. 18001803286 or e-mail id cpwd.support@techmahindra.com. The e- tendering bidders are also advised not to wait to raise any issues till the last date of submission of bid in their own interest.
- 26. Price Preference to SC/ST individual contractor for item rate/percentage rate tender:**

Price preference in quoted item rate/percentage rate tender shall be applicable to the individual enlisted/non-enlisted SC/ST contractor as under:-

- (i) For work(s) upto and equal to an estimated cost of Rs. 2.70 lakh a price preference upto 5% (with reference to the lowest valid tender) may be allowed in favor of individual SC/ST enlisted/non-enlisted contractor. No earnest money is required in such case(s).
- (ii) For work(s) beyond an estimated cost of Rs. 2.70 lakh and upto and equal to estimated cost of Rs. 6.20 lakh, the price preference upto 5% (with reference to the lowest valid tender) may be allowed in favour of individual enlisted SC/ST contractor. However, earnest money at a reduced rate of ½% may be accepted in such cases. The price preference upto 5% (with reference to the lowest valid price bid) may be allowed in favour of individual SC/ST contractor only.

The above concession shall be allowed only after verification of the individual contractor's claim of belonging to SC/ST communit

Executive Engineer, CED-I, CCU
(For and on behalf of President of India)

TECHNICAL BID

Section-I

BRIEF PARTICULARS OF WORK

- 1) The Salient details of the work for which bids are invited are as under:

S.N.	Name of work	Estimated cost	Period of completion
1.	Development of Civil Infrastructure for National Referral Centre-Wildlife at Junagarh, Gujarat (Phase-1) on EPC Mode on EPC Mode.	Rs. 52.58 Crores	18 Months

- 2) The site of work is located/situated at Junagarh, Gujarat having plot area of approximately 52 Acres. Representative site map is as under –

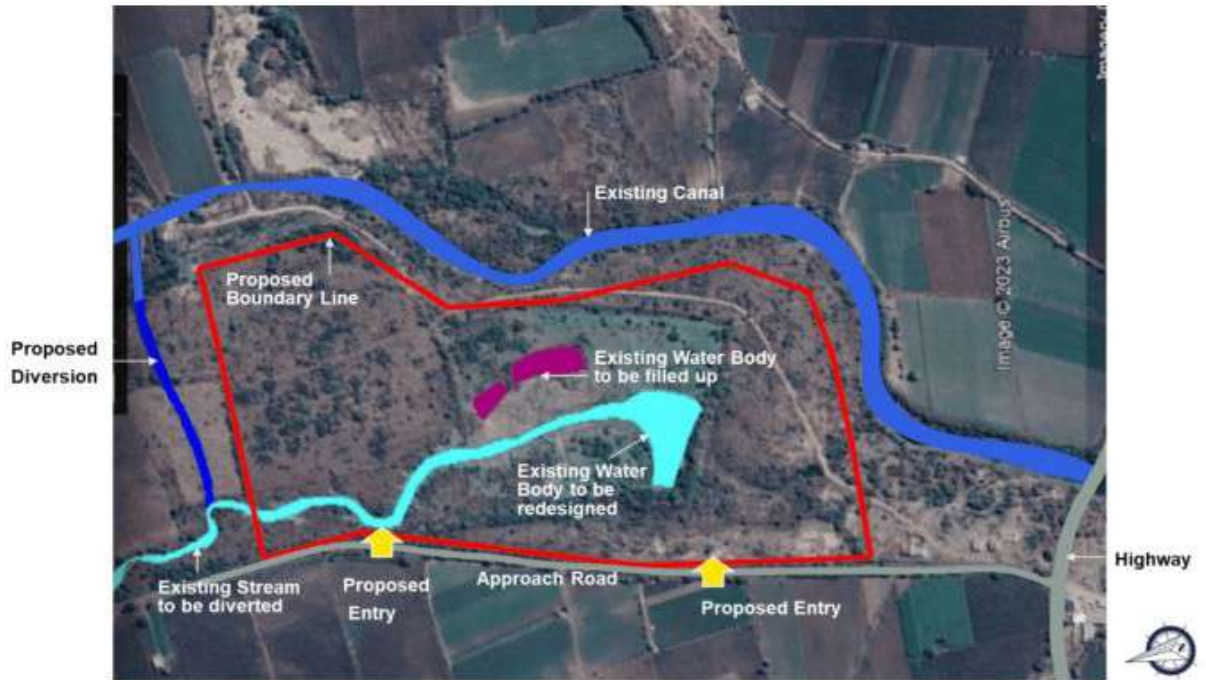


Figure 54: Site Analysis

- 3) The bidder has to develop further the conceptual masterplan which has been attached in the bid document. Obtaining all subsequent statutory approval of the masterplan and building plans is integral part of the scope of work. The scope of work includes (but not limited to) Site Survey, Soil Investigation, preparation of Detailed Master layout plan, detailed Architectural design and preparation of required drawings, Structural design and preparation of required drawings, design of all the required Services and preparation of drawings thereof, obtaining mandatory approvals from local bodies/ authorities for commencement/execution of work, installation of services (civil, electrical & mechanical) and making the building/campus and all the installations functional for the intended purpose. Obtaining NOC regarding use of various installations in the building and premises (Like Fire NOC, use of lift etc.), obtaining building use permission from all the authorities and handing over the building/services after making them habitable in all respect is

part of scope of work. The scope of work also includes modelling, designing, preparation of detailing/drawings in 3D Building Information Modeling (BIM) for Integration and Coordination of all services with LOD 400 type detailing.

- 4) The work shall be planned, designed and executed as per USER REQUIREMENTS and ARCHITECTURAL/ STRUCTURAL CONTROL PARAMETERS laid down in schedule '1'. The location of the existing mature trees and depressions on site shall be verified by the EPC contractor and masterplan be prepared accordingly, if required.
- 5) Proof Checking of the Structural Drawings shall be got carried out from Reputed Government Engineering Institutes like IITs, NIT as approved by the Engineer-in-charge. The fee for proof checking shall be borne by the Department. But submission of drawings, liaison & meetings with concerned officials, shall be in the scope of bidder. Payment to the local bodies or all other authorities concerned for obtaining all the requisite approvals shall be borne by the department.
- 6) The scope of work consists obtaining all Statutory Approvals from Local Authorities/ Central Authorities/ Defense Authority/ Environment Authority/ Airport Authority/ Chief Fire Officer/ Pollution Control Board from inception to completion and occupation. The statutory payments or fees payable to Government/ Local Body for commencement of work and getting occupancy/completion of work, in order to obtain the NOCs/Permissions, shall be reimbursed to the Contractor by CCU. Cutting/transplantation of existing trees after obtaining approval of tree cutting from concerned authority e.g. local body/forest department. The contractor shall also carry out the compensatory plantation (including maintenance of planted trees) in lieu of felled/cut trees as per stipulation of NOC/permission granted by concerned competent authority for cutting of trees. Contractor shall be responsible to adhere the terms of NOCs/Approvals granted by various statutory authorities. Tendered rates/amount of contractor is deemed to be inclusive of these conditions.
- 7) The planning, designing and engineering of all the works (Civil, electrical, mechanical, development works etc. along with services) shall be as per user requirement and architectural/structural control parameters specified in the contract document and compliant to National Building Code of India – 2016, Local Bye-laws applicable to site and subsequent amendment, Guidelines of Ministry of Environment, Forest & Climate Change, Planning for Barrier free environments (ADA & NBC), CPWD Guidelines and Space standards for barrier free built environment for disabled and elderly persons – 1998, ECBC norms – 2024, CPWD GHAR norms – 2021, GRIHA, BIS Codes, any other codes as applicable. Reference to standard/ code shall mean to their latest version/ edition.
- 8) Concept architectural drawings have been prepared by CCU and attached with tender documents. In case of any discrepancy between the bid document and provided indicative drawings, the bid document will prevail over the details provided in the respective drawings. However, agency has to prepare more detailed working architectural drawings as per requirement of local body for approval and as per contract document and as per direction of Engineer-in-charge for execution at site of work. The Engineer-in-charge will issue No Objection Certificate and release the drawings for execution. The work shall be executed based on these approved drawings.

- 9) The present tender is for Design and **Development of all buildings** as per conceptual layout plan and **Civil Infrastructure for National Referral Centre-Wildlife at Junagarh, Gujarat (Phase-1)** which consists of **Construction of buildings of Administrative Department, Wildlife Health Management and Disease Investigation and Surveillance, Informatics and Analytics & Network & Outreach Unit, Training & Capacity Building and Utility Block, Sub-stations and Security Building and miscellaneous works including all Civil, Electrical & Mechanical works.** The scope of work also covers external development works and other allied works within controlled architectural parameters. The indicative list of the structures to be built is as under –

S. N.	Description	Type of Structure & Structural material	(No. of Levels /Floors)	Tentative Covered Area (Sqm.)
1	Administrative Department Building	RCC	2	AS PER INDICATIVE DRAWINGS
2	Wildlife Health Management and Disease Investigation and Surveillance.	RCC	2	AS PER INDICATIVE DRAWINGS
3	Informatics and Analytics & Network & Outreach Unit.	RCC	2	AS PER INDICATIVE DRAWINGS
4	Training & Capacity Building.	RCC	2	AS PER INDICATIVE DRAWINGS
5	Utility Block, Sub-stations and Security Building.	RCC	1	AS PER INDICATIVE DRAWINGS

- 10) The utility duct made up of precast element of M-30 grade shall be planned, designed and constructed preferably parallel to the road or pathways. This duct shall have compartments vertical as well as horizontal to house various utilities, E&M services, cables, pipes etc.
- 11) The scope of work consists of anti-termite treatment of soil wherever required for proposed works.
- 12) The scope of work includes the planning, designing, construction of the controlled connectivity from the nearby surrounding road to proposed campus.
- 13) The contractor shall develop the part of campus (phase one only) as per development / landscape drawings. The work envisages the development of various contrasting

landscape features with huge volume of earthwork/retaining wall etc. as depicted in tender drawings. The scope of work is only indicative and not exhaustive. The contractor shall be responsible for executing all the works/ items required for completing all the building & other services in all respect to make the buildings habitable and ready for occupation as per contract documents and as per direction of Engineer-in-charge. All miscellaneous, Allied Works, incidental work as per norms of NBC 2016, Building Bye Laws and statutory bodies and mentioned in this document which are required to make buildings/ operational / functional shall be carried out by contractor. The Agency is required to complete the project within controlled architectural norms as mentioned in the bid document. The work is to be carried out complete in all respect including all the internal and external services. The Agency is required to connect all the external services like Water Supply, Sewerage, Drainage, Electric Supply, LAN/WAN, Telephone Lines etc. to the main lines of the authorities / service providers or any other agency and this shall be considered as integral part of scope of work and deemed to be included in the quoted price of the agency.

- 14) The contractor shall carry out detail engineering, preparation and submission of all drawings as per proposed specifications, including preparation and submission of area wise bill of materials, quantities as per site conditions.
- 15) Scope of work consists obtaining minimum **SUPER GREEN Rating as per CPWD Green Rating Manual (GHAR) 2021 and 5-star rating under GRIHA norms**. The project/work shall be planned, designed, executed in order to achieve net zero campus w.r.t. energy requirement.
- 16) Electrical & Mechanical services/works: All the electrical & mechanical services mentioned in Part C of the tender document are in scope of work.
- 17) The scope of work also includes:
 - (i) All the items of Delhi Schedule of Rates are in the scope of work against the tender, as may be applicable, according to the design developed by the contractor and discharged by the Engineer-in-Charge by way of Good for Construction drawings.
 - (ii) CPWD Specifications Vol-I and Vol-II as amended from time to time shall be applicable for all the items to be executed as per Good for construction drawings.
 - (iii) Provisions contained in Harmonized Guidelines & Standards for Universal Accessibility in India 2021 (available on CPWD Website) of Ministry of Housing and Urban Affairs, Government of India shall be complied with while preparing drawings.
 - (iv) Contractor shall submit detailed Architectural working drawings to Engineer- In-Charge. The Engineer-in-Charge shall get it examined from the designated Architect of the project and issue NOC for taking up work.

- (v) Contractor shall submit Good for construction drawings (structural, services, MEP etc.) to the Engineer-in-Charge. Work shall be executed only as per NOC issued for Good for construction drawings (structural, services, MEP etc.) by the Engineer- in-Charge.
 - (vi) Contractor shall carry out his own soil investigation from a soil investigating agency approved by the Engineer-in-Charge for the purpose of design of foundation and superstructure. In case of any contradiction between Geo technical report appended if any with tender documents and that undertaken by contractor, the report suggesting of weaker technical conditions shall prevail.
 - (vii) C&D waste products and recycled aggregates to the extent provided in IS codes shall be used as per extant provisions of green building measures. Only water suitable for construction work as per relevant BIS code shall be used in the work. If the C&D waste product are unavailable in market, the conventional products may be used by the contractor at no extra cost to department.
- 18) The Agency shall hand over the assets after completion of work with as built drawings, services route plans, Maintenance manuals, Warrantees / Guarantees or any other document required by the Engineer-in-charge for maintaining these establishments.
- 19) Scope of work also includes to train the 30% workers of the site as per SKILLED INDIA program under National Skill Development Corporation (NSDC) Norms & Conditions.

Section-II
INFORMATION AND GUIDE-LINES FOR BIDDERS

1.0 General:

- 1.1 Letter of transmittal and forms for deciding eligibility are given in Section III.
- 1.2 All information called for in the enclosed forms should be furnished against the relevant columns in the forms. If for any reason, information is furnished on a separate sheet, this fact should be mentioned against the relevant column. Even if no information is to be provided in a column, a "nil" or "no such case" entry should be made in that column. If any particulars/query is not applicable in case of the bidder, it should be stated as "not applicable". The bidders are cautioned that not giving complete information called for in the application forms or not giving it in clear terms or making any change in the prescribed forms or deliberately suppressing the information may result in the bid being summarily disqualified. Bids made by telegram or e-mailed or telex and those received late will not be entertained.
- 1.3 References, information and certificate from the respective clients certifying suitability, technical knowledge or capability of the bidder should be signed by an officer not below the rank of Executive Engineer or equivalent.
- 1.4 The bidder may furnish any additional information, which he thinks is necessary to establish his capabilities to successfully complete envisaged work. He is, however advised not to furnish superfluous information. No information shall be entertained after submission of eligibility criteria document unless it is called for by the Employer.

2.0 Definitions:

- 2.1 In this document the following words and expression have their meaning here by assigned to them.
- 2.2 Employer / Engineer-in-Charge means the President of India, acting through the Executive Engineer, CED-I, Civil Construction Unit (CCU), Ministry of Environment, Forest & Climate Change (MoEF&CC), CGO Complex, Lodhi Road, New Delhi -or his successor or legal assignee thereof. The term Executive Engineer or EE, CED-I referred in this contract document shall mean Executive Engineer, CED-I, Civil Construction Unit (CCU), Ministry of Environment, Forest & Climate Change (MoEF&CC), CGO Complex, Lodhi Road, New Delhi -110003 or his successor or legal assignee thereof.
- 2.3 Bidder/Agency/Contractor/tenderer means the individual, proprietary firm, firm in partnership, limited company, private or public or corporation.
- 2.4 "YEAR" means "Financial year" unless stated otherwise.

3.0 **Method of Application:**

- 3.1 If the bidder is an individual, the application shall be signed by him above his/her full type written name and current address. If the bidder is an individual, the application shall be signed by him above his full type written name and current address.
- 3.2 If the bidder is a proprietary firm, the application shall be signed by the proprietor above his full type written name and the full name of his firm with its current address
- 3.3 If the bidder is a firm in partnership, the application shall be signed by all the partners of the firm above their full typewritten names and current addresses, or, alternatively, by a partner holding power of attorney for the firm. In the latter case a certified copy of the power of attorney should accompany the application. In both cases a certified copy of the partnership deed and current address of all the partners of the firm should accompany the application.
- 3.4 If the bidder is a limited company or a corporation, the application shall be signed by a duly authorized person holding power of attorney for signing the application accompanied by a copy of the power of attorney. The bidder should also furnish a copy of the Memorandum of Articles of Association duly attested by a Public Notary

4 **Final Decision-Making Authority:**

The employer reserves the right to accept or reject any bid and to annul the process and reject all bids at any time, without assigning any reason or incurring any liability to the bidders.

5 **Particulars of works:**

The particulars of the work given in section – I are provisional. They are liable to change and must be considered only as advance information to assist the bidder.

6 **Site Visit:**

The bidder is advised to visit the site of work, at his own cost, and examine it and its surroundings to himself to collect all information that he considers necessary for proper assessment of the prospective assignment.

7.0 **Initial Criteria for Eligibility:**

Enlistment of the contractors should be valid on the last date of submission of bids. In case only the last date of submission of bids is extended, the enlistment of contractor should be valid on the original date of submission of bids. ***Joint ventures/Consortium and Special Purpose Vehicles are not allowed to tender.***

Contractors who fulfill the following criteria shall also be eligible to apply [7.2, 7.3 and 7.4 are not applicable for CPWD enlisted contractors of appropriate class. 7.1, and 7.5 is applicable for CPWD enlisted contractors also]:

7.1 Should have satisfactorily completed the works as mentioned below during the last Seven years ending last day of the month previous to the one in which tenders are invited:

- (i) Three similar works each costing not less than **Rs. 21.10 Crores** or two similar works each costing not less than **Rs. 31.60 Crores** or one similar work costing not less than **Rs. 42.14 Crores**.

“Similar Work” shall mean construction of or completing balance construction work of RCC/Composite framed structure building including civil and electrical services and Development work of 20 acre all executed under one agreement.

Note-1: For this purpose, “Cost of work” shall mean gross value of the completed work including the cost of materials supplied by the Government/Client, but excluding those supplied free of cost. This should be certified by an officer not below the rank of Executive Engineer / Project Manager or equivalent.

In case the certificate of work experience has been issued by any Pvt. Firm / Agency / Builder, the bidders will have to submit the documentary proof of the TDS (Form - 26AS) with income tax department to ensure actual value of work done.

The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum; calculated from the date of completion to previous day of last date of submission of tenders.

7.2 Should have had Average Annual Financial Turnover of Rs. 15.80 Crores on construction works during the last three years ending 31st March 2024 (Scanned copy of Certificate from CA with Unique Document Identification Number (UDIN) to be uploaded). The value of annual turnover figures shall be brought to the current value by enhancing the actual turnover figures at simple rate of 7% per annum.

7.3 Should not have incurred any loss (profit after tax should be positive) in more than two years during the available last five consecutive balance sheets (standalone financial statement), ending 31st March 2024

7.4 Should have a Banker's Certificate from a commercial Bank for Rs. 21.10 Crores or Net Worth certificate of minimum 10 % amount of estimated cost put to tender issued by certified chartered accountant with UDIN (Scanned copy of original to be uploaded).

7.5 Should have bidding capacity equal to or more than the estimated cost of the work put to tender. The bidding capacity shall be worked out by the following formula:

Bidding Capacity = {[AxNx1.5]-B} Where,

A = Maximum turnover in construction works executed in any one year during the last seven years taking into account the completed as well as works in progress. The value of completed works shall be brought to current costing level by enhancing at a simple rate of 7% per annum.

N = Number of years prescribed for completion of work for which bids have been invited.

B = Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited.

Notes:

1. The bidder should submit bidding capacity as per Form 'C-3'.
2. Bidding capacity is applicable for all the contractors including CPWD enlisted contractors.
3. Bidding capacity formula, for CPWD contractors who are enlisted based on rule 6.1.7 of Enlistment Rules-2022 i.e. government retired engineer/ architect for three years from the date of issue of enlistment order, is as follows: -

$$\text{Bidding Capacity} = \{[AxNx1.5]-B\}$$

Where,

A = Banker certificate figure as submitted by applicant (i.e. government retired engineer/ architect) at the time of enlistment for first year of enlistment and subsequent fresh bankers certificate for second and third year respectively. Value of A for first year will be mentioned in the enlistment order by the member secretary of advisory committee for enlisting authority.

N = Number of years prescribed for completion of work for which bids have been invited.

B = Value of existing commitments and on-going works to be completed during the period of completion of work for which bids have been invited. This value is for newly enlisted entity.

Within three years from the date of issue of enlistment order, the newly enlisted entity has to develop its own bidding capacity and thereafter the general bidding capacity formula being used for other entities shall be bidding capacity. Newly enlisted entity may like to follow general bidding capacity formula even before period of three years if it so chooses.

4. Bidding capacity, for CPWD contractors who are enlisted based on rules 9.6.3 & 9.6.4 of Enlistment Rules-2022 i.e. new entity based on previously enlisted entity for three years from date of issue of enlistment order, is as follows:

Annual turnover of newly enlisted entity shall be in proportion to the shareholding of partners/directors in the original enlisted entity at the time of enlistment of the newly enlisted entity.

Within three years from the date of issue of enlistment order, the newly enlisted entity has to develop its own bidding capacity and thereafter the general bidding capacity

formula being used for other entities shall be applicable to it for calculation of bidding capacity. Newly enlisted entity may like to follow general bidding capacity formula even before period of three years, if it so chooses.

Bidding Capacity for newly enlisted entity based on rules 9.6.3 & 9.6.4 enlistment rules -2022 shall be as follows: -

$$\text{Bidding Capacity} = \{[A' \times N \times 1.5] - B\}$$

Where,

A' = Proportionate share of newly enlisted director/partner in originally enlisted company/firm multiplied by the factor A, as given below. Value of A' will be mentioned in the enlistment order by member secretary of Advisory committee for Enlistment Authority, it will remain same for three years.

A = Maximum turnover in construction works executed in any one year during the last seven years taking into account the completed as well as works in progress. The value of completed works shall be brought to current costing level by enhancing at a simple rate of 7% per annum. This value is of originally enlisted entity at the time of enlistment of newly enlisted entity.

N = Number of years prescribed for completion of work for which bids have been invited.

B = Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited. This value is for newly enlisted entity.

5. Enlisted entities based on rules 6.1.7, 9.6.3 or 9.6.4 of enlistment rules-2022 can submit MoU from agency having requisite experience for structural system technology if the enlisted entity does not have required experience.

8.0 Evaluation Criteria:

8.1 The details submitted by the bidder will be evaluated in the following manner.

8.1.1 The initial criteria prescribed in para 7.0 above in respect of experience of eligible similar works completed, loss, Banker's certificate, financial turnover and bidding capacity etc. will first be scrutinized and the bidder's eligibility for the work be determined.

8.1.2 The bidders qualifying the initial criteria as set out in Para 7.0 above will be evaluated for following criteria by scoring method on the basis of details furnished by them.

(a) Financial strength (Form 'A' & 'B' or 'B-1')	Maximum	20	marks
(b) Experience in eligible similar nature of work	Maximum	20	marks

during last 7 years (Form 'C')

(c) Performance on works (Form 'D') Time Over Run	Maximum	20	marks
(d) Performance on works (Form 'D-1')-Quality	Maximum	40	marks
		Completed works (25 Marks) and ongoing works (15 Marks)	

Total		100 marks	

To become eligible for short listing, the bidder must secure at least 50% (Fifty percent) marks in each (section a, b, c, & d) and 60% (Sixty percent) marks in aggregate.

The department, however reserves the right to restrict the list of such qualified bidders to any number deemed suitable by it.

Note: The average value of performance of works for time over run and quality shall be taken on the basis of performance report of the eligible similar works.

8.1.3 Evaluation of Performance: -

Evaluation of the performance of contractor for eligibility shall be done by NIT approving authority or a committee constituted by him. All the eligible similar works executed and submitted by the bidder in support of eligibility and any one of the ongoing works, may be got inspected by a committee which may consists of client or any other authority as decided by NIT approving authority. The marks for the quality shall be given based on this inspection, if inspection is carried out.

Scoring method of evaluation: - The scoring for evaluation shall be done as given in Proforma – I.

9.0 **Financial Information:** Bidder should furnish the Annual financial statement for the last three years in Form 'A'. banker's certificate in Form 'B' or Networth Certificate in Form 'B1'.

10.0 Experience of similar works:

10.1 Bidder should furnish the list of eligible similar nature of works successfully completed during last seven years in Form 'C' and ongoing works as well (Form C-1).

11.0 Organization Information:

Bidder is required to submit the information in respect of his / her /their organization in

Form- 'E'.

12.0 Letter of Transmittal:

The Bidder should submit the letter of transmittal attached with the document.

13.0 Opening of Price Bid: After evaluation of applications, a list of short-listed agencies will be prepared. Thereafter the financial bids of only the qualified and technically acceptable bidders shall be opened at the notified time, date and place in the presence of the qualified bidders or their representatives.

14.0 Award criteria:

14.1 The employer reserves the right, without being liable for any damages or obligation to inform the bidder to:

14.1.1 Amend the scope of work and value of contract.

14.1.2 Reject any or all the applications without assigning any reason.

14.2 Any effort on the part of the bidder or his agent to exercise influence or to pressurize the employer would result in rejection of his bid. Canvassing of any kind is prohibited.

Criteria for Evaluation of the performance of contractors for Pre- Eligibility

S.N.	Attributes	Marks	Evaluation	
(a)	Financial Strength	(20 Marks)		
	(i) Average annual turnover (ii) Banker's or Networth Certificate	16 Marks 04 Marks	(i) 60% marks for minimum eligibility criteria (ii) 100% marks for twice the minimum eligibility criteria or more. (iii) In between (i) & (ii)- on pro-rata basis	
(b)	Experience in similar class of work	(20 marks)	(i) 60% marks for minimum eligibility criteria (ii) 100% marks for twice the minimum eligibility criteria or more. (iii) In between (i) & (ii)- on pro-rata basis	
(c)	Performance on works [Time Over run(TOR)]	(20 marks)		
	Parameter	Calculation for points	Score	Maximum Marks
	If TOR =		1.00 2.00 3.00 >3.50	
	(i) Without levy of compensation		20 15 10 10	<u>20</u>
	(ii) With levy of compensation		20 5 0 -5	
(iii) Levy of compensation not decided		20 10 0 0		
TOR = AT/ST, where AT =Actual Time; ST= Stipulated Time in the agreement plus (+) justified period of Extension of Time. Note: Marks for value in between the stages indicated above is to be determined by straight line variation basis.				
(d)	Performance of works (Quality) as per assessment in Form D-1		(40 Marks)	
	Completed works (max. 25 marks)	Ongoing works (max. 15 marks)	(Total Marks assessed)	

Section-III

LETTER OF TRANSMITTAL

From:

.....
.....

To

The Executive Engineer, CED-I,
Civil Construction Unit (CCU), MoEF&CC,
CGO Complex, Lodhi Road, New Delhi -110003
(email- eeced1ccu-mef@nic.in)

Subject: Submission of Bid for the work of **Development of Civil Infrastructure for National Referral Centre-Wildlife at Junagarh, Gujarat (Phase-1) on EPC Mode.**

Sir,

Having examined details given in bid document for the above work, I/we hereby submit the relevant information.

1. I/We hereby certify that all the statements made and information supplied in the enclosed forms A to I and accompanying statement are true and correct.
2. I/we have furnished all information and details necessary for eligibility and have no further pertinent information to supply.
3. I/we submit the requisite certified Banker's/Networth certificate and authorize the Executive Engineer, CED-I, Civil Construction Unit (CCU), MoEF&CC, CGO Complex, Lodhi Road, New Delhi to approach the Bank issuing the banker's/Networth certificate to confirm the correctness thereof. I/We also authorize the Executive Engineer, CED-I, Civil Construction Unit (CCU), MoEF&CC, CGO Complex, Lodhi Road, New Delhi to approach individuals, employers, firms and corporation to verify our competence and general reputation.
4. I/we submit the following certificates in support of our suitability, technical knowledge and capability for having successfully completed the following eligible similar works:

S.No.	Name of Work	Certificate From

5. If we hereby submit undertaking on structural stability and soundness as per prescribed format Form 'I'.

Certificate: It is certified that the information given in the enclosed eligibility bid are correct. It is also certified that I/We shall be liable to be debarred, disqualified/ cancellation of enlistment in case any information furnished by me/us found to be incorrect.

Enclosures:

Seal of bidder:

Date of submission

Signature(s) of bidder(s)

FORM 'A'

FINANCIAL INFORMATION

Name of the firm / Bidder-

- I. Financial Analysis-Details to be furnished duly supported by figures in balance sheet/ profit & loss account for the last five financial years duly certified by the Chartered Accountant, as submitted by the applicant to the Income Tax Department (Copies to be attached).

Sl. No.	Particulars	Financial Years				
		2019-20	2020-21	2021-22	2022-23	2023-24
i)	Gross Annual Turnover on construction works					
ii)	Profit / Loss (standalone financial statement and consolidated financial statement both)					

- II. Financial arrangements for carrying out the proposed work.

Signature of Chartered Accountant with Seal

SIGNATURE OF BIDDER(S)

BANKERS' CERTIFICATE FROM A COMMERCIAL BANK

This is to certify that to the best of our knowledge and information that M/s./Shri..... having marginally noted address, as a customer of our bank are / is respectable and can be treated as good for any engagement up to a limit of Rs. (Rupees.....).

This certificate is issued without any guarantee or responsibility on the bank or any of the officers.

(Signature)

For the bank

NOTE: (1) Bankers certificate should be on letter head of the Bank, addressed to the Executive Engineer, CED-I, Civil Construction Unit (CCU), Ministry of Environment, Forest & Climate Change (MoEF&CC), CGO Complex, Lodhi Road, New Delhi -110003 (**email- eeced1ccu-mef@nic.in**)

(2) In case of partnership firm, certificate should include names of all partners as recorded with the Bank.

**FORM FOR CERTIFICATE OF NET WORTH FROM CHARTERED
ACCOUNTANT**

"It is to certify that as per the audited balance sheet and profit & loss account during the financial year, the Net Worth of M/s (Name & Registered Address of individual/firm/ company), as on (the relevant date) is Rs..... after considering all liabilities. It is further certified that the Net Worth of the company has not eroded by more than 30 % in the last three years ending on (the relevant date)."

Unique Document Identification Number (UDIN)

Signature of Chartered Accountant

Name of Chartered Accountant

Membership No. of ICAI

Date and Seal

FORM 'C'

DETAILS OF ELIGIBLE SIMILAR NATURE OF WORKS COMPLETED DURING THE LAST SEVEN YEARS ENDING LAST DAY OF THE MONTH PREVIOUS TO THE ONE IN WHICH TENDERS ARE INVITED

Sl. No.	Name of work/ project and location	Owner or sponsoring organization	Cost of work in crores of rupees	Date of commencement as per contract	Stipulated date of completion	Actual date of completion	Litigation/ arbitration cases pending/ in progress with details*	Name and address / telephone number of officer to whom reference may be made	Whether the work was done on back-to-back basis Yes/No
1	2	3	4	5	6	7	8	9	10

* Indicate gross amount claimed and amount awarded by the Arbitration Tribunal.

Signature of Bidder(s)

FORM 'C-1'

PROJECTS UNDER EXECUTION

Sl. No.	Name of work/ project and location	Owner or sponsor- ing organiza tion	Cost of work in crores of rupees	Date of commencement as per contract	Stipulated date of completion	Upto date percentage progress of works	Slow progress if any and reasons thereof	Name and address / telephone number of officer to whom reference may be	Remarks
1	2	3	4	5	6	7	8	9	10

Signature of Bidder(s)

FORM 'C-2'

Calculation of Bidding Capacity

Details of existing commitments and ongoing works

Sl. No.	Name of work/ project and location	Owner or sponsoring organization	Contract value in crores of rupees	Date of commencement as per contract	Stipulated date of completion	Upto date percentage progress of work	Remaining work in percentage (100-column 7)	Existing commitment (column 4 x column 8/100)	Name and address / telephone number of officer to whom reference may be made	Remarks
1	2	3	4	5	6	7	8	9	10	11

Total (B)=

Maximum Turnover in last seven years = Rs.

Updated value of turnover (A) = Rs.

No. of years (N) =.....

Bidders Capacity = {[AxNx1.5]-B} =

Certificate : I certify that all the awarded and ongoing works have been included in the above list.

Signature of Bidder(s)

FORM 'D'

PERFORMANCE REPORT OF WORKS REFERRED TO IN FORMS 'C'

1. Name of work/project & location :
2. Agreement no. :
3. Estimated cost :
4. Tendered cost :
5. Date of start :
6. Date of completion
- (i) Stipulated date of completion :
- (ii) Actual date of completion :
7. Amount of compensation levied for delayed Completion, if any
- (a) Whether case of levy of compensation for delay has been decided or not? : Yes / No
- (b) If decided, amount of compensation levied for delayed completion, if any. :
8. Amount of reduced rate items, if any :
9. Performance Report :
- (1) Quality of work : Outstanding/Very Good/Good/Poor
- (2) Financial soundness : Outstanding/Very Good/Good/Poor
- (3) Technical Proficiency : Outstanding/Very Good/Good/Poor
- (4) Resourcefulness : Outstanding/Very Good/Good/Poor
- (5) General Behavior : Outstanding/Very Good/Good/Poor

Dated:

Executive Engineer or Equivalent

FORM 'D-1'

Assessment of Quality for Completed as well as on-going Works

Name of work:

Date of inspection:

Date of submission of report:

A.	General Observation & Operational aspects	Yes/ No
1.	Availability of approval from local bodies in case of construction of private buildings.	
2.	Availability of approved structural drawings	
3.	Observation on seepage/ leakage in the building	
4.	Whether line & level maintained	
5.	In case of basement, observation on seepage, if any	
6.	Any structural defects/ distress observed. If yes give details	
7.	Whether safety measures adopted at site as per CPWD Safety Code and or govt. guidelines are adequate or not	
8.	Whether the welfare facilities provided to labour as per clause 19 H of GCC for CPWD works/ and or govt. guidelines are adequate or not.	
9.	Whether AHU getting automatically switched off and fire dampers closed in case of fire signal	
10.	Whether thimbles used for termination of wires in DBs, EBDs & panels?	
B.	Quality of work	Marks Assessed
1.	Quality of plaster/ finishing	
2.	Quality of RCC/ CC work	
3.	Quality of flooring	
4.	Quality of wood work	
5.	Quality of steel work/ aluminum work	
6.	Quality of plumbing and sanitary installation	
7.	Quality of Workmanship	
8.	Quality of waterproofing	
9.	If cladding done, observation on efficiency/ quality of cladding/ brick work	
10.	Quality of internal electrification work	
11.	Quality of DBs, EBDs & panels?	
12.	Quality of E&M equipments, panels & feeder pillar	
13.	Quality of fire alarm system/ firefighting system	
14.	Quality of Air Conditioning work	

15.	Quality of Sub-station based on complete live diagram, capacitor panel, power factor, insulating Mat, cleanliness, cable termination, earthing pits, earthing of transformer / DG sets	
16.	Any other aspects (To be elaborated)	

Average marks (To be awarded out of 100 marks based on average of marks assessed on each attribute mentioned at B above).

Note:

1. All the above parameters may be considered for assessing the overall quality of work executed by the contractor. Each attribute shall be assessed on maximum marks of 10 under B above.
2. In case, any attribute is not applicable, the same may not be included in assessment and mentioned are not applicable (N/A)
3. The works as assessed above shall be converted on a scale of 25/15 marks for completed/ongoing works respectively.
4. In case of eligible completed works being more than one the average marks assigned for eligible completed works shall be considered for marking purpose. Only one ongoing work to be assessed.

STRUCTURE & ORGANIZATION

1.	Name & Address of the bidder	
2.	Telephone No. / Email id /Telex No./Fax No.	
3.	Legal status of the bidder (scan & upload copies of original document defining the legal status).	
	a) An Individual	
	b) A proprietary firm	
	c) A firm in partnership	
	d) A limited company or Corporation	
4.	Particulars of registration with various Government bodies (scan & upload attested photo-copy).	
	ORGANIZATION/PLACE OF REGISTRATION	REGISTRATION No.
	1.	
	2.	
	3.	
5.	Names and Titles of Directors & Officers with designation to be concerned with this work.	
6.	Designation of individuals authorized to act for the organization.	
7.	Has the bidder, or any constituent partner in case of partnership firm/ limited company/ joint venture, ever been convicted by the court of law? If so, give details.	
8.	In which field of Civil Engineering Construction, the bidder has specialization and interest?	
9.	Any other information considered necessary but not included above.	

Signature of bidder(s) with stamp

**PROFORMA FOR THE RECEIPT TO BE ISSUED BY THE EXECUTIVE ENGINEER
RECEIVING THE EMD**

Receipt of deposition of original EMD (drawn in favour of Executive Engineer, CED-I, CCU, MoEF&CC, New Delhi) (Receipt No. / date.....)	
Name of work	: Development of Civil Infrastructure for National Referral Centre-Wildlife at Junagarh, Gujarat (Phase-1) on EPC Mode.
NIT No	: 02/2024-25/CE/CCU/CED1/JUNAGARH
Estimated Cost	: Rs. 52.58 Crore
Amount of Earnest Money Deposit	: Rs. 62.58 Lakh
Last date of submission of bid	:
To be filled by EMD receiving Executive Engineer	
Name of contractor	:
Form of EMD	:
Amount of Earnest Money Deposit	:
Date of Submission of EMD	:
	(Signature) Name and Designation of EMD receiving officer (EE/AE(P)/AO/AAO) along with office stamp

(On non-judicial stamp paper of minimum Rs. 100)

(Guarantee offered by Bank to CCU in connection with the execution of contracts)

Form of Bank Guarantee for Earnest Money Deposit /Performance Guarantee/Security Deposit

1. Whereas the Executive Engineer (name of division), CCU on behalf of the President of India (hereinafter called "The Government") has invited bids under(NIT number)..... dated for (name of work) The Government has further agreed to accept irrevocable Bank Guarantee for Rs. (Rupees only) valid upto (date)*..... as Earnest Money Deposit from (name and address of contractor)(hereinafter called "the contractor") for compliance of his obligations in accordance with the terms and conditions of the said NIT.

OR**

Whereas the Executive Engineer (name of division), CCU on behalf of the President of India (hereinafter called "The Government") has entered into an agreement bearing number with(name and address of the contractor) (hereinafter called "the Contractor") for execution of work(Name of work) The Government has further agreed to accept an irrevocable Bank Guarantee for Rs. (Rupees only) valid upto (date)..... as Performance Guarantee/Security Deposit from the said Contractor for compliance of his obligations in accordance with the terms and conditions of the agreement.

2. We, (indicate the name of the bank) (herein after referred to as "the Bank"), hereby undertake to pay to the Government an amount not exceeding Rs. (Rupees..... only) on demand by the Government within 10 days of the demand.

3. We,(indicate the name of the Bank), do hereby undertake to pay the amount due and payable under this guarantee without any demur, merely on a demand from the Government stating that the amount claimed is required to meet the recoveries due or likely to be due from the said Contractor. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs.(Rupeesonly).

4. We, (indicate the name of the Bank), further undertake to pay the Government any money so demanded notwithstanding any dispute or disputes raised by the contractor in any suit or proceeding pending before any Court or Tribunal, our liability under this Bank Guarantee being absolute and unequivocal. The payment so made by us under this Bank Guarantee shall be a valid discharge of our liability for payment there under and the Contractor shall have no claim against us for making such payment.

5. We, (indicate the name of the Bank), further agree that the Government shall have the fullest liberty without our consent and without affecting in any manner our obligation here under to vary any of the terms and conditions of the said agreement or to extend time of performance by the said Contractor from time to time or to postpone for any time or from time to time any of the powers exercisable by the Government against the said contractor and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation or extension being granted to the said Contractor or for any forbearance, act of omission on the part of the Government or any indulgence by the Government to the said Contractor or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.
6. We, (indicate the name of the Bank)....., further agree that the Government at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor at the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee the Government may have in relation to the Contractor's liabilities.
7. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor.
8. We, (indicate the name of the Bank), undertake not to revoke this guarantee except with the consent of the Government in writing.
9. This Bank Guarantee shall be valid up to unless extended on demand by the Government. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to Rs. (Rupees only) and unless a claim in writing is lodged with us within the date of expiry or extended date of expiry of this guarantee, all our liabilities under this guarantee shall stand discharged.

Date

Witnesses:

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Signature.....
Name and address
Designation 2. Signature
Name and address | <p>Authorized signatory
Name
Staff code no.</p> <p>Bank seal</p> |
|---|--|

*Date to be worked out on the basis of validity period of 180 days from the date of submission of tender.

**In paragraph 1, strike out the portion not applicable. Bank Guarantee will be made either for earnest money or for performance guarantee/security deposit/mobilization advance, as the case may be.

UNDERTAKING FOR SIMILAR WORKS(S)

I/We undertake and confirm that eligible similar works(s) has/have not been got executed through another contractor on back-to-back basis. Further that, if such a violation comes to the notice of Department, then I/we shall be debarred for bidding in CCU in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Earnest Money Deposit/Performance Guarantee.

(Note: Scanned copy of this affidavit to be uploaded by bidder(s) at the time of submission of bid.)

Signature of bidder(s) with stamp

UNDERTAKING ON STRUCTURAL STABILITY AND SOUNDNESS OF ALREADY COMPLETED BUILDINGS AND INFRASTRUCTURE PROJECTS

I/we undertake and confirm that any building / infrastructure constructed by our firm /partnership firm/ company has not suffered any failure, making it unfit for intended use, either due to structural design and defects or due to use of sub-standard materials or execution of sub-standard work, poor workmanship or any other reason during the last 25 (twenty-five) years.

I/we, further, undertake that if such information comes to the notice of CCU then Engineer-in-Charge shall be free to terminate the bid/agreement and to forfeit the entire amount of earnest money deposit, performance guarantee and security deposits.

I/we, also undertake that in addition to above, the Engineer-in-Charge shall be free to debar us forever from tendering in department.

The decision of Engineer-in-Charge or any higher authority shall be final and binding.

Signature of Notary with seal

Signature of bidder or
an authorized person of the firm with stamp

Note: Affidavit shall be furnished on a 'non-judicial' stamp paper of Rs. 200/- (scanned copy of the notarized affidavit shall be uploaded at the time of submission of bid).

PROFORMA OF AFFIDAVIT FOR NON - BLACK LISTING

I/we undertake and confirm that our firm / partnership firm has not been blacklisted by any state /Central Departments /PSUs /Autonomous bodies during the last 7 years of its operations. Further that, if Such information comes to the notice of the department, then I / we shall be debarred for bidding in CCU in future forever. Also, if Such information comes to the notice of department on any day before date of start of work, the Engineer-in-charge shall be free to cancel the agreement and to forfeit the entire amount of Earnest Money Deposit/ Performance Guarantee (**Scanned copy of this notarized affidavit to be uploaded at the time of submission of bid**)

NOTE: Affidavit to be furnished on a ‘non-judicial’ stamp paper worth Rs.100/-

Signature of Bidder(s)
or an authorized person of the firm with stamp

Signature of Notary with seal

**GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FORESTS & CLIMATE CHANGE**

PERCENTAGE RATE EPC TENDER AND CONTRACT FOR WORKS

Tender and Contract for Works on EPC Mode

Tender for the work of “**Development of Civil Infrastructure for National Referral Centre-Wildlife at Junagarh, Gujarat (Phase-1) on EPC Mode.**”

- i) To be uploaded by 03:00 PM hours on 17.03.2025 to/upload at
- ii) To be opened in presence of tenderers who may be present at 03:30 PM hours on 17.03.2025 in the office of in the office of the Executive Engineer, CED-I, CCU, New Delhi.

**To be filled by EE, CED-I

TENDER

I/We have read and examined the notice inviting tender, schedule A, D, E & F Specifications, Drawings & Designs, General Rules and Directions, Conditions of Contract, clauses of contract, Special conditions, Schedule of Rates, other documents, regulations, Acts and Rules referred to in the conditions of contract and all other contents in the tender document for the work.

I/We hereby tender for the planning, designing and execution of the work as per scope mentioned in this tender document specified for the President of India within the time specified in Schedule 'F' viz., schedule of quantities and in accordance in all respect with the applicable municipal byelaws , regulations, Acts, NGT guidelines, specifications, designs, drawing and instructions in writing referred to in Rule-1 of General Rules and Directions and in Clause 11 of the Conditions of contract and with such materials as are provided for, by, and in accordance with, such conditions so far as applicable.

I/We agree to keep the tender open for acceptance for 75 days from the date of opening of technical bid and not to make any modifications in its terms and conditions.

I/We have deposited EMD for the prescribed amount in the office of concerned Executive Engineer as per the bid document.

A copy of earnest money deposit receipt of prescribed amount deposited in the form of Insurance Surety Bonds, Account Payee Demand Draft, Fixed Deposit Receipt, Banker's Cheque or Bank Guarantee (as prescribed) issued by a Commercial Bank, is scanned and uploaded (strike out as the case may be). If I/We, fail to furnish the prescribed performance guarantee within prescribed period, I/We agree that the President of India or his successors, in office shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely.

Further, if I/We fail to commence work as specified, I/ We agree that President of India or the successors in office shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said performance guarantee absolutely. The said Performance Guarantee shall be a guarantee to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to those in excess of that limit at the rates to be determined in accordance with the provision contained in Clause 12 of the tender form. Further, I/We agree that in case of forfeiture of Earnest Money or Performance Guarantee as aforesaid, I/We shall be debarred for participation in the re-tendering process of this work.

I/We undertake and confirm that eligible similar work(s) has/have not been got executed through another contractor on back-to-back basis. Further that, if such a violation comes to the notice of department, then I/We shall be debarred for tendering in CPWD as per enlistment rules applicable. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-charge shall be free to forfeit the entire amount of Earnest Money Deposit/Performance Guarantee.

I/We hereby declare that I/We shall treat the tender documents, drawings and other records connected with the work as secret/confidential documents and shall not communicate information derived there from to any person other than a person to whom I/We am/are authorized to communicate the same or use the information in any manner prejudicial to the safety & integrity of the State.

Dated: _____
Witness: _____

Signature of contractor _____
Postal Address _____**

Address:
Occupation:

** To be filled by Bidder

ACCEPTANCE

The above tender (as modified by you as provided in the letters mentioned hereunder) is accepted by me for and on behalf of the President of India for a sum of Rs.....
(Rupees.....
.....)

The letters referred to below shall form part of this contract agreement: -

- (a) _____*
- (b) _____*
- (c) _____*

For & on behalf of President of India

Signature.....*

Dated: _____*

Designation*

* To be filled by Executive Engineer

SCHEDULES (A to F)
(For Civil & Electrical Component)

SCHEDULE ‘A’

Schedule of work As per contract document

SCHEDULE ‘D’

Extra schedule for specific requirement/
document for the work, if any. As per contract document

SCHEDULE ‘E’

Reference to General : CPWD General Conditions of Contract, 2024 for EPC
Conditions of contract Projects as amended / modified upto last date of
submission of bid.

Name of Work : **Development of Civil Infrastructure for National
Referral Centre-Wildlife at Junagarh, Gujarat
(Phase-1) on EPC Mode.**

Estimated cost of work : **Rs. 52.58 Crores**

Earnest Money : **Rs. 62.58 Lakh** (To be returned after receiving
performance guarantee)

Performance Guarantee : 5 % of accepted tendered value

Security deposit : 2.5 % of accepted tendered value

SCHEDULE ‘F’

GENERAL RULES & DIRECTIONS:

Officer inviting tender : The Executive Engineer, CED-I,
Civil Construction Unit (CCU), MoEF&CC,
CGO Complex, Lodhi Road, New Delhi -110003

Applicable mode of EPC contract : Mode-I

Type of Building : Permanent

List of approved construction : NA
technologies

Definitions:			
2(vi)	Engineer-in-Charge	:	The Executive Engineer, CED-I, Civil Construction Unit (CCU), MoEF&CC, CGO Complex, Lodhi Road, New Delhi -110003 or his legal successor or Assignee thereof.
2(viii)	Accepting Authority	:	The Chief Engineer, Civil Construction Unit (CCU), MoEF&CC, CGO Complex, Lodhi Road, New Delhi -110003 or his legal successor or Assignee thereof.
2(x)	Percentage on cost of materials and Labour to cover all overheads and profits	:	15%
2(x)(b)	Standard Schedule of Rates	:	DPAR, 2023 amended / modified upto last date of submission of bid DSR 2024 volume I & II, corrected up to last date of submission of bid for civil work DSR 2022 corrected up to last date of submission of bid for Elect. Work
2 (xi)	Department:	:	Civil Construction Unit, Ministry of Environment, Forest & Climate Change, Government of India.
9 (ii)	Standard CPWD contract form CPWD General Conditions of Contract, 2024 for EPC Projects amended / modified upto last date of submission of bid	:	CPWD-EPC
16	Price Preference to SC/ST individual contractor is valid upto	:	Last date of Bid Submission.
Clause 1			
(i)	Time allowed for submission of Performance Guarantee, Programme chart (time and progress) and applicable labour licenses, registration with EPFO, ESIC and BOCW Welfare Board or proof of applying thereof from the date of issue of letter of acceptance.	:	07 days

(ii)	Maximum allowable extension with late fee @ 0.1 % per day of performance guarantee amount beyond the period provided in (i) above	:	03 days
Clause 2			
Authority for fixing compensation under clause 2:		:	Superintending Engineer, Civil Construction Unit (CCU), MoEF&CC, CGO Complex, Lodhi Road, New Delhi -110003 or his legal successor or Assignee thereof.
Clause 5			
(i)	Authority to convey the decision of shifting of milestone and extension of time.	:	The Executive Engineer, CED-I, Civil Construction Unit (CCU), MoEF&CC, CGO Complex, Lodhi Road, New Delhi -110003
(ii)	Authority to decide rescheduling of milestone and extension of time.	:	Superintending Engineer, Civil Construction Unit (CCU), MoEF&CC, CGO Complex, Lodhi Road, New Delhi -110003 or his legal successor or Assignee thereof.
(iii)	Shifting of date of start in case of delay in handing over of site.	:	Superintending Engineer, Civil Construction Unit (CCU), MoEF&CC, CGO Complex, Lodhi Road, New Delhi -110003 or his legal successor or Assignee thereof.
Time allowed for execution of work		:	18 Months
Numbers of days from date of issue of letter of acceptance for reckoning date of start		:	10 days

TABLE OF MILE STONE (S)

S. N.	Description of Milestone	Time Allowed in days (from stipulated date of start)	Amount to be with held in case of non achievement of mile stone
1.	Work done amounting to 8% of accepted tender amount (Civil+Electrical/ Mechanical)	3 months	0.8 % of the Accepted tendered value.
2.	Work done amounting to 20% of accepted tender amount (Civil+Electrical/ Mechanical)	6 months	0.8 % of the Accepted tendered value.

3.	Work done amounting to 40% of accepted tender amount (Civil+Electrical/Mechanical)	9 months	0.8 % of the Accepted tendered value.
4.	Work done amounting to 70% of accepted tender amount (Civil+Electrical/Mechanical)	12 months	0.8 % of the Accepted tendered value.
5.	Work done amounting to 90% of accepted tender amount (Civil+Electrical/Mechanical)	15 months	0.8 % of the Accepted tendered value.
6.	All Civil, Electrical & Mechanical work complete in all respect, obtaining NOC from Fire deptt & occupancy certificate from local bodies. (100% complete in all respect)	18 months	1.0 % of the Accepted tendered value.

Note: - With held amount shall be released if and when subsequent milestone is achieved within respective time specified. However, in case milestones are not achieved by the Bidder for the work, the amount shown against milestone shall be withheld.

Monthly recovery for delay in submission of the monthly progress report within specified period - not exceeding **Rs. 2000/-** per month for each month default.

PROFORMA OF SCHEDULES

Schedule of handing over of site		
Part	Portion of site	Time period for handing over reckoned from date of issue of letter of intent
Part A	Portion without any hindrance	On commencement date or date of start of work by the Engineer-in-Charge.
Part B	Portions with encumbrances	NA
Part C	Portions dependent on work of other agencies	NA

Schedule of issue of Designs	:	Not Applicable
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Clause 7

Gross work to be done together with net payment /adjustment of advances for material collected, if any, since the last such payment for being eligible to interim payment:	:	Rs. 2.5 Crores (Civil) Rs. 50 Lakhs (Electrical) <i>*Except for initial three running account bills & Final Bill.</i>
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Clause -7A Whether clause 7A shall be applicable	YES
Clause 8	
Detail of building/infrastructure project to be completed early for use:	
Name of building/infrastructure project to be completed	Remarks
NA	NA
Clause -8A Authority to decide compensation on account if contractor fails to submit completion plans	Superintending Engineer, Civil Construction Unit (CCU), MoEF&CC, CGO Complex, Lodhi Road, New Delhi -110003 or his legal successor or Assignee thereof
Clause 10A	
List of testing equipment to be provided by the contractor at site lab.	: (As per Table '1' given)
Clause 10B (ii) Whether Clause 10 B (ii) shall be applicable	: Yes
Clause 10B (iii) Whether Clause 10 B (iii) shall be applicable	: Yes

Clause 10CC

Applicable

A) For construction period		
S.N.	Relevant component of Material /Labour for price escalation	Percentage of total value of work
1	Component of Cement	12%
2	Component of Labour	22%
3	Civil component of the other construction materials	27 %
4	Electrical and Mechanical (E&M) Component of Construction Materials	20 %
5	Components of POL (Diesel)	4%
6	Reinforcement steel bars/ TMT bars/Structural steel (including strands and cables)	15%
	Total	100 %

Clause 11

Specifications to be followed for execution of work (for civil work)	:	<ol style="list-style-type: none">1. Civil work: CPWD Specifications 2019 Volume- I & II.2. MORTH Specifications for Roads and Bridge work.
Specifications to be followed for execution of work (for Electrical work)	:	<p>Electrical & Other works (amended upto date):</p> <ol style="list-style-type: none">1. CPWD General Specification for Electrical Works Part I Internal–2013.2. General Specification for Electrical Works (Part III Lifts & Escalators)-2003.3. CPWD General Specification for Electrical Works Part IV Substation-2013.4. CPWD General Specification for Electrical Works Part V Wet riser and sprinkler system-2020.5. CPWD General Specification for Electrical Works Part VI fire detection and alarm system- 2018.6. CPWD General Specification for Electrical Works Part VII DG Sets– 20137. CPWD General Specification for Electrical Works Part VIII Gas Based Fire Extinguishing System– 2013.8. General Specification for Heating Ventilation & Air-Conditioning-2017.9. CPWD specification of Horticulture & Landscaping – 2018.10. CPWD General Specification for Medical Gas Pipe System 202211. CPWD General Specification for Modular operation Theater. 202212. CPWD General Specification for Nurse Call System 2022

All the afore stated specifications shall be read with updated correction slips issued till last date of submission of bid.

Clause 12

Deviation limit beyond which clauses 12.2 and 12.3 applies for all type of works

In case there is any change in scope as defined in the contract, the contractor shall carry out the changes as per direction of Engineer in Charge and nothing extra shall be payable to the contractor on account of same if the additional cost of such work is up to 0.25% (zero-point two five percent) of the accepted tendered amount.

Clause 16

Competent Authority for deciding reduced rates : Superintending Engineer, Civil Construction Unit (CCU), MoEF&CC, CGO Complex, Lodhi Road, New Delhi-110003 or his legal successor or Assignee thereof

Clause 19 C Penalty for each default	:	Rs. 500/-
Clause 19 D Penalty for each default	:	Rs. 500/-
Clause 19 G Penalty for each default Enhanced penalty per day for continuous default	:	Rs. 500/- Rs. 500/-
Clause 19 K Penalty for each default	:	Rs. 500/-

Clause 25

(i)	Conciliator	:	Superintending Engineer, Civil Construction Unit (CCU), MoEF&CC, CGO Complex, Lodhi Road, New Delhi-110003 or his legal successor or Assignee thereof	
(ii)	Arbitrator Authority	Appointing	:	Chief Engineer, Civil Construction Unit (CCU), MoEF&CC, CGO Complex, Lodhi Road, New Delhi -110003 or his legal successor or Assignee thereof
(iii)	Place of Arbitration	:	Delhi	

Clause 32 (i) Requirement of Technical Representative(s) and Recovery Rates:

S. N.	Minimum Qualification of Technical Representative	Discipline	Designation (Principal Technical/ technical representative)	Minimum Experience (Years)	Number	Rate at which recovery shall be made from the contractor in the event of not fulfilling Provision of clause 32 (i)
						Figures
1	Graduate Engineer	Civil	Project manager with degree in civil engineering	20 (and having experience of one similar nature of work)	1	Rs.1,50,000/- per Month
2	Graduate Engineer	Civil	Deputy Project Manager	12 (and having experience of one similar nature of work)	1	Rs.1,00,000/- per Month
3	Graduate Engineer	Electrical	Deputy Project Manager	12 (and having experience of one similar nature of work)	1	Rs.1,00,000/- per Month
3	Graduate Engineer Or Diploma Engineer	Civil	Project/Site Engineer	5 or 10 respectively	1	Rs. 50000/- Per month
	Graduate Engineer Or Diploma Engineer	Electrical	Project/Site Engineer	5 or 10 respectively	1	Rs. 50000/- Per month
4	Graduate Engineer	Civil	Quality Engineer	8	1	Rs. 70000/- Per month
	Graduate Engineer	Electrical	Quality Engineer	8	1	Rs. 70000/- Per month
5	Diploma Engineer	Civil	Surveyor	8	1	Rs. 50000/- Per month
6	Graduate Engineer	Civil	Project Planning/ Billing	6	1	Rs. 60000/- Per month
	Graduate Engineer	Electrical	Project Planning/ Billing	6	1	Rs. 60000/- Per month

Assistant Engineers retired from Government services that are holding Diploma will be treated at par with Graduate Engineers. Diploma holder with minimum 10-year relevant experience with a reputed construction co. can be treated at par with Graduate Engineers for the purpose of such deployment subject to the condition that such diploma holders should not exceed 50 % of requirement of degree engineers.

Clause 38

(i)	(a)	Schedule/statement for determining theoretical quantity of cement & bitumen on the basis of (for civil work)		Delhi Schedule of Rates 2023 printed by C.P.W.D. with upto date correction slip upto last date of bid submission.
		Schedule/statement for determining theoretical quantity of cement & bitumen on the basis of (for Electrical work)		Delhi Schedule of Rates 2022 printed by C.P.W.D. with upto date correction slip upto last date of bid submission.
(ii)		Variations permissible on theoretical quantities:		
	(a)	Cement	:	3 % plus/minus.
	(b)	Bitumen All Works	:	2.5% plus only & nil on minus side.
	(c)	Steel Reinforcement and structural steel sections for each diameter, section and category	:	2% plus/minus variation
	(d)	All other materials.	:	Nil

RECOVERY RATES FOR QUANTITIES BEYOND PERMISSIBLE VARIATION

S.No.	Description of Item	Rates in figures and words at which recovery shall be made from the Contractor	
		Excess beyond permissible variation	Less use beyond permissible variation
1.	Cement (PPC)	Nil	Not allowed. Substandard work will be rejected.
2.	Reinforcement Steel	Nil	
3.	Structural Steel	Nil	

Executive Engineer, CED-I,
Civil Construction Unit (CCU), MoEF&CC,
CGO Complex, Lodhi Road, New Delhi -110003

Table - 1**Equipment's for Testing of Materials & Concrete at Site Laboratory**

All necessary equipment for conducting all necessary tests shall be provided at the site in the well-furnished site laboratory of minimum size 25 feet X 15 feet by the contractor at his own cost The following minimum laboratory equipment's shall be set up at site office laboratory: -

Sl. No.	Equipment	Numbers (Minimum)
1.	100MT compression testing machine, electrical-cum-manually operated)	1
2.	Slump cone, steel plate, tamping rod, steel scale, scoop	3
3.	Pumps and pressure gauges for hydraulic testing of pipes	2
4.	Weighing scale platform type 100 Kg capacity	1
5.	Graduated glass measuring cylinder	As per requirement
6.	Sets of sieves of 450mm internal dia for coarse aggregate [100mm, 80mm, 40mm; 20mm; 12.5mm, 10mm; 4.75mm complete with lid and pan.	1
7.	Sets of sieves of 200mm internal dia for fine aggregate [4.75mm; 2.36mm; 1.18mm; 600 microns; 300 microns & 150 micron, with lid and pan]	1
8.	Sieve Brushes and sieve shaker capable of 200mm and 450 mm diasieves, manually operated with timing switch assembly	1
9.	Cube moulds size 70mmx70mmx70mm	12
10.	Cube moulds size 150mmx150mmx150mm	15
11.	Hot air oven temp. Range 50°c to 300°c- sensitivity 1 degree	1
12.	Electronic balance	1
13.	Physical balance weight upto 5 kg	1
14.	Air Content of concrete testing machine	As per requirement
15.	Measuring jars 100ml, 200ml, 500ml	3 nos. each size
16.	Spatula 100mm & 200mm with long blade wooden handle	3
17.	Digital Verniercalipers150 mm , 200mm , 300 mm	1 each
18.	Digital PH meter	1
19.	Digital Micrometer	1
20.	Digital paint thickness meter for steel 500 micron Range	1
21.	GI tray 600x450x50mm, 450x300x40mm,300x250x40mm	1 no. each
22.	Electric Motor mixer 0.25 cum capacity	1
23.	Digital rebound hammer	1
24.	Screw gauge 0.1mm-10mm, North count 0.05 mm	1
25.	Water testing kit	1
26.	Motorized sieve shaker	1
27.	Extra Bottom plates for 15 cm cube mould	5
28.	Standard Vibration Table	1

Sl. No.	Equipment	Numbers (Minimum)
29.	Concrete temperature measuring thermometer with Brass protection sheath 0- 100 degree centigrade	1
30.	Dial type spring balance preferable with zero correction knob capacity 100 kgs. reading to ½ kg.	1
31.	Counter scale capacity 1 kg and 10 kg	1
32.	Iron Weight of 5 kg, 2 kg, 1 kg, 500 gm, 200 gm, 100 gm	As per actual requirement.
33.	Brass Weight of 50 gm, 20 gm, 10 gm, 5 gm, 2 gm, 1 gm	
34.	Measuring cylinder TPX or Poly propylene capacity 100 ml, 500 ml, 250 ml	
35.	Set of box spanner ratchet	
36.	Hammer 1lb& 2lb	
37.	Hacksaw with 6 blades	
38.	Measuring tape 3 meter, 5 meter, 10 meter, 30 meter	
39.	Shovels & Spade	
40.	Steel plates 5 mm thick 75x75 cm	
41.	Plastic or G.I. Buckets 15 ltr, 10 ltr, 5 ltr	
42.	Vernier calipers	
43.	Micrometer screw 25 mm gauge	
44.	A good quality plumb bob	
45.	Spirit level, minimum 30 cms long with 3 bubbles for horizontal vertical	
46.	Wire gauge (circular type) disc	
47.	Foot rule	
48.	Long nylon thread	
49.	Rebound hammer for testing concrete	
50.	Dynamic penetrometer	
51.	Magnifying glass	
52.	Screw driver 30 cms long	
53.	Ball pin hammer, 100 gm	
54.	Plastic bags for taking samples	
55.	Moisture meter for timber	
56.	Any other equipment for site tests as outlined in BIS codes and as directed by the Engineer-in-charge.	

Table – 2

PLANT AND EQUIPMENT REQUIRED TO BE OWNED / TAKEN ON LEASE BY THE CONTRACTOR

Sl. No.	Equipment	Numbers
1.	Builder's Hoist	1
2.	Centralized concrete batch mix plant of capacity 30 cum per hour (fully automatic with computer control)	1
3.	Excavator cum loader (JCB 3D model or equivalent).	1
4.	Compressor machine minimum 20 CFM with rock Breaker.	1
5.	DG set of minimum capacities of 62.5 KVA.	As per requirement
6.	Transit mixers.	As per requirement
7.	Concrete pump	As per requirement
8.	Needle Vibrators.	5
9.	Screed leveller.	As per requirement
10.	Plate Vibrator	As per requirement
11.	Dumper/Tipper	As per requirement
12.	Reinforcement bending machine.	As per requirement
13.	Reinforcement cutting machine.	As per requirement
14.	Power driven earth rammer (Soil compactor).	As per requirement
15.	Total Station Machine.	1
16.	Water tanker (Minimum capacity of 5000 liters)	As per requirement
17.	Welding machine 400 Ampere	As per requirement
18.	Screener for coarse sand and fine sand	As per requirement
19.	Centrifugal mono block water pump minimum capacity 2 HP	As per requirement
20.	Road roller 8 to 10 tons	As per requirement
21.	Vibratory roller	As per requirement
22.	Drilling machine	As per requirement
23.	Double steel scaffolding and staging materials	As per requirement
24.	Air compressor	As per requirement
26.	Floor grinding/polishing machines	1 Nos.
27.	Granite cutting machine	1 Nos.
28.	Ceramic tile cutting machine	2 Nos.
29.	Granite polishing machine	1 Nos.
30.	Granite hand polishing machine	2 Nos.
31.	Any other machinery required for completion of the work as per decision of Engineer-in-charge.	As per Actual requirement

Note: The above list is only indicative and not exhaustive. However, quantity may be optimised commensurate to progress of work with the approval of engineer in Charge.

PART B

SPECIAL CONDITIONS, PARTICULAR SPECIFICATION FOR CIVIL WORK

SPECIAL CONDITIONS

1.0 GENERAL

- 1.1** The Contractors are advised to inspect and examine the site and its surroundings and satisfy themselves with the nature of site, the means of access to the site, the constraints of space for stacking material / machinery, accommodation of labour etc., constraints put by local regulations (if any), weather conditions at site (rainfall, snowfall, winter/summer temperatures etc.), general ground/subsoil conditions etc. or any other circumstances which may affect or influence their tenders. No claims, whatsoever, shall be entertained at a later date for any errors found, on plea that the information supplied by the Department in the tender is insufficient or is at variance with the actual site conditions.
- 1.2** The contractor shall, if required by him, before submission of the tender, study the drawings and tender document carefully as the work is to be executed (on the basis of the same) in EPC mode. The Department shall not bear any responsibility for the lack of knowledge and also the consequences, thereof to the Contractor. The information and data shown in the drawings and mentioned in the tender documents have been furnished, in good faith, for general information and guidance only. The Engineer-in-Charge, in no case, shall be held responsible for the accuracy thereof and/or interpretations or conclusions drawn there from by the Contractor and all consequences shall be borne by the Contractor. It is presumed that the Contractor shall satisfy himself for all possible contingencies, incidental charges, wastages, bottlenecks etc. likely during execution of work and acts of coordination which may be required between different agencies. Nothing extra shall be payable on this account.
- 1.3** The work shall be carried out, all in accordance with true intent and meaning of the scope of work, specifications and the drawings taken together, regardless of whether the same may or may not be particularly shown on the drawings and/or described in the specifications or scope of work, provided that the same can be reasonably inferred. There may be several incidental works, which are not mentioned in the contract document but will be necessary to complete the item in all respects. All these incidental works / costs which are not mentioned in specifications/drawings/tender document but are necessary to complete the item shall be deemed to have been included in the rates quoted by the contractor. No adjustment of rates shall be made for any variation in quantum of incidental works due to variation / change in actual detailed working drawings. Also, no adjustment of rates shall be made due to any change in incidental works or any other deviation in such element of work (which is incidental to the items of work and are necessary to complete such works in all respects) on account of the directions of Engineer-in-Charge.
- 1.4** The work shall generally be carried out in accordance with the “CPWD Specifications 2019 Vol. I & II” with correction slips up to last date of submission of bid (including any extension in last date of bid submission), additional/Particular Specifications, Architectural/Structural drawings and as per instructions of Engineer-in-Charge. Any additional item of work, if taken up subsequently, shall also conform to the relevant specifications mentioned hereinabove.
- 1.5** The several documents forming the tender are to be taken as mutually complementary to each other. Detailed drawings shall be followed in preference to small scale drawings and figured dimensions in preference to scale dimensions. Between two or more Clauses of this Contract, the provisions of a specific Clause relevant to the issue under consideration shall prevail over those in other Clauses.

- 1.6** The work shall be carried out in accordance with the Architectural drawings and Structural drawings, to be prepared by contractor and issued by the Engineer-in-Charge. Before commencement of any item of work, the contractor shall correlate all the relevant architectural, structural and services drawings issued for the work and satisfy himself that the information available there from is complete and unambiguous. The discrepancy, if any, shall be brought to the notice of the Engineer-in-Charge before execution of the work. The contractor alone shall be responsible for any loss or damage occurring by the commencement of work on the basis of any erroneous and or incomplete information.
- 1.7** Should there be any difference or discrepancy between the description of items or condition of contract or conditions of contract as given in the particular specifications, special conditions, general condition of contract and I.S. Codes, drawings etc., the following order of preference shall be observed-
- a) Particular specification
 - b) Schedules (Door, Hardware, Finishing etc.)
 - c) Special conditions
 - d) Additional Conditions
 - e) Architectural drawings /Structural drawings
 - f) CPWD Specifications including upto date correction slips.
 - g) CPWD General Conditions of Contract 2024 EPC Project including correction slips issued up to last date of submission of bid including extensions if any.
 - h) Indian Standards Specifications of B.I.S.
 - i) ASTM, BS, or other foreign origin code mentioned in tender document.
 - j) Manufacturer's specifications and as decided by the Engineer-in-Charge.
 - k) Sound Engineering practices or well-established local construction practices.
- 1.8** In the event of any variation/ discrepancy in the drawings, specifications and tender Documents etc. the decision of the Engineer-in-Charge shall be final binding and conclusive and if, the contractor have any doubt, the same should be got clarified immediately from the Engineer-in-charge and no claim of the contractor shall be entertained thereafter. Moreover, the contractor is not allowed to take benefit out of any clerical/ grammatical mistake in the standard clauses/Specifications etc. being used in the agreement.
- 1.9** The contractor shall give to the local body, police and other authorities all necessary notices etc. that may be required by law and obtain all requisite licenses for temporary obstructions, enclosures etc. and pay all fee, taxes and charges which may be levied on account of these operations in executing the contract. The charges to be paid by contractor are not related to permanent constructed asset as per contract.
- 1.10** The contractor shall ensure that there is no damage to adjoining property. If any such untoward incident happens, he shall be entirely responsible for any consequences besides making good any damages to the adjoining property whether public or private. He shall supply and maintain lights either for illumination or for cautioning the public at night.
- 1.11** Proper temporary barricading by fencing with G.I. sheets around the site. It shall be done by providing, erecting, maintaining temporary protective barricading of minimum 6.0 meters in height, made in panels, with each panel having MS frames / MS scaffolding pipes of suitable size and stiffness, with 24-gauge thick GI corrugated sheet or suitably stiffened plain GI sheet fixed on

frames. Such panels shall be suitably connected to each other for stability with nuts and bolts, hooks, clamps etc. and fixed firmly to the ground at about 2 meters (or as per design) spacing, for the entire duration till completion of the work. The contractor shall also provide and erect temporary protective barricades within the plot as per stipulations/guidelines of statutory authorities. Temporary protective roofing near the Entrance to the building, under construction, shall be made to protect the visiting officials from getting hurt by falling debris etc. Also, one or more coat of enamel paint of shade as approved and directed by the Engineer-in-Charge shall be applied on the panels and "CCU, MoEF&CC" shall be painted over that in suitable sizes, shapes and numbers as directed by the Engineer-in-Charge. It shall be dismantled and taken away by the contractor after the completion of work at his own cost with the approval of the Engineer-in-Charge. Nothing extra shall be payable on this account. **The contractor shall maintain the site barricading during the complete period of execution and realign it if required, for execution of works. A Recovery of Rs. 25000/- per day shall be levied for not maintaining the barricading in good condition or breach of any of the above conditions as per the direction of Engineer-in-charge.**

- 1.12 The contractor shall bear all incidental charges for cartage, storage and safe custody, insurance, erection, testing and commissioning of materials issued by department (if any) as well as to those materials arranged by the contractor. The contractor shall also be responsible for the watch and ward / guard of the buildings, safety of all fittings and fixtures including sanitary and water supply fittings and fixtures provided by him against pilferage and breakage during the period of installations and thereafter till the building is physically handed over to the department. No extra payment shall be made on this account.
- 1.13 Wherever any reference to any Indian Standards occurs in the documents relating to this contract, the same shall be inclusive of all amendments issued thereto or revisions thereof, if any, up to the last date of receipt of tenders (including extended date, if any).
- 1.14 No claim whatsoever on account of any discrepancy between the sub-surface strata conditions shall be entertained.
- 1.15 Any legal or financial implications resulting out of disposal of earth shall be sole responsibility of the contractor. Nothing extra shall be paid on this account.
- 1.16 Wherever required for the execution of work, scaffolding shall be provided and suitably fixed, by the Contractor. The contractor shall provide steel double scaffolding system, suitably braced for stability, with all the accessories, gangways, etc. with adjustable suitable working platforms to access the areas with ease for working and inspection. It shall be designed to take all incidental loads. It should cater to the safety features for workmen. Nothing extra shall be payable on this account. It shall be ensured that damage is not caused to any structure due to the scaffolding.
- 1.17 The contractor may be allowed to erect labour huts on the plot without disturbing the construction area and other occupants/establishments operating/residing therein. However, the contractor shall make his own arrangements to provide for additional accommodation, if required (in addition to available area at site), as per the rules of the local bodies. The Engineer-in-Charge shall in no way be responsible for any delay on this account and no claim, whatsoever, on this account shall be entertained. Nothing extra shall be payable on this account.

- 1.18** No tools and plants including any special T&P etc. shall be supplied by the Department and the Contractor shall have to make his own arrangements at his own cost. No claim of hindrance (or any other claim) shall be entertained on this account.
- 1.19** The Contractor shall take all precautions to abide by the environmental related restrictions imposed by any statutory body having jurisdiction in the state as well as prevent any pollution of streams, ravines, river bed and waterways. All waste or superfluous materials shall be transported by the Contractor and disposed off at designated places only. Nothing extra shall be payable on this account.
- 1.20** No claim on account of site constraints mentioned in this document or any other site constraints such as lack of public transport, inadequate availability of skilled, semi-skilled or unskilled workers in the near vicinity, non-availability of construction machinery spare parts etc. or any other constraints not specifically stated here shall be entertained from the Contractor. Therefore, the tenderers are advised to visit site and get first-hand information of site constraints. Accordingly, they should quote their tenders. Nothing extra shall be payable on this account. Any hindrances claimed by the contractor on this account shall not be considered while action under clause '2' and '5' of General condition of contract amended upto date till last date or extended last date of submission of tender.
- 1.21** Other agencies may also simultaneously execute and install the works of other civil and E&M services for the work. The contractor shall afford necessary facilities for the same. The contractor shall leave such recesses, holes, openings, trenches etc. as may be required for such related works and the contractor shall fix the same at time of casting of concrete, stone work and brick work, if required, and nothing extra shall be payable on this account.
- 1.22** The contractor shall take all precautions to avoid accidents by exhibiting necessary caution boards day and night. The contractor shall ensure entire necessary precaution during the entire period of work and site related activities to ensure full safety to workers and avoid any kind of accident. In case of any accident of labour's/ contractual staffs or any other human being the entire responsibility will rest on the part of the contractor both legally and financially and any compensation under such circumstances, if becomes payable, shall be entirely borne by the contractor.
- 1.23** Any cement slurry added over base surface (or) for continuation of concreting for better bond is deemed to have been included in the contract amount and nothing extra shall be payable for extra cement considered in consumption on this account.

1.24 FACILITIES FOR THE DEPARTMENT

- (a) **Site Office-** The contractor shall provide one number site office accommodations of approximately 100 sqm area (as per layout plan approved by engineer-in-charge) i/c conference hall at location as specified by Engineer in charge, including but not limited to following-
- i) The site office accommodation shall be provided with all necessary furniture, fitted with all electrical items like light, fans, air conditioners, heaters, all office utilities, good quality projector in conference room etc. and complete wiring, water supply, sewerage and drainage etc. The office should have Engineered marble flooring in common areas and vitrified tiles in rooms with UPVC windows and hollow metal doors. The toilet

fixtures shall be as per specifications mentioned in this document. The Agency shall provide necessary Air Conditioners, lights and fixtures i/c fan, RO etc.

- ii) The contractor shall provide the office accommodation within 03 (Three) months from the date of commencement of work failing which the recovery @ **Rs.1,00,000/- per month shall be levied from the contractor.**
- iii) The contractor shall arrange to maintain the site offices which includes watch and ward, day to day up keeping of the building and surroundings, periodic whitewashing/ color washing of the building including utilities, payment of AMC charges, Electricity bill, water supply bills, RO/drinking water bills etc.
- iv) The cost of construction, cost of all furniture ((of Godrej or equivalent), fittings/fixtures /electrical fittings etc. and cost of maintenance and the related service charges of the office building is deemed to be included in the quoted rates of work and nothing extra shall be payable. This site office accommodation shall be maintained properly till completion of work and no claim whatsoever shall be entertained on the ground whether the delay in completion of work has been attributable to the Department or to the contractor.

(b) Communication and Commuting

- i) The contractor shall provide one number laptop-cum-tablet (latest surface pro or macbook air models) and two Nos. All-in-one Desktop (window 10) with 3G/4G enabled internet connection for the supervisory staff of Employer. The contractor shall also provide one number color laser printer (A3 Size) to the department. These accessories shall be retained by the department and the quoted rates are deemed to be inclusive of this cost. No additional payment shall be made to the Contractor on this account. The laptop/computer shall be provided with software viz. with MS-project, Primavera, MS office, Auto Cad, STADD etc.
- ii) The contractor shall make arrangements for one number of inspection vehicles (Innova Crysta Hybrid or equivalent model) not older than January 2025, from start to completion of entire work, at disposal of Engineer-in-Charge to facilitate work inspection, quality control, coordination with multiple agencies and liasoning. This facility will be provided till six months after the actual date of completion of work. The average mileage of each inspection vehicle shall be approximately 3000 Km/month. The inspection vehicle shall be made available for 12 hours per day on daily basis including holidays as per the direction of Employer. All expenses of this inspection vehicle including running and maintenance, fuel charges, driver's salary, toll tax, parking charges etc. shall be borne by the contractor. **Recovery @ Rs. 5000/- per day per Inspection vehicles shall be made, if contractor fails to provide Inspection vehicles within 15 days of letter of award/acceptance. Recovery @ Rs. 5000/- per day per Inspection vehicles shall be made, in case of occurrence of a default i.e. non-availability of vehicle, breakdown of vehicle etc.**
- iii) The contractor shall make arrangement for Helmets and leather shoes (meant of construction work at sites) for all field staff of the department during the entire period of construction for safety reasons. One helmet and two pairs of shoes per staff member (maximum ten members) of the departments per year shall be arranged by the contractor.

- (c) **IP Based CCTV:** The contractor shall provide IP Based CCTV (in sufficient number to capture/monitor whole site) with all requisite software, hardware and accessories. A monitoring room with digital screens shall be made in site office.

1.25 NUISANCE PREVENTION AND POLLUTION CONTROL

The Contractor shall take all necessary precautions to prevent any nuisance or inconvenience to the owners, tenants or occupants of the adjacent properties and to the public in general. The Contractor shall take all care, as not to damage any other adjacent property or other services running adjacent to the plot. If any damage is done, the same shall be made good by the Contractor at his own cost and to the entire satisfaction of the Engineer-in-Charge. The Contractor shall use such methodology and equipment's for execution of the work, so as to cause minimum environmental pollution of any kind during construction, to have minimum construction time and minimum inconvenience to road users and to the occupants of the buildings on the site/adjacent plot and public in general, etc. He shall make good at his own cost and to the entire satisfaction of the Engineer in Charge any damage to roads, paths, cross drainage works or public or private property whatsoever caused, due to the execution of the work or by traffic brought thereon, by the Contractor. Further, the Contractor shall take all precautions to prevent any pollution of streams and waterways. All waste or superfluous materials shall be carted away by the contractor, entirely to the satisfaction of the Engineer-in-Charge.

- 1.26** The site of work has limited availability of space left out for accommodation, stores, field office, batching plant etc. The contractor may be allowed to erect labour huts, site office, stores, field office, batching plant within site/plot subject to availability of space and without disturbing the construction area. However, the contractor shall make his own arrangements to provide for additional requirement (in addition to available area at site), as per the rules of the local bodies. Before tendering, he shall visit the site and assess the manner in which he is able to arrange the above facilities. The Engineer-in-Charge shall in no way be responsible for any delay on this account and no claim, whatsoever, on this account shall be entertained.
- 1.27** No payment shall be made for any damage caused by rain, snowfall, flood or any other natural calamity, whatsoever during the execution of the work. The contractor shall be fully responsible for any damage to the govt. property and the work for which payment has been advanced to him under the contract and he shall make good the same at his risk and cost. The contractor shall be fully responsible for safety and security of his material, T&P/Machinery brought to the site by him. Nothing extra shall be payable on this account. Also, no claims for hindrance shall be entertained on this account
- 1.28** Royalty at the prevalent rates shall be paid by the Contractor or by RMC supplier as per the terms of supply between them on all materials such as boulders, metals, sand and bajri etc. collected by him for the execution of the work, directly to the revenue authority of the state government concerned. Nothing extra shall be payable on this account.
- 1.29** The Contractor shall keep himself fully informed of all acts/laws of the Central/State/Local Governments, orders of central/state/local government, decrees of statutory bodies, tribunals having any jurisdiction or authority, which in any manner may affect those engaged or employed and anything related to carrying out the work. All the rules & regulations and bye-laws laid down by Collector / Municipal Corporation of area (where site is located) and any other statutory bodies shall

be adhered to, by the contractor, during the execution of work. The Contractor shall also adhere to all traffic restrictions notified by the national/state/local authorities. The contractor shall abide and ensure compliances to terms and conditions of various approvals obtained for the work/ project. He shall work and indemnify the Department and it's officials & employees against any claim and /or liability arising out of violations of any such laws, ordinances, orders, decrees, by himself or by his employees or his authorized representatives. The Contractor shall indemnify the Department against all claims in respect of patent rights, royalties, design, trademarks- of name or other protected rights, damages to adjacent buildings, roads or members of public, in course of execution of work or any other reasons whatsoever, and shall himself defend all actions arising from such claims and shall indemnify the Department in all respect from such actions, costs and expenses. Nothing extra shall be payable on this account.

1.30 The fee payable to statutory authorities for obtaining the various permanent service connections and occupancy certificate for the building shall be borne by the Department.

1.31 The earth work under this work will be treated as earth work for major works under CPWD Specifications Volume 1, 2019 (as applicable). No extra payment will be made for shoring, strutting and planking or cut slopes with or without steps including maintaining water level low enough so as not to cause any harm to work inclusive of pumping out or bailing out water, if required.

1.32 SETTING OUT

- (i) The contractor shall carry out survey of the work area, setting out the layout and fixing of alignment of the building as per architectural and Structural drawings in consultation with the Engineer-in-Charge and proceed further ensuring full structural continuity and integrated/monolithic construction. Any discrepancy between the architectural drawings and actual layout at site shall be brought to the notice of the Engineer-in-charge. It shall be responsibility of the contractor to ensure correct setting out of alignment/layout using total station instrument. Nothing extra shall be payable on this account.
- (ii) The initial levels shown in the layout plan are indicative and the actual ground levels may vary. Though the site levels are indicated in the drawings the Contractor shall ascertain and confirm the site levels with respect to benchmark from the concerned authorities. No claim due to difference in ground levels as per layout plan and as per actual on ground shall be entertained.
- (iii) The Contractor shall establish, maintain and assume responsibility for grades, lines, levels and benchmarks. He shall report any errors or inconsistencies regarding grades, lines, levels, dimensions etc. to the Engineer -in-Charge before commencing work. Commencement of work shall be regarded as the Contractor's acceptance of such grades, lines, levels, and dimensions and no claim shall be entertained at a later date for any errors found.
- (iv) If at any time, any error appears due to grades, lines, levels and benchmarks during the progress of the work, the Contractor shall, at his own expense rectify such error, if so required, to the satisfaction of the Engineer -in-Charge.
- (v) The Contractor shall protect and maintain temporary/ permanent benchmarks at the site of work throughout the execution of work. These benchmarks shall be got checked by the

Engineer-in-Charge or his authorized representatives. The work at different stages shall be checked with reference to bench marks maintained for the said purpose.

(vi) The approval by the Engineer-in-Charge, of the setting out by the Contractor, shall not relieve the Contractor of any of his responsibilities and obligation to rectify the errors/ defects, if any, which may be found at any stage during the progress of the work or after the completion of the work.

(vii) The Contractor shall be entirely and exclusively responsible for the horizontal, vertical and other alignments, the level and correctness of every part of the work and shall rectify effectively any errors or imperfections therein. Such rectifications shall be carried out by the Contractor at his own cost to the entire satisfaction of the Engineer-in-Charge.

1.33 INTEGRATED SERVICE DRAWINGS: Before taking up the work, the contractor shall prepare integrated drawings for various civil and electrical services showing details of their lay out plan including sectional elevations and contractor shall plan and mobilize his resources as per these Integrated drawings and as per the site conditions to facilitate convenient execution, installation as well as maintenance of these services.

1.34 The Contractor shall do proper sequencing of the various activities by suitably staggering the activities within various pockets in the site so as to achieve early completion. The contractor shall deploy adequate equipment, machinery and labour as required for the completion of the entire work within the stipulated period specified. Also, ancillary facilities shall be provided by contractor commensurate with requirement to complete the entire work within the stipulated period. Nothing extra shall be payable on this account. Adequate number/sets of equipment in working condition, along with adequate stand-by arrangements, shall be deployed during entire construction period. It shall be ensured by the Contractor that all the equipment, Tools & Plants, machineries etc. provided by him are maintained in proper working conditions at all times during the progress of the work and till the completion of the work. Further, all the construction tools, plants, equipment and machineries provided by the Contractor, on site of work or his workshop for this work, shall be exclusively intended for use in the construction of this work and they shall not be shifted/ removed from site without the permission of the Engineer-in-Charge.

1.35 The Engineer-in-Charge shall not be responsible for any claims for injuries to person/workmen or for structural damage to property happening from any neglect, default, want of proper care or misconduct on the part of the Contractor or of his representatives, during the execution of the work. The compensation, if any, shall be paid directly to the Department / authority / persons concerned, by the Contractor at his own cost.

1.36 PRESERVATION AND CONSERVATION MEASURES

- (i) Existing drains, pipes, cables, over-head wires, sewer lines, water lines and similar services, if any, encountered in the course of the execution of work shall be protected against the damage by the contractor at his own expense. Even in case of accidental damage, the responsibility of repair / replacement including removal of leaked/Spilled water sewage etc. will be on the contractor at his own cost.
- (ii) Existing services shall not be diverted permanently until they are interfering directly with the layout. Notwithstanding anything to the contrary contained herein, the Contractor shall ensure

that the respective entities owning the existing roads, right of way, level crossings, structures, or utilities on, under or above the Site are enabled to keep them in continuous satisfactory use, if necessary, by providing suitable temporary diversions with the Authority of the controlling body of that road, right of way or utility. All temporary supports and other measures required to protect and maintain the services during construction period as per direction of Employer, shall be deemed to be included in the quoted rate / amount of the contractor and nothing extra shall be paid on this account. In case the same are to be removed and diverted, expenditure incurred in doing so shall be payable to the contractor. The contractor shall work out the cost, get the same approved by Engineer-in-Charge before taking up actual execution. The contractor shall not store materials or otherwise occupy any part of the site in a manner likely to hinder the operation of such services.

- (iii) All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on work / project location during excavation/construction shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation. The contractor will take reasonable precaution to prevent his work men or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Engineer-in-charge of such discovery and carry out the official instructions of Engineer-in-charge for dealing with the same, till then all work shall be carried out in a way so as not to disturb/damage such article or thing.

1.37 A site laboratory with the minimum equipment's as specified in CPWD specifications/in this tender document shall be established, made functional and maintained within three months from the commencement date or date of start without any extra cost to the department. In case of noncompliance / delay in compliance of this condition, a recovery @ Rs. 5000/- per day will be imposed which will be recovered from the immediate next R/A Bill of the Contractor.

1.38 CO-OPERATION WITH SPECIALIZED AGENCIES/ SUB-CONTRACTORS

- (i) The Contractor shall cooperate with and provide the facilities to the sub-Contractors and other agencies working at site for smooth execution of the work. The contractor shall indemnify the Department against any claim(s) arising out of such disputes. The Contractor shall:
- a) Allow use of toilets, sheds etc.
 - b) Properly co-ordinate their work with the work of other Contractors.
 - c) Provide control lines and benchmarks to his Sub-Contractors and the other Contractors.
 - d) Provide electricity and water at mutually agreed rates.
 - e) Provide hoist and crane facilities for lifting material at mutually agreed rates.
 - f) Co-ordinate with other Contractors for leaving inserts, making chases, alignment of services etc. at site.
 - g) Adjust work schedule and site activities in consultation with the Engineer-in- Charge and other Contractors to suit the overall schedule completion.

- h) Resolve the disputes with other Contractors/ sub-contractors amicably and the Engineer-in-Charge shall not be made intermediary or arbitrator
- (ii) The work should be planned in a systematic manner so as to ensure proper co-ordination of various disciplines e.g. sanitary & water supply, drainage, rainwater harvesting, electrical, firefighting, information technology, communication & electronics and any other services.
- (iii) The contractor shall conduct his work, so as not to interfere with or hinder the progress or completion of the work being performed by other contractor(s) or by the Engineer-In-Charge and shall as far as possibly arrange his work and shall place and dispose of the materials being used or removed so as not to interfere with the operations of another contractor. The contractor shall arrange his work with that of the others, in an acceptable, and in a proper coordinated manner and shall perform it in proper sequence to the complete satisfaction of others

1.39 Foundation system and Soil Investigation: The foundation shall be laid on firm strata as per soil bearing capacity determined by carrying out geotechnical/soil investigation by contractor. The contractor shall carry out the soil investigation of entire site, as per relevant Indian standards, before taking up the foundation work. Subsurface conditions encountered during construction may vary somewhat from the conditions encountered during site investigation. Therefore, it is essential to examine the founding levels very carefully during excavation and remove the localized clay if met with till firm strata is ensured prior to laying of PCC. It should be ensured that at foundation level, no voids are there, if voids are observed the same shall be grouted. The contractor shall quote the rate accordingly.

1.40 RATES

- i. The rates quoted by the contractor are deemed to be inclusive of site clearance, setting out work, creating profile, establishment of reference bench mark(s), installing various signage, taking spot levels, survey with total station, construction of all safety and protection devices, compulsory use of helmet and safety shoes, and other appropriate safety gadgets by workers, imparting continuous training for all the workers, barriers, preparatory works, working during monsoon or odd season, working beyond normal hours, working at all depths, height, lead, lift, levels and location, implementation of green building norms to achieve desired 5* GRIHA rating etc. and any other unforeseen but essential incidental works required to complete this work. Nothing extra shall be payable on this.
- ii. The rates quoted by the tenderer, shall be firm and inclusive of all taxes and levies.
- iii. No foreign exchange shall be made available by the Department for importing (purchase) of equipment, plants, machinery, materials of any kind or any other items required to be carried out during execution of the work. No delay and no claim of any kind shall be entertained from the Contractor, on account of variation in the foreign exchange rate.
- iv. Ancillary and incidental facilities required for execution of work like labour accommodations, stores, fabrication yard, offices for Contractor, watch and ward, temporary ramp required to be made for working at the basement level (if any), temporary structure for plants and machineries, water storage tanks, installation and consumption charges of temporary

electricity, telephone, water etc. required for execution of the work, liaison and pursuing (for obtaining various No Objection Certificates, completion certificates, Occupancy certificates) from local bodies etc., protection works, testing facilities / laboratory at site of work, facilities for all field tests and for taking samples etc. during execution or any other activity which is necessary (for execution of work and as directed by Engineer-in-Charge), shall be deemed to be included in rates quoted by the Contractor. Nothing extra shall be payable on these accounts. Before start of the work, the Contractor shall submit to the Engineer-in-Charge, a site / construction yard layout, specifying areas for construction, site office, positioning of machinery, material yard, cement and other storage, steel fabrication yard, site laboratory, water tank, etc.

- v. For completing the work in time, the Contractor might be required to work in two or more shifts (including night shifts). No claim whatsoever shall be entertained on this account.
- vi. All material shall only be brought at site as per program finalized with the Engineer-in-Charge. Any pre-delivery of the material not required for immediate consumption shall not be accepted and thus not paid for.

1.41 SAFETY PRACTICES

- i. **WARNING/ CAUTION BOARDS:** All temporary warning / caution boards / glow signage display such as "Construction Work in Progress", "Keep Away", "No Parking", diversions & protective Barricades, barricading as required from environmental protection view as per Hon'ble NGT etc. shall be provided and displayed by the Contractor, wherever required. These glow signage and red lights shall be suitably illuminated during night also. The contractor shall be solely responsible for damage and accident caused, if any, due to negligence on his part. Also, he shall ensure that no hindrance, as far as possible, is caused to general traffic during execution of the work. Nothing extra shall be payable on this account. If the contractor fails to provide the warning /caution boards within 7 days of written direction of Engineer In charge or his authorized representative, **recovery of Rs. 1000/- on per day basis shall be made.**
- ii. **SIGN BOARDS:** The Contractor shall provide and erect a display board of size and shape as required and paint over it, in a legible and workman like manner, the details about the salient features of the work / project, as required by the Engineer-in-Charge. The Contractor shall fabricate and put up a sign board in an approved location and to an approved design indicating name of the work / project, Client/Owner, Engineer-in-charges, Structural Consultants, Department etc. besides providing space for names of other Contractors, Sub-Contractors and specialized agencies within 15 days from issuance of letter of acceptance. Nothing extra shall be payable on this account. In case of noncompliance/delay in compliance, a **recovery @ Rs. 500/- per day will be imposed which will be recovered from the immediate next R/A Bill of the Contractor.**
- iii. Necessary protective and safety equipment's shall be provided to the Site Engineer, Supervisory staff, labour and technical staff by the Contractor at his own cost.
- iv. All signage shall be dismantled and taken away by the contractor after completion of the work with the approval of Engineer in charge. No payment shall be made on this account.

- v. No inflammable materials including P.O.L shall be allowed to be stored in huge quantity at site. Only limited quantity of P.O.L may be allowed to be stored at site subject to the compliance of all rules / instructions issued by the relevant authorities and as per the direction of Engineer -in- Charge in this regard. Also, all precautions and safety measures shall be taken by the Contractor for safe handling of the P.O.L products stored at site. All consequences on account of unsafe handling of P.O.L shall be borne by the Contractor.

1.42 QUALITY ASSURANCE

- i. The proposed work is a prestigious work / project and quality of work is of paramount importance. Contractor shall have to engage well-experienced skilled labour and deploy modern T&P and other equipment to execute the work. Many items like exposed finish form work, specialized flooring work, Oxysulphide sealant and backer rod fixing in structural glazing works, factory made door- window shutters, proper slope maintaining in toilet units, sanitary- water supply installation, water proofing treatment will specially require engagement of skilled workers having experience particularly in execution of such items.
- ii. The contractor shall ensure quality construction in a planned and time bound manner. Any sub-standard material/work beyond set out tolerance limit shall be summarily rejected by the Engineer-in-charge & contractor shall be bound to replace / remove such sub-standard / defective work immediately. If any material, even though approved by Engineer-In-Charge is found defective or not conforming to specifications shall be replaced / removed by the contractor at his own risk & cost.
- iii. The contractor/ associated agency shall extend full cooperation to **Third Party Quality Assurance Agencies** engaged by the department for the Work during their field visits.
- iv. In addition to the supervision of work by Engineer- in-charge or his representatives, the Consultants deployed by the department shall also be carrying out regular and periodic inspection of the ongoing activities in the work and deficiencies, shortcomings, inferior workmanship pointed out by them shall be communicated by Engineer- in-charge or his representatives to the contractor. Upon receipt of instructions from Engineer in Charge, the work so pointed out shall be made good by necessary improvement, rectification, replacement upto his complete satisfaction. Special attention shall be paid towards line and level of internal and external plastering, exposed smooth surface of RCC members by providing fresh shuttering plates, rubberized linings to all the shuttering joints, accurate joinery work in wooden doors and windows, thinnest joints in stone/ tiling / cladding work, non-hollowness in floor and dado tiles work, protection from scratches over flooring by impounding layer of plaster of Paris, water tight pipe linings, absence of hollow vertical joints in brick masonry, proper compaction of filled up earth etc. to achieve an facility of international standards.
- v. The Contractor shall submit immediately after the issuance of letter of acceptance within 20 days, Minimum Quality Assurance Plan (a detailed and complete method statement for the execution, testing and Quality Assurance Plan/procedures for basic materials and such items, to be followed during the execution of the work), for approval of the Engineer-in-Charge. All the materials to be used in the work, to give the finished work complete in all respects, shall comply with the requirements of the specifications and shall pass all the tests required as per specifications as applicable or such specifications / standards as

directed by the Engineer-in-Charge. Further, **a recovery of Rs. 1000/- shall be made on per day basis in case of delay in submission of the Minimum Quality Assurance Plan.**

- vi. All materials and fittings brought by the contractor to the site for use shall conform to the samples approved by the Engineer-in-charge which shall be preserved till the completion of the work. If a particular brand of material is specified in the particular specification, the same shall be used after getting the same approved from Engineer-In-Charge. Wherever brand / quality of materials are not specified in the particular specifications; the contractor shall submit the sample as per list of preferred make given in tender documents. For all other items, materials and fittings of ISI Marked shall be used with the approval of Engineer-In-Charge. Wherever ISI Marked material / fittings are not available, the contractor shall submit samples of materials / fittings manufactured by firms of repute conforming to relevant specifications or IS codes and use the same only after getting the approval of Engineer-In-Charge.
- vii. The Contractor shall procure and provide all the materials from the manufacturers / suppliers as per the item description/particular specifications for the work. The equivalent brand other than brand / make mentioned in particular specification for any item, shall be permitted to be used in the work, only when the specified make is not available subject to documentary evidence produced by the contractor for non-availability of the brand specified and also subject to independent verification by the Engineer-in-Charge. In exceptional cases, where such approval is required, the decision of Engineer-in-Charge as regards equivalent make of the material shall be final and binding on the Contractor. The material shall be procured only after written approval of the Engineer-in-Charge. No claim, whatsoever, of any kind shall be entertained from the Contractor on this account. Nothing extra shall be payable on this account.
- viii. All materials whether obtained from Govt. stores or otherwise shall be got checked by the Engineer-in-Charge or his authorized supervisory staff on receipt of the same at site before use.
- ix. The tests, as necessary, shall be conducted in the laboratory approved by the Engineer-in-Charge. The samples shall be taken for carrying out all or any of the tests stipulated in the particular specifications, minimum quality assurance plan, and as directed by the Engineer-in-Charge or his authorized representative.
- x. All the registers of tests (carried out at Construction Site or in outside laboratories) and all material at site (MAS) registers including cement register shall be maintained by the contractor which shall be issued to the contractor by Engineer-in-charge. All the entries in the registers will be made by the designated Engineering Staff of the contractor and same should be regularly reviewed by JE/AE/AEE/EE. Contractor shall be responsible for safe custody of all the registers.
- xi. The Contractor shall at his own risk and cost make all arrangements and shall provide all such facilities including material and labour, the Engineer-in-Charge may require for collecting, preparing, forwarding the required number of samples for testing as per the frequency of test stipulated in the contract specifications or as considered necessary by the Engineer-in-Charge, at such time and to such places, as directed by the Engineer-in-Charge. Nothing extra shall be payable for the above.

- xii. The Contractor or his authorized representative shall associate in collection, preparation, forwarding and testing of such samples. In case he or his authorized representative is not present or does not associate him, the result of such tests and consequences thereon shall be binding on the Contractor. The Contractor or his authorized representative shall remain in contact with the Engineer-in-Charge or his authorized representative associated for all such operations.
- xiii. Unless specified otherwise, all the testing charges shall be borne by contractor.
- xiv. All the hidden items such as water supply lines, drainage pipes, electrical conduits, sewers etc. are to be properly tested as per the design conditions before covering.
- xv. Water tanks, taps, sanitary, water supply and drainage pipes, fittings and accessories should conform to byelaws and municipal body / corporation where CPWD Specifications are not available. The contractor should engage licensed plumbers for the work and get the materials (fixtures/fittings) tested by the Municipal Body/Corporation authorities wherever required at his own cost.
- xvi. The contractor shall give performance test of the entire installation(s) as per the standing specifications before the work is finally accepted.
- xvii. The Contractor shall arrange electricity at his own cost for testing of the various electrical installations as directed by Engineer-in-Charge and for the consumption by the contractor for executing the work. Also, all the water required for testing various electrical installations, fire pumps, wet riser / firefighting equipment's, fire sprinklers etc. and also testing water supply, sanitary and drainage lines, water proofing of underground sump, overhead tanks, water proofing treatment etc. shall be arranged by the contractor at his own cost.
- xviii. The Contractor shall make available, on request from the Department, the copies of challan, cash memos, receipts and other certificates, if any, vouchers towards the quantity and quality of various materials procured for the work. The Contractor shall also provide information and necessary documentation on the name of the manufacturer, manufacturer's product identification, manufacturer's instructions, warning, date of manufacturing and test certificates (from manufacturers for the product for each consignment delivered at site), shelf life, if any etc., for the department to ensure that the material have been procured from the approved source and is of the approved quality, as directed by the Engineer-in-Charge. Wherever specified, day-to-day account of receipt of such material shall be maintained at site of work.
- xix. If the Contractor does not provide adequate supporting staff or labour or both for carrying out field tests or collecting and forwarding samples to outside laboratory or for maintaining test records, Engineer in charge may carry out field tests or collect and forward sample to outside laboratory or appoint any person to maintain the registers at risk and cost of Contractor. The charges so incurred shall be entirely borne by contractor and shall be deducted from Running or final bill of contractor. Further, **recovery of Rs. 2000/- for each default shall be levied to contractor.**
- xx. In case there is any discrepancy in frequency of testing as given in list of mandatory tests and that in individual sub-heads of work as per CPWD Specifications, higher of the two

frequencies of testing shall be followed and nothing extra shall be payable on this account.

1.43 SUBMISSION AND DOCUMENTATION

The Contractor shall render all help and assistance in documenting the total sequences of this work / project by way of photography, slides, audio / video recording etc. The original films shall be the property of the Department. No copy shall be prepared without the prior approval of the Engineer-in – Charge.

- (i) The Contractor shall display all permissions, licenses, registration certificates, bar charts, other statements etc under various labour laws and other regulations applicable to the works, at his site office. He should also keep at site at least one set of BIS Codes and other relevant codes and produce the same if asked for by Engineer-In-Charge. In case of noncompliance, these codes will be purchased from the Market and actual cost of purchase will be recovered from the next RA Bill of the Contractor.
- (ii) The Contractor shall make available five (05) sets of “AS BUILT” architectural, structural, all services (internal & external) drawings (including soft copy of the same), along with literatures, maintenance manuals, warranty certificates etc. of various installed fittings, fixtures and equipment for the completed work / projects. This shall be the prerequisite for payment of final bill.
- (iii) The contractor shall make available four (04) sets of computerized Standard Measurement Books (SMBs) having measurement of all the permanent standing.
- (iv) The Performance Guarantee shall not be released to the contractor until the aforesaid drawings are submitted to the Engineer-in-Charge.
- (v) The contractor shall comply the conditions of various NOC, clearance obtained for the work and submit the necessary document mentioned in these statutory NOC / Clearance.

1.44 PROGRAM /SCHEDULE

The Contractor shall prepare an integrated program chart including civil, electrical & mechanical, horticulture, landscaping activities for the execution of work, showing clearly all activities from the start of work to completion, with details of manpower, equipment and machinery required for the completion of the work within the stipulated period and submit the same for approval of the Engineer-In-Charge within fifteen days of the issuance of letter of acceptance. The integrated program chart so submitted should not have any discrepancy with the physical/financial milestones specified in this tender documents. The program chart should include the following: -

- i) Descriptive note explaining sequence of various activities.
- ii) Construction Program prepared on PRIMAVERA/ M.S. Project etc. Software, which will indicate resources in terms of materials, manpower and specialized equipment for every important stage.
- iii) Program for procurement of materials by the contractor.
- iv) Program for arranging and deployment of manpower both skilled and unskilled so as to

achieve targeted progress.

- v) Program of procurement of machinery/equipment having adequate capacity, commensurate with the quantum of work to be done within the stipulated period, by the contractor.
- vi) In case of noncompliance/delay in compliance, a recovery @ Rs. 5000/- per week or part thereof will be imposed which will be recovered from the immediate next R/A Bill of the Contractor.
- vii) If at any time, it appears to the Engineer-In-Charge that the actual progress of work does not conform to the approved program referred above, the contractor shall produce a revised program showing the modifications to the approved program by additional inputs to ensure completion of the work within the stipulated time.
- viii) The submission for approval by the Engineer-In-Charge of such program or the furnishing of such particulars shall not relieve the contractor of any of his duties or responsibilities under the contract. This is without prejudice to the right of Engineer-In-Charge to take action against the contractor as per terms and conditions of the contract.

1.45 SUBMISSION OF PROGRESS REPORT:

Apart from the above integrated program chart, the contractor shall be required to submit fortnightly progress report of the work in a computerized form on 5th and 20th of every month. The progress report shall contain the following -

- a) Construction schedule of the various components of the work through a bar chart for the next two fortnights (or as may be specified), showing the micro- milestone/milestones, targeted tasks (including material and labour requirement) and up to date progress. At least 20 digital photographs showing all the parts of construction site along with at least 10 minutes video of executions of different items in soft copy has to be submitted in every fortnightly progress report.
- b) Comparative Progress chart of the various components of the work that were planned and achieved, for the fortnight, with reason for deviations, if any in a tabular format.
- c) Plant and machinery statement, indicating those deployed in the work.
- d) Man-power statement indicating:
 - Individually the names of all the staff deployed on the work, along with their designations.
 - No. of skilled workers (trade wise) and total no. of unskilled workers deployed on the work and their location of deployment within site.
- e) Financial statement, indicating the broad details of all the running account payment received up to date, such as gross value of work done, advances taken, recoveries effected, amount withheld, net payments details of cheque payment received, extra/substituted/deviation items if any, etc.

- f) In case of noncompliance / delay in compliance in submission of fortnightly progress report, a recovery @ Rs. 2000/- per report will be imposed which will be recovered from the immediate next R/A Bill of the Contractor.

1.46 TEMPORARY WATER/ ELECTRICITY/ TELEPHONE CONNECTION

- (i) Arrangement of temporary connection for telephone, water and electricity etc. by him, shall be made by the Contractor at his own cost and also necessary permissions shall be obtained by him directly from concerned authorities, under intimation to the Department. Also, all initial cost, running charges, and security deposit, if any, in this regard shall be borne by him. The Contractor shall abide by all the rules/ bye laws applicable in this regard and he shall be solely responsible for any penalty on account of violation of any of the rules / byelaws in this regard. The contractor may bring water from outside through tankers from authorized sources.
- (ii) The Contractor shall be responsible for maintenance and watch and ward of the complete installation and water / electricity meter. The contractor shall also be responsible for any pilferage, theft, damage, penalty etc. in this regard. The Contractor shall indemnify the Department against any claim arising out of pilferage, theft, damage, penalty etc. whatsoever on this account. Security deposit for the work shall be released only after No Dues Certificates are obtained from the local Authorities from whom temporary electric/ water / telephone connection have been obtained by the Contractor.
- (iii) The Department shall in no way be responsible for either any delay in getting electric and/or water and/or telephone connections for carrying out the work or not getting connections at all. Also, contingency arrangement of stand-by water & electric supply shall be made by the Contractor for commencement and smooth progress of the work so that work does not suffer on account of power failure or disconnection or not getting connection at all. No claim of delay of any kind whatsoever shall be entertained on this account from the Contractor.

1.47 CLEANLINESS OF SITE

- i. The Contractor shall not stack building material / malba / muck on the land or road of the local development authority or on the land owned by the others, as the case may be. So, the muck, rubbish etc. shall be removed periodically, from the site of work to the approved dumping grounds as per the local byelaws and regulations of the concerned authorities and all necessary permissions in this regard from the local bodies shall be obtained by the Contractor. In case, the Contractor is found stacking the building material / malba as stated above, the Contractor shall be liable to pay the stacking charges / penalty as may be levied by the local body or any other authority and also to face penal action as per the rules, regulations and bye-laws of such body or authority. The Engineer –in-Charge shall be at liberty to recover, such sums due but not paid to the concerned authorities on the above counts, from any sums due to the Contractor including amount of the Security Deposit and performance guarantee in respect of this contract.
- ii. The contractor shall take instructions from the Engineer-In-Charge regarding collection and stacking of materials at any place within the site. No excavated earth or building rubbish shall be stacked on areas where other buildings, roads, services or any development works are to be constructed/carried out.

- iii. The site of work shall always be kept clean due to constraints of space and to avoid any nuisance to the users of buildings in the adjacent plots. The Contractor shall take all care to prevent any water- logging at site. The wastewater, slush etc. shall not be allowed to be collected at site. For discharge into public drainage system, necessary permission shall be obtained by the contractor from relevant authorities after paying the necessary charges, if any, directly to the authorities. The work shall be carried out in such a way that the area is kept clean and tidy. All the fees/charges in this regard shall be borne by the Contractor.
- iv. It is the responsibility of contractor to keep building neat and clean. The contractor shall spray the chemicals fumigate site area to check the mosquitoes at frequent interval or as directed by the Engineer in charge. The contractor shall also make lighting and temporary ventilation arrangement in basement. The contractor shall provide submersible pumps with automatic on/off system in each sump in basement to bail out the water accumulated. The contractor shall quote rates after considering the above sated conditions and nothing extra shall be paid on this account.
- v. The contractor shall not wash the drum of TM (transit mixture) at site and shall avoid the spread of leachate / cement slurry at the site of work and all care shall be taken to keep the site neat and clean at his own cost.

1.48 INSPECTION OF WORK

- (i) In addition to the provisions of relevant clauses of the contract, the work shall also be open to inspection by Senior Officers of department & the representative of the Consultants. The contractor shall at times during the usual working hours and at all times at which reasonable notices of the intention of the Engineer-in-charge or other officers as stated above to visit the works shall have been given to the contractor, either himself be present to receive the orders and instructions or have a responsible representative duly accredited in writing, to be present for that purpose.
 - a) The consultant and third-party quality assurance agency appointed by department shall be inspecting the works including workshops and fabrication factory to ensure that the works are in general being executed according to the design, drawings and specifications laid down in the contract. Their observations shall be communicated by department to contractor and compliance shall be reported to department by the contractor.
 - b) Senior Officers of department, Dignitaries from Central Ministry / Department, shall be inspecting the on-going work at site at any time with or without prior intimation. The contractor shall, therefore, keep updated the following requirements and detailing.
 - i) Display Board showing detail of work, weekly progress achieved with respect to targets, reason of shortfall, status of manpower, wages being paid for different categories of workers.
 - ii) Keep entrance and surrounding area clean.
 - iii) Display layout plan, key plan, building drawings including plans, elevations and sections.

- iv) Upto date displays of progress of work in form of Bar chart, CPM and PERT etc.
- v) Keep details of quantities executed, balance quantities to be executed, deviations, possible Extra item, etc.
- vi) Keep plastic / cloth mounted one sets of building drawings.
- vii) Set of Helmets and safety shoes for exclusive use for officers/dignitaries visiting at site.

1.49 PRODUCT DELIVERY, STORAGE AND HANDLING OF CHEMICALS

- (i) The contractor shall construct storage space for Chemicals materials to ensure that the storage conditions are as recommended by the manufactures.
- (ii) All the chemical shall be procured and delivered in sealed containers with labels legible and intact.
- (iii) All the chemicals (polymers, epoxy, water proofing compound, plasticizer, Polysulphide, SBR based elastomeric, all exterior and interior paints, polish etc.) shall be procured in convenient packings (say 20 litres/Kgs.) with packing capacity as approved by the Engineer-in-Charge, and not in bigger capacity containers, say 200 litre (Kgs.) drums unless otherwise specifically permitted by the Engineer-in-Charge. One sample from each lot of the chemicals procured by the contractor shall be tested in a laboratory approved by the Engineer-in-charge.
- (iv) All chemicals required for the execution of the work shall be got approved, procured and deposited with the Departmental supervisory staff. The chemicals shall be kept in joint custody of the contractor and the Department. The watch and ward of such material shall, however, remain to be the responsibility of the contractor and no claim, whatsoever, on this account shall be entertained. Different containers of each chemical shall be serially numbered on packing and also consumed in that order. Day-to-Day account of receipt, issue and balance shall be regulated by the Department and proper account shall be maintained at site of work in the prescribed form as per the standard practice.
- (v) All the chemicals shall be procured by the contractor directly from the manufacturer. In exceptional circumstances, the contractor may be allowed to procure the materials from the authorized dealers of the manufacturers, if specifically permitted by the Engineer-in-Charge.
- (vi) The original copies of challan/cash memos towards the quantity of various chemicals procured shall be made available by the contractor at the request from the Engineer-in- Charge and a copy of the same shall be kept in record.
- (vii) The Name of manufacturers, manufacturer's product identification, manufacturer's mixing instructions, warning for handling and toxicity and date of manufacturing and shelf life shall be clearly and legibly mentioned on the labels of each container.
- (viii) The contractor shall submit for the chemicals procured, manufacturer's and / or authorized dealer's certificate regarding supplying and verifying conformance to the material specifications, as specified.

- (ix) All filled containers shall be handled in safe manner and in a way to avoid breaking container seals.
- (x) Empty containers of the chemicals should not be removed from site till the completion of work and shall be removed only with the written approval of the Engineer-in-Charge.
- (xi) All arrangements for measuring, dosing and mixing of material / chemicals at site have to be made by the contractor.
- (xii) Contractor shall suitably advise his site Engineer and all the workers as regards safe handling of chemicals. Necessary protective and safety equipment's in form of hand gloves, goggles etc. shall be provided by the contractor and be also used at site.
- (xiii) All incidental charges of any kind including cartage, storage and wastage and safe custody of material/chemical etc. shall be borne by the contractor and no claim, whatsoever, shall be entertained on this account.
- (xiv) The chemicals shall be tested at the frequency as specified in an independent laboratory as approved by the Engineer-in-charge. If required, more samples may have to be tested as per the directions of the Engineer-in-Charge. Nothing extra shall be payable on this account. Testing charges shall be borne by the contractor.

1.50 DE-WATERING

- i. De-watering required, if any, shall be done conforming to BIS Code IS: 9759 (guide lines for de-watering during construction) and / or as per the specifications approved by the Engineer-in-Charge. Design of an appropriate and suitable dewatering system shall be the Contractor's responsibility. Such scheme shall be modified / augmented as the work proceeds based on fresh information discovered during the progress of work. At all times during the construction work, efficient drainage of the site shall be carried out by the Contractor and especially during the laying of plain cement concrete, taking levels etc. The Contractor shall also ensure that there is no danger to the nearby properties and installations on account of such lowering of water table. If needed, suitable precautionary measures shall be taken by the Contractor. Also, the scheme of dewatering adopted shall have adequate built in arrangement to serve as stand-by to attend to repair of pumps etc. and disruption of power / fuel supply.
- ii. In trenches where surface water is likely to get into cut / trench during monsoons, a ring bund of puddle clay or by any other means shall be formed outside, to the required height, and maintained by the Contractor. Also, suitable steps shall be taken by the Contractor to prevent back flow of pumped water into the trench. Nothing extra shall be payable on this account.
- iii. The Agency shall be responsible for taking necessary approval from the concerned authority for the discharge of the water. Nothing extra shall be payable on this account.

1.51 INSURANCE POLICIES

Before commencing the execution of work, the Contractor shall, without in any way limiting his obligations and liabilities, insure at his own cost and expense against any damage or loss or injury, which may be caused to any person or property, at site of work. The Contractor shall obtain and

submit to the Engineer-in-Charge proper Contractor All Risk Insurance Policy for an amount 1.25 times the contract amount for this work, with Engineer-in-Charge as the first beneficiary. The insurance shall be obtained in joint names of Engineer-in-Charge and the Contractor (who shall be second beneficiary). Also, he shall indemnify the Department from any liability during the execution of the work. Further, he shall obtain and submit to the Engineer-in-Charge, a third-party insurance policy for maximum Rs.10 lakh for each accident, with the Engineer-in-Charge as the first beneficiary. The insurance shall be obtained in joint names of Engineer-in-Charge and the Contractor (who shall be second beneficiary). The Contractor shall, from time to time, provide documentary evidence as regards payment of premium for all the Insurance Policies for keeping them valid till the completion of the work. The Contractor shall ensure that Insurance Policies are also taken for the workers of his Sub-Contractors / specialized agencies also. Without prejudice to any of its obligations and responsibilities specified above, the Contractor shall within 10 days from the date of letter of acceptance of the tender and thereafter at the end of each quarter submit a report to the Department giving details of the Insurance Policies along with Certificate of these insurance policies being valid, along with documentary evidences as required by the Engineer-in-Charge. No work shall be commenced by the Contractor unless he obtains the Insurance Policies as mentioned above. Also, no payment shall be made to the Contractor on expiry of insurance policies unless renewed by the Contractor. Nothing extra shall be payable on this account. No claim of hindrance (or any other claim) shall be entertained from the contractor on these accounts.

1.52 PRESERVE AND PROTECT LANDSCAPE DURING CONSTRUCTION

- (a) The contractor shall ensure that no trees, existing or otherwise, shall be harmed and damage to roots should be prevented during trenching, placing backfill, driving or parking heavy equipment, dumping of trash, oil, paint, and other materials detrimental to plant health. These activities should be restricted to the areas outside of the canopy of the tree, or, from a safe distance from the tree/plant by means of barricading. Trees will not be used for support; their trunks shall not be damaged by cutting and carving or by nailing posters, advertisements or other material. Lighting of fires or carrying out heat or gas emitting construction activity within the ground, covered by canopy of the tree is not to be permitted.
- (b) The contractor shall take steps to protect trees or saplings identified for preservation within the construction site using tree guards of approved specification.
- (c) Contractor should limit all construction activity within the specified area as per the Construction Management Plan (CMP) approved by Engineer in Charge.
- (d) The contractor shall avoid cut and fill in the root zones, through delineating and fencing the drip line (the spread limit of a canopy projected on the ground) of all the trees or group of trees. Separate the zones of movement of heavy equipment, parking, or excessive foot traffic from the fenced plant protection zones.
- (e) The contractor shall ensure that maintenance activities during construction period shall be performed as needed to ensure that the vegetation remains healthy.

1.53 PREPARATION OF SAMPLE (MOCK UP)

The contractor shall prepare one sample/Mock-Up for typical units (e.g. Room / Lobby/ Corridor of minimum 10m length/ complete male, female, Handicap toilet unit, external development work

etc.). Samples of representative units shall be prepared by the contractor well in advance before taking up the mass execution at the appropriate time as per mile stones. The contractor shall invariably prepare the samples units with finishing items i.e. flooring of different types, external & internal finishing i/c colour scheme of paint, tiles in dado, flooring in platforms & staircase, water supply & sanitary fittings and any other item as per direction of Engineer-in-charge. The contractor shall proceed with further finishing works only after getting the samples of these items approved in writing from Engineer-in-charge.

1.54 SPECIALIZED AGENCIES

- (i) The contractor shall engage specialized agency for carrying out specialized item such as Structural Glazing, Aluminum work, Waterproofing and insulation work, Water supply & Plumbing work, Fire check Doors, Bamboo works, Anti-termite treatment, etc. Before engaging such agency, the contractor shall submit the name of the agency along with their working experience, presentation on method statement and materials being used for execution of such items etc. to Engineer-in-charge for approval. Contractor shall submit the proposal (along with work experience certificate issued by competent authority) of only those specialized agencies who have work experience of satisfactorily completion of similar works as per following criteria during last seven years –

Three works each costing not less than 40% of estimated cost for concerned similar work

Or

Two works each costing not less than 60% of estimated cost for concerned similar work

Or

One work costing not less than 80% of estimated cost for concerned similar work item.

- (ii) Estimated cost of the specialized item/work for various items/schemes shall be as per schedule of stage payments or as determined by Engineer-in-charge. Unless specified otherwise, the contractor shall be fully responsible shall guarantee proper design and performance of specialized works for a period of 10 years from the date of completion of work. All the Guarantees shall be submitted before final payment and shall not in any way limit any other rights to correct which the Employer may have under the contract. In addition, an amount of 10 % of work done of specialized work, shall be retained in interim/final payment till it reaches the 10 % of estimated cost of such specialized item/work. This amount shall be withheld towards guarantee and shall be in addition to the other amounts to be withheld as mentioned elsewhere in the contract agreement. However, this amount (withheld) would be released after guarantee period if the performance, as required, is found satisfactory. If any defects are noticed during the guarantee period, it shall be rectified by the contractor within seven days of issuance of notice to the contractor, temporarily, to the satisfaction of the department or any other authorized representative of department and permanent rectification of the defects/replacement of defective should be carried out by the contractor within a period of one month after issuance of notice to the contractor. If not attended to, the same shall be got done through other agency at the risk and cost of the contractor and the cost, which shall be final and binding on the contractor, shall be recovered from the amount withheld towards the guarantee as mentioned above or from any other amount due to the contractor. However, the amount withheld as guarantee can be released in full on submission of irrevocable bank guarantee, from a Schedule/Nationalized Banks, of the same amount, for the guarantee period by the

contractor. The defects, if any, shall be rectified in a workmanlike manner, retaining the same aesthetics and other functional parameters of the original work.

- (iii) The main contractor shall submit the credential of specialized agency well in advance as per the direction of Engineer-in-charge. After verification of the same, written approval will be conveyed to main contractor in this regard. The main contractor shall not change the specialized agency. However, if the change is warranted, he may do so, with permission of Engineer-in-charge. However, before making any such change, he has to enter into similar agreement as with previous agency & submit the same to Engineer - in – Charge for approval. This shall however be without any change in the accepted rates of the contract agreement and without any cost implications to the Department. If the contractor proposes name of specialized agencies from list of preferred makes, there is no need to comply eligibility criteria mentioned in para (i) above. Also, if the specialized work is carried out by the authorized fabricator/ applicator of the manufacturers then there is no need to comply eligibility criteria mentioned in para (i) above.
- (iv) The main contractor cannot work as a specialized agency unless his name is approved as specialized agency by Engineer-in-charge in accordance with criteria mentioned at sr. No. (i) above.
- (v) Approval of the specialized agencies for each specialized work shall be obtained from the Engineer-in-Charge within three months of issuance of letter of acceptance even if, such specialized items of work shall be executed by the specialized agencies at later date. **Recovery @ Rs. 5000/- per day for each specialized work shall be made in case of the delay in submission of proposals of specialized agencies, satisfying the criteria mentioned hereinabove.** The work shall be deemed to be executed by the tenderer for all purposes and the responsibility of the quality of items of works executed etc. shall continue to be that of the tenderer only. It is expressly agreed that the Contractor shall, at all times, be responsible and liable for all its obligations under this Contract notwithstanding anything contained in the contracts with its Sub-contractors or any other contract that may be entered into by the Contractor, and no default under any such contract shall excuse the Contractor from its obligations or liability hereunder.
- (vi) It shall be the responsibility of main contractor to sort out any dispute / litigation with the Specialized Agencies without any time & cost overrun to the Department. The main contractor shall be solely responsible for settling any dispute / litigation arising out of his agreement with the Specialized Agencies. The contractor shall ensure that the work shall not suffer on account of litigation/ dispute between him and the specialized agencies / sub- contractor(s). No claim of hindrance in the work shall be entertained from the Contractor on this account. No extension of time shall be granted and no claim whatsoever, of any kind, shall be entertained from the Contractor on account of delay attributable to the selection/rejection of the Specialized Agencies or any dispute amongst them.

1.55 APPOINTMENT OF THE ARCHITECTURAL CONSULTANT

- a) The contractor shall engage an architectural consultant from approved and eligible empaneled Architectural Consultant in CPWD (All over India) of appropriate category/class (Category I or II or III). The enlistment/empanelment of the consultant should be valid on the last date of submission of bids.

- b) **Experience of Similar Works:** The architectural consultant should have satisfactorily completed **consultancy work for “institutional building having plot area of minimum 50 acres”** during the last 07 years ending previous day of last date of submission of tender.
- c) The experience certificate for similar work should be certified by an officer not below the rank of Executive Engineer/Project Manager or equivalent.
- d) In case of Consultancy works of private nature, other than Central/State Government/Central Autonomous Body/Central Public Sector undertaking/City Development Authority/ Municipal Corporation of city), they shall be required to submit copy of Agreement & Final Bill and TDS certificates for Consultancy works issued by respective clients.
- e) The proposal for appointment of architectural consultant shall be submitted by the contractor to engineer in charge within 15 days of date of start. **Recovery @ 5000/- per day shall be made for delay in submission of the proposal by the contractor.**
- f) The proposal shall contain three options i.e. three architectural consultants empaneled/enlisted in category I/II/III in CPWD and having similar work experience mentioned hereinabove. Each prospective architectural consultant shall make presentation which shall be evaluated by a committee formed by the department.
- g) Evaluation of the proposals submitted by the consultant shall be done w.r.t. Technical Evaluation Criteria as given below:

S. NO.	PARAMETERS	MAX MARKS	MARKS AWARDED
PART-I: PROJECT PERSONNEL (Qualification & Experience) (Max. Marks= 100):			
A	Team Leader / Project Architect (Max. Marks= 30):		
(i)	Graduate with 15 Yrs Experience - 20 Marks Post Graduate with 15 Yrs Experience - 25 Marks Post Graduate with 25 Yrs Experience - 30 Marks	30	
B	Team Members / Domain Experts (Max. Marks= 70):		
	5 marks for each in-house Professional having minimum 10-year experience and 2½ marks for each Associated Professional having minimum 10 year experience. Maximum number considered for evaluation in case of associated professionals shall be limited to in house personnel required to secure maximum marks against each criterion.		
(ii)	Architects	15	
(iii)	Structural Engineers	5	
(iv)	Landscape Architect	10	
(v)	MEP Engineers	10	
(vi)	Horticulture Expert having experience of	20	

	development of Botanical Garden		
(vii)	Green Building Consultant	10	
TOTAL PART- I		100	
PART-II: PRESENTATION OF REPORT (Max. Marks= 275)			
A	Site layout and land utilization, Urban Context, diversity of plants, themes Landscaping & aesthetics and Parking (Max. Marks= 100)		
(i)	Site Layout and land utilization	30	
(ii)	Urban context, diversity of plants, themes	30	
(iii)	Landscaping & aesthetics of various aspects of botanical garden	20	
(iv)	Parking, waterbodies	20	
B	Concept & Design of buildings/project (Max. Marks = 150)		
(v)	Concept & Design	40	
(vi)	Space programming, waiting areas, service areas, Light and ventilation	30	
(vii)	Design methodology, approach for implementation of work / project	30	
(viii)	Design approach for MEP services including Solar power generation, External services etc.	20	
(ix)	Eco friendly/ Environment aesthetics / sustainability	15	
(x)	FAR utilization and future expansion	15	
C	Building efficiency, services in building and FAR utilization etc (Max Marks= 25)		
(xi)	Building efficiency, services in building	15	
(xii)	Conservation of water	5	
(xiii)	Waste management system	5	
TOTAL PART- II		275	
PART-III: Approach paper on proposed methodology and work plan in response to the terms of reference (Max. Marks = 25)			
(i)	Technical approach, objective formulations functional analysis	5	
(ii)	Program and phasing	10	
(iii)	Consultant's understanding of work / project requirement	10	
Total part-III		25	
Total Technical Marks (T)		400	

- h) The consultant securing the maximum marks in evaluation shall be appointed as “architectural consultant” for the work / project.
- i) **Architectural consultant’s personnel:** The contractor shall ensure deployment of following minimum technical personnel by the architectural consultant for the work / project–

S. N.	Description	Min. Experience	Min. Number	Minimum Qualification	Period of deployment	Rate at which recovery shall be made from the contractor in the event of failure to deployment (per month basis)
A	Team Leader / Project Architect					
1	Post Graduate	20 years	1	B-Arch	Entire work / Project duration	Rs. 3,00,000/-
B	Team Members / Domain Experts					
1	Architects	15 Years	1	B-Arch	First 6 months on regular basis thereafter as and when required	Rs. 150,000/-
2	All other specialised work / E&M service etc consultants	10 years	1	As per Specialised work requirement	as and when required	Rs. 100,000/-

1.56 STRUCTURAL SAFETY

Following guidelines shall be followed where height of casting of concrete is higher than 3.5 m or where higher loading is coming during casting of concrete or span is more than 6 meter long or special structure like domes, vaults, steel structure etc. are to be constructed:

- I. Centering/scaffolding/staging for casting of these structures should be properly designed by a qualified and experienced person/agency having past experience in design of false work (centering) for concrete structures and should be proof checked by similar experienced person/agency and it should be approved by Engineer-in-Charge. The provisions of relevant Indian standard (IS: 14687) may be referred for design of false work (centering).
- II. A method statement for erection and dismantling of the centering/scaffolding/staging and process of concreting & process of anchor of steel structure shall be prepared by contractor and submitted to Engineer-in-Charge for approval and the work shall be commenced only after approval of method statement by Engineer-in-Charge. The provisions of relevant Indian standard (IS: 14687) may be referred for erection of false work (centering), safety precautions and other site operations, pertaining to false work (centering).
- III. Engineering form watcher shall be engaged during erection, concreting and dismantling for early detection of any movement or instability in the system.
- IV. A detailed programme of field safety inspection of centering/scaffolding/form work of such

structures during different stages should be chalked out and strictly followed.

- V. The prime responsibility of safety of false work shall be with contractor.
- VI. Provision of safety net, fall arresting system including other safety gears, for workers, working over these structures shall be used strictly.

1.57 OTHER CONDITIONS W.R.T EXECUTION OF WORK

- a. The work shall be carried out in accordance with the contract specification/terms, tendered drawings and detailed drawings including revised drawings, if any, issued during execution of work by the Engineer-in-Charge.
- b. Before commencement of any item of work, the contractor shall correlate all the relevant architectural, structural and MEP drawings, and specifications etc. issued for the work and satisfy himself that the information available there from is complete and unambiguous. The figure and written dimension of the drawings shall be superseding the measurement by scale. The discrepancy, if any, shall be brought to the notice of the Engineer-in-charge before execution of the work. The contractor alone shall be responsible for any loss or damage occurring by the commencement and execution of work based on any erroneous and or incomplete information and no claim whatsoever shall be entertained on this account.
- c. The contractor is required to deploy resources as per availability of site and as per approved programme chart of the work. However, no claims shall be entertained for idle labour, idle machinery, idle technical/no-technical staff, idle T&P etc.
- d. The work of services may be executed simultaneously. The Contractor shall minimize the scope of making recesses, holes, opening etc. as the same shall be planned in advance and necessary grooves/niches shall be provided in shuttering of RCC.
- e. Gypsum plaster shall be executed using pneumatic spray machine of reputed make.
- f. Laminates on flush doors shall be machine pressed, preferably in factory. The design and pattern of laminates shall be as approved by engineer in charge.
- g. The Aluminium door-windows-framework, lamination and Lipping on flush doors shall be factory made.
- h. Unless otherwise specified, wherever mild steel / galvanized iron sections and pipes are provided in the work, priming coat of approved steel primer shall be done after removing rust from section if any and finally finished with low VOC synthetic enamel paint or as mentioned in specification.
- i. Unless otherwise specified, Monkey ladder shall be provided for overhead water tanks, mumty and lift machine room doors with frame and steps of 40x40x6 mm angle iron, etc.
- j. Wall mounted door stoppers shall be provided to protect the wall where the door handle would run into it.

- k. For avoiding of scratch marks or damage to the vitrified / ceramic floor tile, the necessary arrangement of hessian cloth with a coat of plaster of paris over it shall be provided. Nothing shall be paid extra on this account.
- l. Fall nets and scaffolding nets for protection from debris / dusts and noise etc. are to be provided during the construction period. Nothing extra shall be paid on this account.
- m. Wherever M.S. grill provided in window, weight of grill in each window should not be less than 12 kg/sqm.
- n. Wherever utility ducts, drains etc. are required, the same shall be provided with precast concrete units made of M-30 grade concrete and reinforcement steel of grade of Fe-500D.
- o. Wherever the doors are required to be fixed to AAC block masonry, the frame shall be fixed in RCC band or concrete block masonry.
- p. No sunken floor slab except floor depression for maintaining slopes. However, camouflaging of water supply and sanitary line of upper floor to be done by false ceiling.
- q. If details for any area/space w.r.t. finishing schedule, door & window schedule, sanitary fitting schedule, hardware schedule etc. are not mentioned in the particular specification/schedules/drawings, the details of area/space having similar functionality shall be followed.

1.58 It is intended to make our built environment barrier free and accessible to all. Bidders are instructed to strictly adhere to the provision contained in Hand Book on Barrier free and accessibility containing and corresponding provisions of NBC 2016 while incorporating such features in the building. Nothing extra shall be payable on this account.

1.59 In case of reduction in scope of work, no claim on account of reduction in value of work, loss of expected profit, consequential overheads etc. shall be entertained

2.0 SPECIAL CONDITIONS FOR GREEN BUILDING

The building shall confirm to Super Green rating as per CPWD GHAR 2021 & 5-Star rating as per GRIHA.

2.1 Construction Stage-

- (i) All vehicles, equipment and machinery to be procured for construction shall conform to the relevant Bureau of India Standard (BIS) norms.
- (ii) Emission from the vehicles must conform to environmental norms.
- (iii) Dust produced from the vehicular movement and other site activities shall be mitigated by sprinkling of water.
- (iv) The pre-identified dump locations will be a part of solid waste management plan to be prepared by the Contractor in consultation with Engineer -in-charge.

- (v) Contractor shall get approved the location of disposal site prior to commencement of the excavation on any section of the work / project location.
- (vi) Contractor shall ensure that any spoils of material will not be disposed off in any municipality solid waste collection bins.

2.2 Procurement of Construction Materials

- i. All vehicles delivering construction materials to the site shall be covered to avoid spillage of materials and maintain cleanliness of the roads.
- ii. Wheel Tyres of all vehicles used by the contractor, or any of his sub-contractor shall be cleaned and washed clear of all dust/mud before leaving the work / project premises. This shall be done by routing the vehicles through tyre washing tracks.
- iii. Contractor shall arrange for regular water sprinkling at least twice a day (i.e., morning and evening) for dust suppression of the construction site and unpaved roads used by his construction vehicles.

2.3 Water Pollution

- i. The contractor shall take all precautionary measures to prevent accumulation of the wastewater during construction.
- ii. The wastewater arising from the work / project shall be disposed off in the manner that is acceptable to the Engineer -in-charge.

2.4 Air and Noise Pollution

- i. Contractor shall use dust screens and sprinkle water around the construction site to arrest spreading of dust in the air and surrounding areas.
- ii. Contractor shall ensure that all vehicles, equipment and machinery used for construction are regularly maintained and shall confirm that emission levels comply with environmental emission standards/norms.
- iii. All vehicles and equipment used in construction may be fitted with exhaust silencers.
- iv. Servicing of all construction vehicles and machinery shall be done regularly and during routine servicing operations, the effectiveness of exhaust silencers may be checked and be replaced if, found defective.
- v. Noise emission from compactors (rollers) front loaders, concrete mixers, cranes (movable), vibrators and saws should be less than 75 dB(A).

2.5 Personal Safety, Hygiene Measures for Labour

- i) Contractor may provide the following items for safety of workers employed by contractor and associate agencies:

- a. Protective footwear and gloves to all workers employed for the work on mixing, cement, lime mortars, concrete etc. and works of water pipeline/sewer line.
 - b. Welder's protective eye-shields to workers who are engaged in welding works.
 - c. Safety helmet and Safety harness/ belt.
 - d. Provide adequate sanitation/safety facilities for construction workers to ensure the health and safety of the workers during construction, with effective provisions for the basic facilities such as sanitation, drinking water and safety equipment's or machinery.
- ii) All the workers should be wearing helmet and shoes all the time on site.
 - iii) Masks and gloves should be worn whenever and wherever required.
 - iv) Adequate drinking water facility should be provided at site, adequate number of decentralized latrines and urinals to be provided for construction workers.
 - v) If allowed and full-time workers are residing on site, then they should be provided with clean and adequate temporary hutment.
 - vi) First aid facility should also be provided.
 - vii) Overhead lifting of heavy materials should be avoided. Barrow wheel and hand-lift boxes should be used to transport materials onsite.
 - viii) Tobacco and cigarette smoking should be prohibited onsite.
 - ix) All dangerous parts of machinery are well guarded and all precautions for working on machinery are taken.
 - x) Maintain hoists and lifts, lifting machines, chains, ropes and other lifting tackles in good condition. Provide safety net of adequate strength to arrest falling material down below.
 - xi) Use of durable and reusable formwork systems to replace timber formwork and ensure that formwork is properly maintained.
 - xii) Ensure that walking surfaces or boards at height are of sound construction and are provided with safety rails and belts.
 - xiii) Provide measure to prevent fire. Fire extinguisher and buckets of sand may be provided in fire-prone area.
 - xiv) Provide sufficient and suitable light for working during night.
 - xv) Ensure that the construction firm/division/company should have sound safety policies.
 - xvi) Comply with the safety procedure, norms and guidelines (as applicable) as outlined in NBC 2016.

xvii) Adopt additional best practices and prescribed norms as in NBC 2016

- 2.6** Contractor is required to get existing top soil tested for fertility. If test finds it fertile, then top soil preservation is required. For preservation, top layer of soil (150mm- 300mm from the top) must be stripped off the site areas where construction activity will be carried out and kept separately for preservation. The preserved top soil must NOT be mixed with subsoil (soil excavated below 150mm – 300mm depth). The top soil should be preserved from erosion by wind/rain water by planting plants or grass on it. The preserved top soil stack height should not be more than 400mm – 600mm. The area used for preserved top soil should be barricaded from all the sides & nothing should be dumped on it during the construction process. There should be regular water sprinkling on the preserved top soil for its compaction & to maintain its fertility by adding organic manure as per the direction of horticulturist. Top-soil fertility test must be carried out before preservation and post construction to ensure and maintain its fertility. The soil fertility should be enhanced by organic means only if required. Preserved top soil must be spread back to landscaped areas after the construction activity is completed as per the direction of engineer in charge. Top soil fertility test must be done from an ICAR or NABL accredited laboratory for the following parameters- P.H., Mineral Content, Organic Matter (%), Nitrogen (kg/Hec), Phosphorus (kg/Hec), Potassium (kg/Hec), Free Lime content (%), Iron (ppm), Maganese (ppm), Bauxite (ppm), Copper (ppm), Texture (%), Bulk Density (Mg m³), Particle Density (Mg m³), Maximum Water Holding Capacity (%), Exchangeable Sodium (Mg/100g)
- 2.7** Identify roads on-site that would be used for vehicular traffic. Vehicular roads may be upgraded (if these are unpaved) by increasing the surface strength by improving particle size, shape and mineral type that make up the surface base. Surface gravel may be added and number of fine particles (smaller than 0.075mm) may be limited to 10 -20% to reduce source of dust emission. Vehicular speed on site may be limited to 10km/h. Nothing extra will be payable for this.
- 2.8** All material storages should be adequately covered and contained so that they are not exposed to situations where winds on site could lead to dust/particulate emissions.
- 2.9** Spills of dirt or dusty materials shall be cleaned up promptly so the spilled material does not become a source of fugitive dust and also to prevent of seepage of pollutant laden water into the ground aquifers. When cleaning up the spill, ensure that the clean - up process does not generate additional dust. Similarly, spilled concrete slurries or liquid wastes should be contained/cleaned up immediately before they can infiltrate into the soil/ground or runoff in nearby areas.
- 2.10** The contractor shall ensure that water spraying is carried out by wetting the surface by spraying water on:
- (i) Any dusty material.
 - (ii) Areas where demolition work is carried out.
 - (iii) Any unpaved main-haul road and.
 - (iv) Areas where excavation or earth moving activities are to be carried out.
- 2.11** The contractor shall ensure the following:

- i. Cover and enclose the site by providing dust screen, sheeting or netting to scaffold along the perimeter of a building.
 - ii. Covering stockpiles of dusty material with impervious sheeting.
 - iii. Covering dusty load on vehicles by impervious sheeting before they leave the site.
 - iv. Transferring, handling/storing dry loose materials like bulk cement and dry pulverized fly ash inside a totally enclosed system.
 - v. Clear vegetation only from areas where work will start right away.
 - vi. Vegetate/mulch areas where vehicles do not ply.
 - vii. Apply gravel / landscaping rock to the areas where mulching/paving is impractical.
- 2.12** The contractor shall adopt measures to prevent air pollution in the vicinity of the site due to construction activities.
- 2.13** Prior to the commencement of any work, the method of working, plant equipment and air pollution control system to be used on -site should be made available for the inspection and approval of the Engineer -in-Charge to ensure that these are suitable for the work / project.
- 2.14** The contractor shall employ measures to segregate the waste on-site into inert, chemical or hazardous wastes. The inert waste may be disposed off to Municipal Corporation/local bodies dump yard and landfill sites.
- 2.15** The contractor shall preserve the existing landscape and protect it from degradation during the process of construction. Proper timing for construction activity shall be selected to minimize the disturbance such as soil pollution due to spilling of the construction material and its mixing with rainwater. The construction management plan including soil erosion control management plan shall be prepared accordingly for each month. The application of erosion control measures includes construction of gravel pits and tyre washing bays of approved size and specification for all vehicular site entry/exits, protection of slopes greater than 10%. Existing vegetation shall be preserved and protected by not-disturbing or damaging to specified site areas during construction.
- 2.16** The contractor should follow the construction plans proposed by the Engineer-in-charge / landscape consultant to minimize the site disturbance such as soil pollution due to spilling.
- 2.17** The contractor shall ensure that no construction leachate (e.g., cement slurry) is allowed to percolate into the ground. Temporary drainage channels, perimeter dike/swale, etc. shall be constructed to carry the pollutant -laden water directly to the treatment device or facility (municipal sewer line).
- 2.18** All lighting installed by the contractor around the site and at the labour hutments during construction shall be CFL/ LED bulbs of the appropriate illumination levels.
- 2.19** All the building materials and systems used on site must be as per the specifications and approved makes by the Engineer-in-Charge.

- 2.20 All required certificates explaining the properties of the building material/system needs to be obtained from the manufacturer/vendor as required by the green building rating authority. The purchase orders of all the materials made with the manufacturers / authorized vendors should be maintained and shall be provided for the process with due diligence upon request.
- 2.21 All paints, adhesives and sealants should comply with the VOC limits prescribed by **5* GRIHA/super gree GHAR**.
- 2.22 Water saving measures need to be followed on site. If bore well water is used for construction, it must be metered. For waste water use in construction, record must be maintained of all tankers used at site. All sources of water use during construction must be regularly monitored.
- 2.23 The contractor / subcontractor shall prepare and submit a Site Management Plan (SMP) within 10 days of commencement date, for approval by the Engineer -in-charge. This SMP shall indicate the locations of go down, stockpiles, barricading, waste storage, offices, vehicular movement routes etc. In short, this SMP would comprehensively represent how the site activities shall be managed conforming to GRIHA/GHAR guidelines. **Contractor will be penalized @ Rs. 500 per day** of delay on non-submission of SMP beyond due date which shall be recovered from next RA bill.
- 2.24 Any other site management measures suggested by the Engineer-in-charge shall be followed on site.
- 2.25 The contractor & his team shall put adequate efforts to minimize construction waste generation at site. This shall include collection and segregation of all construction waste at site like broken bricks, tiles, glass, pavers, Steel scrap, Concrete debris, Plastic bags, drums, packaging cardboard, Timber scrap, Cement bags etc.
- 2.26 The contractor must keep record of all the construction waste being recycled or reused at site and also maintain receipts/records of waste sold from site. The contractor must ensure that no waste from the site is sent to landfill sites, either all waste is reused within the site or sent for recycling. The waste sent off the site to its final destination may be tracked. Contractor must keep record as gate passes / challans for all the waste material sent out for selling.
- 2.27 The contractor shall submit to the Engineer-in-Charge after completion of the buildings, a detailed as built quantification of the following within 10 days of recording of completion. Contractor will be penalized @ Rs. 500 per day of delay on non-submission beyond due date which shall be recovered from the Final bill:
- (i) Total materials used
 - (ii) Total waste generated,
 - (iii) Total waste reused,
 - (iv) Total water used,
 - (v) Total electricity consumed, and
 - (vi) Total diesel consumed.
- 2.28 Evidence for the implementation of the all the above required measures shall be provided in the form of photographs and templates as required for the submission to the green building rating authority (GRIHA/GHAR).

2.29 The contractor shall provide potable water for all workers. The contractor shall provide the minimum level of sanitation and safety facilities for the workers at site. The contractor shall ensure cleanliness of workplace with regard to the disposal of waste and effluent; provide clean drinking water, latrines and urinals as per applicable standard. Adequate toilet facilities shall be provided for the workman within easy access of their place of work. The total no. of toilets to be provided shall not be less than 1 per 30 employees in any one shift. Toilet facilities shall be provided from the start of building operations, and connection to a sewer shall be made as soon as practicable. Every toilet shall be so constructed that the occupant is sheltered from view and protected from the weather and falling objects. Toilet facilities shall be maintained in a sanitary condition. A Sufficient quantity of disinfectant shall be provided. Natural or artificial illumination shall be provided.

2.30 In compliance to the Hon'ble National Green Tribunal (NGT) and Office Memorandum no. DG/SE/CM/CON/Misc./02 dated 16.03.2016 along with other orders issued upto dates following preventive/corrective measures to be taken at site in order to control Air pollution from construction and demolition activity: –

- (i) The contractor shall not store/dump construction material or debris on metaled road.
- (ii) The contractor shall get prior approval from Engineer-in-charge for the area where the construction material or debris can be stored beyond the metaled road. This area shall not cause any obstruction to the free flow of traffic/inconvenience to the pedestrians. It should be ensured by the contractor that no accidents occur on account of such permissible storage.
- (iii) The contractor shall take appropriate protection measures like raising wind breakers of appropriate height on all sides of the plot /area using CGI sheets or plastic and /or other similar material to ensure that no construction material dust fly outside the plot area.
- (iv) The contractor shall ensure that all the trucks or vehicles of any kind which are used for construction purposes/or are carrying construction material like cement, sand and other allied material are fully covered. The contractor shall take every necessary precaution that the vehicles are properly cleaned and dust free to ensure that enroute their destination, the dust, sand or any other particles are not released in air/contaminate air.
- (v) The contractor shall provide mask to every worker working on the construction site and involved in loading, unloading and carriage of construction material and construction debris to prevent inhalation of dust particles.
- (vi) The contractor shall provide all medical help, investigation and treatment to the workers involved in the construction.
- (vii) The contractor shall ensure that C&D waste is transported to the C&D Waste site only and due record shall be maintained by the contractor.
- (viii) The contractor shall compulsorily use of wet jet in grinding and stone cutting.
- (ix) The contractor shall comply all the preventive and protective environmental steps as stated in the MoEF guidelines, 2010 (Amended and updated).

- (x) The contractor shall carry out on-Road-Inspection for black smoke generating machinery. The contractor shall use cleaner fuel.
- (xi) The contractor shall ensure that all DG sets comply emission norms notified by MoEF.
- (xii) The contractor shall use vehicles having pollution under control certificate. The emissions can be reduced by a large extent by reducing the speed of a vehicle to 20 kmph. Speed bumps shall be used to ensure speed reduction. In cases where speed reduction cannot effectively reduce fugitive dust, the contractor shall divert traffic to nearby paved areas.
- (xiii) The contractor shall ensure that the construction material is covered by tarpaulin. The contractor shall take all other precaution to ensure that no dust particles are permitted to pollute air quality as a result of such storage.
- (xiv) The paving of the path for plying of vehicles carrying construction material is more permanent solution to dust control and suitable for longer duration works / projects.

- 2.31** In case of non-availability of the C& D waste Material / Product, the contractor shall make arrangement of substitute materials/Products without any cost adjustment.
- 2.32** Any Penalty imposed by Civic bodies/ NGT for Non-Compliance of their guidelines issued by them from time to time shall be borne by the contractor.
- 2.33** The contractor shall comply with the safety procedures, norms and guidelines (as applicable) as outlined in the Part 7 of National Building code 2016 of India, Bureau of Indian Standards. A copy of all pertinent regulations and notices concerning accidents, injury and first-aid shall be prominently exhibited at the work site. Depending upon the scope & nature of work, a person qualified in first-aid shall be available at work site to render and direct first-aid to wounded/causalities. A telephone may be provided to first-aid assistant with telephone numbers of the hospitals. Complete reports of all accidents and action taken thereon shall be forwarded to the competent authorities.
- 2.34** Evidence for the implementation of the all the above required measures shall be provided to the Engineer-in-Charge in the form of photographs and templates as required which is required for the submission to the green building rating authority (GRIHA/GHAR).
- 2.35** The contractor shall preferably select materials / vendors, harvested and manufactured regionally, within a 800-km radius of the work / project site. Contractor shall collect & submit the relevant material certificates for materials with high recycled (both post-industrial and post-consumer) content, including materials like RMC mix with fly-ash, glass with recycled content, calcium silicate boards etc.
- 2.36** The contractor shall ensure that a flush out of all internal spaces is conducted prior to handover. This shall comprise an opening of all doors and windows for 14 days to vent out any toxic fumes due to paints, varnishes, polishes, etc.

2.37 Wherever required, Contractor shall meet and carry out all activities on site, supplement information, and make submittals.

2.38 CONSTRUCTION WASTE

- 2.38.1 Contractor shall ensure that wastage of construction material is within 3%. Subject to the suitability, all construction debris shall be used for road preparation, back filling, etc, as per the instructions of the Engineer in Charge, with necessary activities of sorting, crushing, etc. No construction debris shall be taken away from the site, without the prior approval of the Engineer in Charge. If and when construction debris is taken out of the site, after prior permissions from the Engineer in Charge, then the contractor shall ensure the safe disposal of all wastes and will only dispose of any such construction waste in approved dumping sites.
- 2.38.2 Contractor shall collect all construction waste generated on site. Segregate these wastes based on their utility and examine means of sending such waste to manufacturing units which use them as raw material or other site which require it for specific purpose. All construction debris generated during construction shall be carefully segregated and stored in a demarcated waste yard. Clear, identifiable areas shall be provided for each waste type. Typical construction debris could be broken bricks, steel bars, broken tiles, spilled concrete and mortar etc.
- 2.38.3 Water spray, through a simple hose for small works / projects, to keep dust under control. Fine mists should be used to control fine particulate. However, this should be done with care so as not to waste water. Heavy watering can also create mud, which when tracked onto paved public roadways, must be promptly removed. Also, there must be an adequate supply of clean water nearby to ensure that spray nozzles don't get plugged.
- 2.38.4 Contractor shall be required to provide an easily accessible area that serves the entire building and is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, corrugated cardboard, glass, plastics, and metals. He shall coordinate the size and functionality of the recycling areas with the anticipated collections services for glass, plastic, office paper, newspaper, cardboard, and organic wastes to maximize the effectiveness of the dedicated areas.
- 2.38.5 Staging (dividing a construction area into two or more areas to minimize the area of soil that will be exposed at any given time) should be done to separate undisturbed land from land disturbed by construction activity and material storage.
- 2.38.6 The storage of material shall be as per standard good practices as specified in Part 7, Section 2 in Storage, Stacking and Handling practices, NBC 2016 and shall be to the satisfaction of the Engineer in Charge to ensure minimum wastage and to prevent any misuse, damage, inconvenience or accident. There should be a proper planning of the layout for stacking and storage of different materials, components and equipment's with proper access and proper maneuverability of the vehicles carrying the materials. While planning the layout, the requirements of various materials, components and equipment's at different stages of construction shall be considered.
- 2.38.7 The contractor shall provide for adequate number of garbage bins around the construction site and the workers facilities and will be responsible for the proper utilization of these bins for any solid waste generated during the construction. The contractor shall ensure that the site and the workers

facilities are kept litter free. Separate bins should be provided for plastic, glass, metal, biological and paper waste and labelled in both Hindi and English with suitable symbols.

2.38.8 The Contractor shall remove from site all rubbish and debris generated by the Works and keep Works clean and tidy throughout the Contract Period. All the serviceable and non-serviceable (malba) material shall be segregated and stored separately. The malba obtained during construction shall be collected in well-formed heaps at properly selected places, keeping in a view safe condition for workmen in the area. Materials which are likely to cause dust nuisance or undue environmental pollution in any other way, shall be removed from the site at the earliest and till then they shall be suitable covered. Glass & steel should be dumped or buried separately to prevent injury. The work of removal of debris should be carried out during day. In case of poor visibility artificial light may be provided.

2.39 DOCUMENTATION:

- (a) The contractor shall submit to the Engineer in Charge, before the start of construction, a site plan along with a narrative to demarcate areas on site from which top soil has to be gathered, designate area where it will be stored, measures adopted for top soil preservation and indicate areas where it will be reapplied after construction is complete.
- (b) The contractor shall, during the entire tenure of the construction phase, maintain the following records and submit to the Engineer in Charge on demand:
 - (i) Water consumption in litres
 - (ii) Electricity consumption in 'kwh' units
 - (iii) Diesel consumption in litres
 - (iv) Quantum of waste (volumetric/weight basis) generated at site and the segregated waste types divided into inert, chemical and hazardous wastes.
 - (v) Digital photo documentation to demonstrate compliance of safety guidelines as specified herein.
 - (vi) Quantities of material brought into the site, including the material issued to the contractor by the Engineer in charge.
 - (vii) Quantities of construction debris (if at all) taken out of the site
 - (viii) Digital photographs of the works at site, the workers facilities, the waste and other material storage yards, pre-fabrication works, etc.
- (c) The contractor shall submit to the Engineer in Charge, following information, for all material brought to site for construction purposes, including manufacturer's certifications, and test data, but not limited to:
 - i) Source of products: Supplier details and location of the supplier.
 - ii) Recycled Content: Submit information regarding product post-industrial recycled and post-

consumer recycled content.

- iii) **Product Recyclability:** Submit information regarding product and product's component's recyclability including potential sources accepting recyclable materials wherever applicable.
- (d) The contractor shall provide total support to Engineer in Charge and Green Building Consultants appointed by the Engineer in charge in completing all Green Building Rating related formalities, including signing of forms, providing signed letters in the contractor's letterhead whenever required.
- (e) The contractor is expected to go through all other conditions of the GHAR/GRIHA rating stipulations. Failure to adhere to any of the above-mentioned conditions, without approval of the Engineer in Charge, shall be deemed as a violation of contract and the contractor shall be held liable for penalty as per terms of the agreement.

3.0 Special condition for Cement

- 3.1** Unless otherwise specified in this document, PPC cement shall be used. Agency shall procure PPC conforming to IS : 1489 (Part 1) as required in the work from cement manufacturers mentioned in the list of Preferred makes for civil works or from any other reputed cement manufacturer having a production capacity not less than 1 million tons per annum as approved by competent authority of CCU.
- 3.2** The supply of cement shall be taken in 50 kg. bags bearing manufacturer's name and ISI marking. Samples of cement arranged by the Contractor shall be taken by the Engineer-in-charge and got tested in accordance with provisions of relevant BIS codes. In case the test results indicate that the cement arranged by the Contractor does not conform to the relevant BIS codes, the same shall stand rejected, and it shall be removed from the site by the Contractor at his own cost within a week's time of written order from the Engineer- in-charge to do so. Supply of cement shall be taken in 50-kg bags bearing manufacturer's name, or his registered trademarks if any and grade and type of cement as well as ISI marking.
- 3.3** The cement shall be brought at site in bulk supply of approximately 20 tons or as decided by the Engineer-in-charge on the basis of requirement of work in progress. The cement godown of Minimum 500 bags capacity to store the cement shall be constructed by the Contractor at site of work for which no extra payment shall be made.
- 3.4** Double lock provision shall be made to the door of the cement godown. The keys of one lock shall remain with the engineer-in-charge or his authorised representative and the keys of other lock shall remain with the contractor. The contractor shall be responsible for the watch and ward and safety of cement godown. The contractor shall facilitate the inspection of cement godown by the Engineer-in-charge at any time.
- 3.5** The cement shall be got tested by the Engineer-in-charge and shall be used on the work only after satisfactory test results have been received.
- 3.6** The actual issue and consumption of cement on work shall be regulated and proper accounts shall be maintained. The theoretical consumption of cement shall be worked out. In case the cement

consumption is less than theoretical consumption including permissible variation, recovery at the rate so prescribed shall be made. In case of excess consumption, no cost adjustment shall be made.

- 3.7 The cement brought to the site and the cement remaining unused after completion of the work shall not be removed from site without the written permission of the Engineer-in-charge.
- 3.8 The damaged cement shall be removed from the site immediately by the Contractor on receipt of a notice in writing from the Engineer-in-charge. If he does not do so within 3 days of receipt of such notice, the Engineer-in-charge shall get it removed at the cost of the Contractor.

4.0 Special Conditions for Steel Reinforcement

- 4.1 The Contractor shall/procure ISI marked TMT bars of grade 500D or more from the Steel Manufacturers mentioned in preferred make list for civil works or their authorized dealers/ authorized distributors/channel partners.
- 4.2 Samples shall also be taken and got tested by the Engineer-in-Charge as per the provisions in this regard in relevant BIS codes. In case the test results indicate that the reinforcement steel arranged by the contractor does not conform to the specifications, the same shall stand rejected, and it shall be removed from the site of work by the contractor at his cost within a week time or written orders from the Engineer-in-Charge to do so.
- 4.3 The steel reinforcement bars shall be brought to the site in bulk supply of 25 tonnes or more, or as decided by the Engineer-in-charge.
- 4.4 The steel reinforcement bars shall be stored by the contractor at site of work in such a way as to prevent their distortion and corrosion, and nothing extra shall be paid on this account. Bars of different sizes and lengths shall be stored separately to facilitate easy counting and checking.
- 4.5 For checking nominal mass, tensile strength, bend test, re-bend test etc. specimens of sufficient length shall be cut from each size of the bar at random, and at frequency not less than that specified below:

Size of bar	For consignment below 100ton	For consignment above 100ton
Under 10 mm dia bars	One sample for each 25 tonnes or part there of	One sample for each 40 tonnes or part there of
10 mm to 16mm dia bars	One sample for each 35 tonnes or part there of	One sample for each 45 tonnes or part there of
Over 16mm dia bars	One sample for each 45 tonnes or part there of	One sample for each 50 tonnes or part there of

- 4.6 The contractor shall supply free of charge the steel required for testing including its transportation to testing laboratories.
- 4.7 The actual issue and consumption of steel on work shall be regulated and proper accounts maintained. The theoretical consumption of steel shall be worked out. In case the consumption is less than theoretical consumption including permissible variations, recovery at the rate so prescribed shall be made. In case of excess consumption, no adjustment needs to be made.

- 4.8** The Steel brought to site and remaining unused shall not be removed from site without the written permission of Engineer-in-Charge.
- 4.9** The standard sectional weights referred to shall be as given in Table 5.4 in para 5.3.4 in CPWD Specification 2019 Vol.-I and will be considered for conversion of length of various sizes of TMT Bars in to standard weight. Record of actual sectional weights shall also be kept diameter and lot wise. The average sectional weight for each diameter shall be arrived at from samples from each lot of steel received at site. The decision of the Engineer-in-Charge shall be final for the procedure to be followed for determining the average sectional weight of each lot. Quantity of each diameter of steel received at site of work each day will constitute one single lot for the purpose. The weight of steel by conversion of length of various sizes of bars based on the actual weighted average sectional weight shall be termed as Derived Actual Weight. If the derived weight is less than the standard weight, then the Derived Actual Weight shall be accepted if it is within the following tolerances specified in IS:1786-2008, otherwise whole lot will be rejected. However, deductions shall be made for the difference in derived actual weight and standard weight at the rate determined by engineer-in-charge. If the derived actual weight is found more than the standard weight, then nothing shall be paid extra for the difference in derived actual weight and standard weight.
- 4.10** The contractor shall submit original vouchers from the manufacturer for the total quantity of steel supplied under each consignment to be used in the work. All consignment received at the work site shall be inspected by the Site staff along with the relevant documents before acceptance. The contractor shall obtain Original Vouchers and copy of Test Certificates and furnish the same to the Engineer-in-Charge in respect of all the lots of steel brought by him from approved supplier to the site of work. The original vouchers and copy of test certificates shall be defaced by the Site staff and kept on record in the site office.
- 4.11** The reinforcement steel brought to site of work shall be stored on brick / timber platform of 30/40-cm height, nothing extra shall be paid on this account.

PARTICULAR SPECIFICATIONS FOR CIVIL WORKS

1.0 General:

- (i) CPWD Specifications 2019, Vol. I & Vol II as amended from time to time shall be applicable for all the items to be executed as per good for construction drawings.
- (ii) Provision contained in the harmonized guidelines & standard for universal Accessibility in India 2021 (Available on CPWD website) of Ministry of Housing and urban affairs, Government of India shall be complied with while preparing drawings.
- (iii) C& D waste products and recycled aggregates to the extent provided in IS codes shall be used as per extant provisions of the green building measures. Only potable water shall be used in the work

2.0 Earthwork, Foundation and Plinth:

- (i) Scope of work includes all items of DSR as contemplated in the Sub Head Earthwork of DSR (including bailing and pumping out water, strutting etc.) as may be applicable to the work as per design and drawings submitted by the contractor and as confirmed by the Engineer-in-Charge and are to be executed as per CPWD specifications.
- (ii) Excavation (surface excavation, over area, foundation, trenches etc.) in all kind of soil shall be carried out upto desired level as per structural drawings.
- (iii) Earth required for filling in all works like trenches, foundations, plinth, around building, road work and other development works shall be of good quality useful for filling as per CPWD specifications.
- (iv) The available excavated earth suitable for filling shall be used by the contractor. Excess earth required if any shall be procured from outside the campus for which nothing extra shall be paid.
- (v) Surplus excavated earth after filling as per site conditions to be disposed outside the campus after remittance of due royalty to concerned authority, as applicable, by taking required permission from concerned Government authority.
- (vi) Appropriate ground improvement or soil stabilization measures as per the soil investigation report and structural design, if any recommended shall be carried out.
- (vii) Appropriate foundation system Including isolated footing/combined footing/ Raft/ pile and possible combination of these as per the recommendations of the soil investigation report containing borehole data, seasonal variation of subsoil water table, and as per structural design conforming to relevant Indian Standard Codes shall be provided.
- (viii) Anti-termite treatment as per the necessity of ground shall be carried out as per relevant Indian standard codes/CPWD specifications.
- (ix) Structural Grade slab shall be designed & provided accordingly.

- (x) Damp proof course shall be provided wherever required as per CPWD specification.
- (xi) Basement if provided shall be designed as an integral part of superstructure and integrated with foundation system with suitable water proofing system as mentioned in relevant sections and measures for collection, pumping and disposal of any water.
- (xii) Any extended basement beyond footprint of the superstructure shall be designed and integrated with foundation system and its roof slab designed to carry all loads including fire tender load as required.
- (xiii) Drainage and Plinth protection along the perimeter of the buildings shall be provided as per CPWD specifications or as per specific functional requirement
- (xiv) All the excavated earth/soil shall be levelled & neatly dressed. Sand filling of minimum 150mm thickness, with river sand, shall be done under floor.

3.0 Superstructure:

- (i) Structural system for the superstructure shall be adopted as mentioned in scope of work and user requirements.
- (ii) Structural design shall be carried out conforming to relevant Indian Standard codes. Building shall be designed based on latest IS codes and should have seismic resistant provisions as per IS codes. The materials like concrete, steel, centering and shuttering shall be as per the approved technology and as per CPWD specifications/ IS codes.
- (iii) All the horizontal, vertical, inclined projections of the structure like porticos, slab projections, staircases, mummy, machine rooms, water tanks, any other architectural features shall be designed as integral part of the structure and provided.
- (iv) Expansion joints/seismic separation joints shall be provided as per the approved structural drawing and treated and covered as per CPWD specifications / manufacturer specifications.
- (v) The Structural Steel shall be made fire resistant or **fire rated for appropriate duration as per NBC 2016** by using vermiculite coating as per manufacturer's specifications and by applicators approved by them.

4.0 Concrete Works:

All concrete works shall be carried out in general as per CPWD Specifications 2019, Volume-I & II with upto date revisions/ amendments / correction slips issued till last date (including any extension, if any) of submission of bid. Unless specified otherwise, all the PCC work shall be of grade M-10 with minimum cement content of 220 kg/cum and of 100 mm thickness. Unless specified otherwise, cement concrete of 1:1½:3 (1 Cement: 1½ C & D recycled stone dust: 3 graded stone aggregate 20 mm nominal size) may be used for Lintels, RCC bands, in trenches for cables and pipes, filling in sunken area etc. **If the C&D waste product are unavailable in market, the conventional products may be used by the contractor at no extra cost to department.**

5.0 RCC WORKS:

Foundation (isolated/combined, strip, raft, pile etc.) shall be with RCC along with retaining walls as per detailed structural design and structural drawing prepared by the contractor and vetted by the proof consultant using specified grade of concrete. RCC retaining/breast wall shall be provided as per drawings and site condition. Unless specified otherwise, all structural members like footings/foundations, Columns, Beams, slabs etc. shall be provided with following specified grades of concrete as under –

S. N.	Structural Element	Grade of Concrete
1	Foundations (Isolated or combined Footings, Pedestals, Rafts, Strip footings, pile foundation etc.)	M-30
2	Retaining Wall	M-30
3	Columns and walls (shear/lift)	M-30
4	Beams	M-30
5	Slabs*	M-30

For composite slabs, the minimum thickness shall be 150 mm.

6.0 Design Mix Concrete (from Batch Mix Plant or from RMC Plant)

- 6.1** Design mix is to be carried out as per IS 10262, IS 456, IS 4926, and other relevant IS codes / CPWD Specifications amended upto last date (including extended date, if any) of submission of bid. The contractor shall carry out design mixes for each class of concrete indicating that the concrete ingredients and proportions will result in concrete mix meeting requirements specified. The cement shall be actually weighed as presumption of each bag having 50 kg shall not be allowed. In case of use of admixture, the mix shall be designed with these ingredients as well. All the ingredient shall confirm to relevant Indian standard as well as the CPWD specification.
- 6.2** The Contractor shall install fully automatic Batch Mix Plant at site or in nearby area wherever permissible. Under special circumstances, Contractor will arrange concrete from RMC (Ready Mix Concrete) producing plants with prior approval from Engineer-in-charge. Nothing extra shall be payable for sourcing concrete from RMC plant. For all purposes, the Contractor shall carry out fully, the responsibilities of the “placement Contractor” and the “manufacturer of concrete”.
- 6.3** The Engineer-in-Charge will reserve the right to inspect at any stage and reject the concrete if he is not satisfied about quality of product at the user’s end.
- 6.4** The Engineer-in-charge reserves the right to exercise control over the: -
- Ingredients, water and admixtures purchased, stored and to be used in the concrete including conducting tests for checking quality of materials, recording of test results and declaring the materials fit or unfit for use in production of mix.
 - Calibration checks of the Fully Automatic Batching plant /RMC.
 - Weight and quantity check on the ingredients, e.g. cement, aggregates, water and admixtures added for batch mixing.

- iv. Time of mixing of concrete.
- v. Testing of fresh concrete, recordings of results and declaring the mix fit or unfit for use. This will include continuous control on the workability during production and taking corrective action, if required.

6.5 All stone aggregate and stone ballast shall be of hard stone variety to be obtained from approved quarries. Coarse sand should be obtained from approved sources. The same shall be clean and sharp angular grit type. The coarse sand shall be screened before using, if required. If the sand brought to site is dirty, it must be washed in clean water to bring the sand to the required specifications. Nothing extra shall be payable on this account.

6.6 For exercising such control, the Engineer-in-charge shall periodically depute his authorized representative at the fully automatic batching plant/ RMC. It shall be responsibility of the Contractor to ensure that all necessary equipment, manpower & facilities are made available for inspections/checking to Engineer-in-Charge and/or his authorized representative at fully automatic batching plant/ RMC.

6.7 All relevant records of produced and used concrete shall be made available to the Engineer-in-Charge or his authorised representative. Engineer-in-Charge shall, as required, specify guidelines & additional procedures for quality control & other parameters in respect of materials, production & transportation of concrete mix which shall be binding on the Contractor. Concrete as per design mix approved by Engineer-in-Charge shall be produced and transported to the site.

6.8 The terms machine batched, machine mixed and machine vibrated concrete used elsewhere in contract shall mean the concrete produced in concrete batching and mixing plant and if necessary, transported by transit concrete mixers, placed in position by the concrete pumps, tower crane and vibrated by surface vibrator /needle vibrator / plate vibrator, as the case may be to achieve required strength and durability.

6.9 The concrete mix design with and without admixture will be carried out by the Contractor, at his own cost, through one of the laboratories/Test houses to be approved by Engineer-in-charge.

6.10 Ultrasonic Pulse Velocity Method of Test for RCC

- a) The underlying principle of assessing the quality of concrete is that comparatively higher velocities are obtained when the quality of concrete in terms of density, homogeneity and uniformity is good. In case of poorer quality lower velocities are obtained. If there are cracks, voids or flaws inside the concrete which come in the way of transmission of pulse, lower velocities are obtained.
- b) The quality of concrete in terms of uniformity, incidence or absence of internal flaws, cracks and segregation etc. are indicative of the level of workmanship employed, can thus be assessed using the guidance given in table below, which have been evolved for characterizing the quality of concrete in structure in term of the ultrasonic pulse velocity.

Velocity criterion for Concrete Quality Grading

S.N.	Pulse Velocity by Cross Probing (Km/Sec)	Concrete Quality grading
1	Above 4.5	Excellent
2	4.5 to 3.5	Good
3	3.5 to 3.0	Medium
4	Below 3.0	Doubtful

- c) Ultrasonic Pulse velocity method of testing of concrete is to be conducted for works as a routine test. The acceptance criteria as per the above table will be applicable which is as per IS 13311 (part-1): 1992. From the above “Good” and “Excellent” grading are acceptable and the grading “Medium” and “Doubtful” will not be acceptable.
- d) At least **5%** of the total number of RCC members in each category i.e. beam, column, slab and footing may be tested by Ultrasonic Pulse velocity test method for establishing quality of concrete. It is suggested that test may be conducted on RCC beam near joint with column, on RCC column near joint with beam, on RCC footings and rafts. On RCC rafts a suitable grid can be worked out for determining number of tests. In addition, doubtful areas such as honeycombed locations, locations, where continuous seepage is observed, construction joints and visible loose pockets may also be tested.
- e) The test results shall be examined in view of the above acceptance criteria “Good” and “Excellent” and wherever concrete is found with less than required quality as per acceptance criteria, repairs to concrete will be made. Honeycombed areas and loose pockets will be repaired by grouting using Portland Cement Mortar/Polymer Modified Cement Mortar /Epoxy Mortar, etc. after chipping loose concrete in appropriate manner. In areas where concrete is found below acceptance criteria and defects are not apparently visible on surface, injecting approved grout in appropriate proportion using epoxy grout /acrylic Polymer modified cements slurry made with shrinkage compensating cement / plain cement slurry etc. shall be resorted to for repairs (refer relevant chapters from CPWD Hand Book on Repairs and Rehabilitation of RCC Buildings). Repair to concrete shall be done till satisfactory results are obtained as per the acceptance criteria by retesting of the repaired area. If satisfactory results are not obtained dismantling and relaying of concrete will be done at the cost of contractor.

6.11 Standard of acceptance shall be same as specified in clause 16 of IS 456-2000. In case of rejection of concrete on account of unacceptable compressive strength, the work for which samples have failed shall be redone at the cost of contractor. However, the Engineer in charge may order for additional tests (like cutting cores, ultrasonic pulse velocity test, load test on structure or part of structure etc) to be carried out at the cost of contractor to ascertain if the portion of structure wherein concrete represented by the sample has been used, can be retained on the basis of results of individual or combination of these tests. The contractor shall take remedial measures necessary to retain the structure as approved by the Engineer in charge without any extra cost.

6.12 COVER/SPACER BLOCK- The contractor shall provide approved type of support for maintaining the bars in position and ensuring required spacing and correct cover of concrete to reinforcement as called for in the drawings, by providing spacer blocks of required shape and size. Chairs and spacer bars shall be used in order to ensure accurate positioning of reinforcement. Only factory-made cover blocks shall be used. **Pre-cast cement mortar/concrete blocks/blocks of polymer shall not be used as spacer blocks unless specially approved by the Engineer-in-charge.**

7.0 SHUTTERING/FORMWORK:

- 7.1 The work shall be done in general as per CPWD Specifications 2019, Volume-I & II with date revisions/ amendments / correction slips issued upto last date of submission of bid.
- 7.2 Double steel scaffolding having two sets of vertical supports shall be provided for external wall finish, cladding etc. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding platform shall be fixed. Scaffolding shall have steel staircase for inspection of works at upper levels.
- 7.3 In order to keep the floor finish as per architectural drawings and to provide required thickness of the flooring as per specifications, the level of top surface of R.C.C. shall be accordingly adjusted at the time of its centering, shuttering and casting for which nothing extra shall be paid to the Contractor.
- 7.4 As per general engineering practice, level of floors in toilet / bath, balconies, shall be kept lower than general floors as required from waterproofing point of view. Shuttering should be adjusted accordingly. Nothing extra is payable on this account.
- 7.5 Dented, broken, cracked, twisted or rusted shuttering shall not be allowed to be used on the work.
- 7.6 The shuttering shall be cleaned properly with electrically driven sanders to remove any cement slurry or cement mortar or rust. Proper shuttering oil or de-bonding compound shall be applied on the surface of the shuttering in the requisite quantity before laying of steel reinforcement.
- 7.7 For the execution of centering and shuttering, the contractor shall use propriety shuttering oil as approved by Engineer-in-Charge and nothing extra shall be paid on this account.
- 7.8 All existing formwork that fails to meet the specifications mentioned above or do not qualify to meet the minimum standards in the view of Engineer-in-Charge shall have to be removed and stacked.

8.0 REINFORCEMENT:

- 8.1 The reinforcement work shall be done as per CPWD Specifications 2019, Volume-I & II with revisions/ amendments / correction slips upto last date of bid submission (including extensions if any).
- 8.2 Reinforcement work includes all operations including straightening, cutting, bending, welding, binding with annealed steel or welding and placing in position at all the floors with all leads and lift complete as per CPWD Specifications.
- 8.3 The contractor shall provide approved type of support for maintaining the bars in position and ensuring required spacing and correct cover of concrete to reinforcement as mentioned in the drawings. Spacer blocks of required shape and size, chairs and spacer bars shall be used in order to ensure accurate positioning of reinforcement. To ensure proper cover, factory made round / rectangular type cover blocks will be used to avoid displacement of bars in any. Couplers shall be used for splicing of reinforcement bars.
- 8.4 Reinforcement TMT bars, to be used for the work, shall be TMT bars of grade Fe 500D or more.

8.5 Bar Bending Schedule: The agency shall prepare bar bending schedule as per structural drawings and submit to Engineer-in-Charge in advance for approval. The bar bending schedule shall conform to Indian Standard IS 2502-Code of Practice for Bending and Fixing of bars for Concrete Reinforcement. Before execution of work, two copies of these bar bending schedules including revision, will be submitted to Engineer-in-Charge for approval.

9.0 MASONRY WORK:

The masonry work shall be done as per CPWD Specifications 2019, Volume-I & II with revisions / amendments / correction slips upto last date of bid submission (including extensions if any). In case of conflict or contradiction between detailing shown in drawings and specification mentioned herein under this subhead, the specification mentioned herein under this subhead will be followed.

- 9.1** Chicken mesh 85gsm or fibre mesh of good quality to be provided in plaster at the junction of Masonry and RCC or CC Member/band.
- 9.2** For masonry work above plinth level, RCC band at sill level and lintel level shall be provided. This thickness of the band shall preferably be 100 mm or as approved by the Engineer-in-Charge.
- 9.3** All opening on masonry wall shall be provided with RCC lintels, RCC bands/ lintel over top of parapet wall at corridors, balconies etc. with cement concrete of 1:1½:3 (1 Cement: 1½ C & D recycled stone dust: 3 graded stone aggregate 20 mm nominal size) shall be provided. If the C&D waste product are unavailable in market, the conventional products may be used by the contractor at no extra cost to department.
- 9.4** Fly ash brick masonry of class designation 10, with cement mortar 1:6 (1 cement: 6 coarse sand), shall be done in wet areas. FPS bricks of class designation 7.5 in cement mortar 1:6 (1 Cement: 6 Coarse Sand) shall be used in brick work in foundation upto plinth level and other masonry work shown in drawings. All the walls of corridors shall be of full brick thick wall or with 200mm thick AAC blocks.
- 9.5** AAC blocks masonry shall be of Grade I and of oven dry density 551-650 kg/cum with polymer modified adhesive mortar above plinth level except wet areas. The polymer modified adhesive mortar shall be provided @ 30 kg per cum. AAC Block confirming the IS Code – 2185 (Part-3) 1984 (Reaffirmed 2005) shall be used.
 - a) **Dimensions & Tolerances:** Autoclave Aerated Concrete Block shall be made in sizes and shapes to fit different needs.
 - b) The maximum variation in the length of the Autoclave Aerated Concrete Block shall not be more than plus/minus 5mm and maximum variation in the height and width of Autoclave Aerated Concrete Block, not more than plus/minus 3mm.
 - c) The faces of Autoclave Aerated Concrete Block shall be flat & rectangular, opposite faces shall be parallel and all arises shall be square. The bedding surfaces shall be at right angle to the face of the Blocks. The Autoclave Aerated Concrete Block with special faces shall be manufactured and supplied if so required.
 - d) The autoclaved aerated concrete block shall be classified in two grades according to their compressive strength as indicated in table below:

S.N.	Density in Oven dry Condition (Kg/m ³)	Compressive Strength (N/mm ²)		Thermal Conductivity in air dry condition (W/m.k)
		Grade I	Grade II	
1	451 to 550	2.00	1.50	0.21
2	551 to 650	4.00	3.00	0.24
3	651 to 750	5.00	4.00	0.30
4	751 to 850	6.00	5.00	0.37
5	851 to 1000	7.00	6.00	0.42

- e) All Autoclave Aerated Concrete Block shall be sound, free of cracks or other defects which interfere with the proper placing of block units and impair the strength or performance of the construction. The face or faces that are to be exposed shall be free of chips, cracks or other imperfections except that if not more than 5% of a consignment contains slight cracks or small chippings not larger than 25mm, this shall not be deemed grounds for rejection.
- f) **Block Density** – The Block density shall conform to the requirements specified in above table, when tested accordance with IS 6441 (Part-1) -1972.
- g) **Compressive Strength** – The minimum compressive strength being the average of twelve block units shall be as prescribed in above table, when tested accordance with accordance with IS 6441 (Part-5) -1972.
- h) **Thermal Conductivity** – The thermal conductivity shall not exceed the values specified in above table when tested in accordance with IS 3346 -1980.
- i) **Drying Shrinkage** – The drying shrinkage shall be not more than 0 .05% for grade –1 block and 0.10% for grade-2 block when tested in accordance with IS 6441 (Part-2) -1972.
- j) **Number of tests:** A sample of 24 blocks shall be selected at random. All the 24 Blocks shall be checked for dimensions and inspected for visual defects. Out of the 24 blocks, 12 blocks shall be subjected to the test for compressive strength, 3 blocks to the test for density, 3 blocks to the test for thermal conductivity and 3 blocks to the test for drying shrinkage. The remaining 3 blocks shall be reserved for re-test for drying shrinkage if a need arises.
- k) The samples of AAC blocks (each sample consisting of 6 specimen) shall be chosen randomly from the lot procured and tested for various parameters specified as above. One samples shall be tested for every **200 cum** or part thereof. However, minimum one sample shall be tested from each lot received at site if the quantity procured in the lot is less than 200 cum. If required, Engineer-in-Charge or his authorized representative shall inspect the factory during production of the material for this work and also collect samples (of materials used for making AAC blocks and precast AAC blocks) from the factory itself. The contractor shall consider this contingency also while placing the order with one of the approved firms. Nothing extra shall be payable on this account.
- l) **Criteria for conformity:** The number of blocks with dimensions outside the tolerance limit and or with visual defects, among those inspected, shall not be more than two. For density, the mean value shall be within the range as specified in above Table. For compressive strength, the mean value, say X shall be determined. The test results shall be grouped into

groups of 4, individual values of ranges shall be determined, the average range a calculated from these values and shall satisfy the following condition: $X - 0.6 R >$ minimum value specified in above Table. For thermal conductivity, the mean value shall be equal to or less than the value specified in above Table. For drying shrinkage, all the test specimens shall satisfy the requirements of the test. If one or more specimens fail to satisfy the requirements, the remaining 3 blocks shall be subjected to these tests. All these blocks shall satisfy the requirements.

- m) **Manufacturer's Certificate:** The manufacturer shall satisfy himself that the masonry units conform to the requirements of these specification and, if requested, shall supply a certificate to this effect to the purchaser or his representative.
- n) **Marking:** Each lot of concrete masonry units manufactured in accordance with this specification shall preferably be marked with information-
 - o The identification of the manufacture
 - o The grade and block density of the unit
 - o The month and year of manufacturing

10.0 DOOR/WINDOW WORK:

The door/window work in general shall be carried out as per CPWD Specifications 2019, Volume-I & II with revisions/ amendments / correction slips upto last date of bid submission (including extensions if any). In case of conflict or contradiction between detailing shown in drawings and specification mentioned herein under this subhead, the specification mentioned herein under this subhead shall be followed. Before taking up any procurement/construction activity, shop drawings (for fixing of all kind of doors, showing all hardwares) shall be prepared (on the basis of specification laid herein) and submitted by contractor for obtaining approval from Engineer-in-Charge.

- 10.1 Windows along with glazing shall be designed for wind loads applicable to the area/location as per relevant IS codes.
- 10.2 The samples of species of timber to be used, shall be deposited by the contractor with the Engineer-in-Charge before commencement of the work. The contractor shall produce cash vouchers and certificates from standard kiln seasoning plant operator about the timber to be used on the work having been kiln seasoned by them, failing which it would not be accepted as kiln seasoned. Specified timber shall be of good quality and well-seasoned. It shall have uniform colour, reasonably straight grains and shall be free from dead knots, cracks and sapwood.
- 10.3 Wood work shall not be painted, oiled or otherwise treated before it has been approved by the Engineer-in-Charge. All portion of timber including architrave abutting against masonry concrete stone or embedded in ground shall be painted with approved wood preservative or with boiling coal tar.
- 10.4 Door/window schedules is provided with the tender document which shall be followed invariably. If any door type or tag is not mentioned in drawings or door & window schedule, decision shall be given by Engineer in charge based on door specified in door & window schedule for similar functional area.

- 10.5 Flush Door Shutters** - Flush door shutters shall be of 35 mm thick or of thickness as specified/required/decided (in door & window schedule) and conforming to IS: 2202 (Part I) decorative type, core of block board construction with frame of 1st class hard wood and well-matched teak 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters. Stainless Steel butt hinges with necessary screws shall be used for fixing. Lipping with 2nd class teak wood battens of 25 mm minimum depth on all edges of flush door shutters shall be provided. Rebate shall be cut (in frames/shutters) as specified and instructed by Engineer-in-charge. Vision panel of required and specified shape e.g. rectangular, square, circular etc. shall be provided.
- 10.6 Laminates**- Flush doors shall be provided with 1.5 mm thick Decorative high pressure laminated sheet (on both side) of plain / wood grain in gloss / matt/ suede finish with high density protective surface layer and reverse side of adhesive bonding quality conforming to IS: 2046 Type S, including adhesive of approved quality. The laminates shall be resistant to fungal attack at the end of 28 days of incubation when tested as per ASTM: G 21 - 2015.
- 10.7 PU Polish** interior grade or exterior grade as per exposure condition (Asian, MRF or equivalent) shall be done (in 3 or more coats to achieve superior finish) on all hard wood & decorative veneered surfaces.
- 10.8 Hollow Metal Doors (Pressed Metal Doors):** Hollow Metal doors should confirm to IS 16074 & IS 4351 and shall be made of pressed galvanized steel conforming to IS 277. The door frame shall be single rebate profile made out of 1.2 mm thick (minimum) galvanized steel sheet (18 gauge) and Door shutter shall be single leaf/double leaf fully flush double skin with or without vision panel manufactured from 0.8 mm minimum thick galvanized steel sheet. The profile of frame and thickness of shutter shall be as per manufacturer's specifications. Frames should be mitred, field assembled with self-tab. All provision should be mortised, drilled and tapped for receiving appropriate hardware. Frames to have inbuilt grooved sealing system for taking appropriate seal. Frames should be provided with back plate for anchor fasteners for installation on a finished plastered wall opening. Once frames are installed, it should be grouted with non-fire rated PUF. The internal construction of the door should be rigid reinforcement pads for receiving appropriate hardware. The edges should be interlocked with a bending radius of 1.4 mm. Vision panel wherever applicable should be provided with minimum 4 mm clear toughened glass with suitable gaskets as per manufacturers recommendation with a clipon arrangement. For Double leaf doors astragal has to be provided on meeting stile for both active and inactive leaf. Doors should have passed minimum 500 hours of salt spray test. All doors should be finished with pure polyester powder coating (minimum 60 micron) in desired regular RAL Shades.
- 10.9 FRP Doors:** - Fiber Glass Reinforced plastic (FRP) Door Frames shall have cross-section 90 mm x 45 mm with single rebate of 32 mm x 15mm to receive shutter of 30 mm thickness. Door frame laminate shall be 2 mm thick and shall be filled with suitable wooden block in all the three legs. The laminate shall be moulded with fire resistant grade unsaturated polyester resin and chopped mat. The frame shall be covered with fiber glass from all sides. M.S. stay shall be provided at the bottom to steady the frame. Fiberglass Reinforced Plastic (F.R.P.) flush door shutter of (30 mm thickness) should consist in different plain and wood finish made with fire retardant grade unsaturated polyester resin, moulded to 3mm thick FRP laminate all around, with suitable wooden blocks inside at required places for fixing of fittings and polyurethane foam (PUF)/ Polystyrene foam to be used as filler material throughout the hollow panel, casted monolithically with testing parameters of F.R.P. laminate conforming to table - 3 of IS: 14856, as per direction of Engineer-in-charge.

10.10 High Pressure Compact Laminate: It shall be provided as per finishing schedule in 8 mm thick High Pressure interior compact Laminate (of Greenlam, Merino, Fundermax) made out of thermosetting resin treated, Kraft as core material and design paper as a finish surface. The compact laminates should be resistant to water immersion through permissible increase on thickness and mass <0.60% and board should have density >1.35kg/cm³. Compact laminates should be flame retardant and fulfill the criteria of classification of B-s1, d0 of EN 13501-1. It shall have Anti-bacterial and anti-termite property as per JIS Z2801:2000, Chemical resistance, Scratch resistant, fire resistance, weather & climatic shock resistance. It should fulfill the criteria of FSC and Green Guard Gold certification and manufactured under EN438-2&3:2005 standard. Finish and colour of compact laminates should be finalised under direction of Engineer –in-charge. Compact laminates should be installed on 25x50mm MS tube at 600 c/c or tube size as suggested by the manufacturer various height and fixed through same compact colour rivets or compact adhesive as per recommended by manufacturer’s specification/instructions. The manufacturer should provide 10 years warranty certification on any manufacturing and moisture related defects.

10.11 Glazed Doors: All the glazed doors (non-fire rated) shall be made in Aluminum door frames, shutters of suitable section, (with powder coating in required shade and colour of not less than 50 microns), toughened glass with necessary fittings and fixtures of stainless steel (SS 304) required to make the door operational and function smoothly, complete as per directions of Engineer-in-charge. Necessary shop drawings should be prepared by the contractor and work shall be executed after obtaining approval from Engineer-in-charge. The thickness of glazing should not be less than 8 mm.

10.12 AUTOMATIC SLIDING DOORS:

Automatic Sliding Door shall be with Microprocessor controlled System consisting of 10mm thick Toughened Glass, Glass Box, High performance & Heavy Duty DC Motor, minimum IP54 Protection class, Weight carrying capacity of 240 kg (Frameless double leaves) with Auto/Open/In/Out/Locked/Half Opening user modes with Opening speed as 10-45 cm/s and closing speed as 10-25 cm/s. The system shall be eligible for obstacle detection in both opening and closing cycles with short braking distance during opening and closing cycle for energy saving. The system shall be compatible with fire alarm systems.

The radar in the system shall be with Microwave movement sensor, for application on the external side with Sensor having Microwave doppler movement sensor with integrated active infrared motion presence sensor, energy saving, for application on the internal side EN 16005.

The system shall be inclusive of all Aluminum glass holder/glass point fitting, sliding channel, rollers, fittings, accessories etc. as required in order to complete the system in all respects.

10.13 Roller Blinds shall be provided of approved make and approved shades having 0.40mm thickness in 100% polyester material with 100% Degree of opacity & having Weight of 375gm/Sqm to 450gm/Sqm in all sizes and for all Heights complete as per the direction of Engineer in Charge.

10.14 All fittings and fixtures shall be as per hardware schedule for doors / windows (mentioned in contract document) and got approved from the Engineer-in-Charge before procurement well in advance and the approved samples shall be kept at site till completion of the work.

10.15 HARDWARE FOR DOORS /WINDOWS: Following specifications of the hardwares for door /windows shall be followed:

- a) **BUTT HINGES:** 5 Knuckle, 2 bearing butt hinges size 4" x 3" x 3mm, in SS 304 and in satin finish in stainless steel as per EN 1935, CE Marked suitable for door weights upto 120kgs (Make: DORMA 3090F, HORMANN, ABECO, GEZE OR HAFELE)
- b) **VISION PANEL:** Unless otherwise specified, toughened glass of 6 mm thickness.
- c) **GRAVITY COORDINATOR:** Door coordinator /sequencer for the double leaf doors (Make – Dorma SR390, Hormann, ABECO, Geze 013525, and Hafele).
- d) **DOOR LOCK:** 55mm backset, 20mm square forend prepared for euro profile cylinder including strike plate. and EPC 70mm Length both side key operation & Escutcheons in SSS Finish (Make: DORMA 288a, Hormann, Geze, ABECO,)
- e) **FLUSH BOLT:** DORMA lever action flush bolt with 19mm projecting bolt (LENGTH 172 mm OR 300 MM AS PER DIRECTION OF ENGINEER IN CHARGE) in satin chrome (Make-Dorma, Hormann, Geze ABECO,,).
- f) **FLOOR SOCKET:** Spring loaded dust excluding floor socket with fixing accessories, in satin Chrome finish (Make-Dorma, Hormann, Geze, ABECO,,).
- g) **DOOR BOTTOM SEAL:** Automatic Door Bottom Seal, Heavy Duty, Face Mounted Version, spring loaded to lift clear of the floor as soon as the door leaf is opened, suitable to be used on Fire and smoke check doors, Seal Material = Silicon, Finish = Anodized Satin Clear, Length = 48"IN SATIN CLEAR FINISH (Make-Dorma, Hormann, Geze ABECO,,)
- h) **DELTA SEAL:** Delta Seal for acoustic, fire and smoke protection, suitable for wooden and steel frames, self-adhesive, Finish = Black, Length = 1 x 2000mm, Height- 2 x 2750mm IN BLACK FINISH (Make-Dorma, Hormann, Geze, ABECO,,).
- i) **PA BRACKET:** Parallel arm bracket suitable for surface mounted door closer for fixing of door closer in silver finish of (Make-Dorma, Hormann, Geze, ABECO).
- j) **ARMOR PLATE:** Armour plate with smoothed edges and rounded corners flush face fixing screws height 1000mm and thickness 1.2 mm in SS 304 grade in satin stainless steel. Length=5mm short of the shutter width (Make-DORMA, Hormann, GEZE, ABECO).
- k) **PUSH PLATE:** Push plate with smoothed edges and rounded corners flush face fixing screws size 150 x 400 x 1.2 mm in SS 304 grade in satin stainless steel (Make: Hormann, Dorma, Geze, ABECO).
- l) **SIGN PLATES:** Male/Female/Disable sign plate for WC application with fixing screws size 150x150x1.2 mm, rounded corners in SS 304 satin stainless-steel finish with marking in black (Make: Hormann, Dorma, Geze, ABECO).
- m) **MOP PLATE:** Mop plate with smoothed edges and rounded corners flush face fixing screws height 150mm and thickness 0.9mm in SS 304 grade in satin stainless steel.

Length=5mm short of the shutter width. Max door width =1200mm (Make: DORMA, Hormann, GEZE, ABECO).

- n) **KICK PLATE:** Kick plate with smoothened edges and rounded corners flush face fixing screws height 300mm and thickness 1.2 mm in SS 304 grade in satin stainless steel. Length=5mm short of the shutter width (Make: DORMA, Hormann, GEZE, ABECO).
- o) **D- TYPE HANDLE:**
- i. D type 300mm long CTC, 22mm Dia Pair of pull handle in SS 304 B/B fixing (Make – Dorma TGDI300, Hormann PD12, Geze 98163036).
 - ii. Offset type D handle of 450mm long CTC, 25mm Dia pair of handles in SS 304 B/B fixing (Make-Dorma TGDI, Hormann, Geze 98163179).
- p) **FLUSH PULL HANDLE:** Stainless steel Flush Pull handle with fixing of screw at flush with surface of doors (Make-Dorma, Hormann, Geze, ABECO equivalent model).
- q) **Door Stoppers:** Stainless Steel (grade 304) wall mounted or hanging floor door stoppers (Hormann/ Dorma/ Geze ABECO equivalent model /) in stainless steel satin finish with necessary ss screws etc.
- r) **Door Closer:** Aluminium die cast body tubular type universal hydraulic door closer (Hafele-DCL15/ Dorma-TS73V/ Geze-TS4000, or ABECO equivalent model) (having brand logo with ISI mark, IS: 3564, embossed on the body, with necessary accessories and screws etc.
- s) **Stainless Steel handles:** Bright /matt finished Stainless Steel handles (Window) of approved quality & make (Dorma/Hormann/ Geze/ ABECO equivalent model) with necessary screws etc.
- t) **Pull Handle:** 25mm dia, 300 mm long in cranked / square shape stainless steel (Grade 304) satin finish pull handle (Hafele 903.05.700/ Dorma 9125409/ Geze 8133006 or ABECO equivalent model) with necessary screws etc.
- u) **Sliding Door Bolt:** 250x16mm Stainless steel (Grade 304) satin finish sliding door bolts of superior quality with necessary SS screws etc.
- v) **Mortice Latch:** Brushed finished 100mm mortice latch in stainless steel satin/polished finish with euro deadlock (Coin release) (Hafele-903.92.586/Dorma-XLH5071/Geze-8012101 or ABECO equivalent model) with rose rings and pair of stainless steel (grade 304) lever handles with necessary SS screws etc.
- w) **Tower Bolt:** Stainless steel (Grade 304) tower bolts (Hafele 903.05.700/ Dorma 9125409/ Geze 8133006 or ABECO equivalent model) with necessary SS screws etc complete.

11.0 FIRE CHECK/RATED DOOR:

CPWD Specification 2019 Vol. I & II with revisions/ amendments / correction slips upto last date of bid submission (including extensions, if any), National Building Code (NBC) 2016 and manufacturer's specification will be followed. Fire Check doors shall be provided in buildings

wherever necessary and required as per National Building Code 2016, as per door & window schedule and as per architectural drawing provided with tender document. Unless otherwise specified elsewhere in tender document, all fire doors should be fire rated for 120 minute and doors of fire exit corridor should meet the requirement of fire exit corridor specified in NBC 2016. In general, all the services/electrical rooms/shafts shall be provided with Metal Fire Check/rated doors whereas all the lobbies, entry/exit to corridors shall be provided with the Glazed fire check/rated doors. Rooms opening in fire exit corridors may be provided with Metal fire check/rated doors. In case of any deviation is found between general principle mentioned herein and Fire check doors shown in architectural drawings (or mentioned door & window schedule), the former i.e. general principle (mentioned herein) will be followed. If any door type or tag is not mentioned in drawings or door & window schedule, decision shall be given by Engineer in charge based on principles mentioned herein. Before taking up any procurement/construction activity, shop drawings (for fixing of all kind of doors, showing all hardware) shall be prepared and submitted for obtaining approval from Engineer-in-Charge.

- 11.1** The Fire check/rated Door should not collapse during the rated period of the fire under specified fire conditions. The fire check door should not allow the passage of hot gases or the flames through the rebate or the gap between the door frame and shutter. The integrity or smoke sealing function is achieved by Fire check Door by incorporating an “Intumescent Seal”. This Intumescent Seal in the form of a strip, which under fire conditions expands many times its original size and forms a hard char which has high insulation properties and does not permit the smoke or flames to escape through the gap between the shutter and frame.
- 11.2** Observation, if any, made by the fire officer on the fire check/rated doors, shall be incorporated suitably. Nothing extra shall be paid on this account.
- 11.3** Execution of Fire Check Doors shall be carried out through the Specialized Agencies having sufficient work experience in the same field and shall be got approved from the Engineer-in-Charge well in advance. Specialized firm shall furnish all materials, labour, accessories, equipment, tool and plant and incidentals required for providing and installing the fire check/rated doors. Contractor has to select one specialized agency from list of preferred makes/brands and specialized agencies.
- 11.4** Fire resistance and smoke check doors shall be made of proper sizes and section as per the available opening at the site. Before proceeding with manufacturing, the contractor shall prepare and submit complete manufacture and installation drawing for approval of the Engineer-in-Charge and no work shall be performed until the approval of these drawings is obtained.
- 11.5** The term “Fire Rating” referred in tender documents means fire rating of complete assembly of fire check door e.g. frames, shutter, Vision Panel, Glass, Hinges and other hardwares. Doors will be approved only after door passes the required tests from fire testing lab approved by the Engineer-in-Charge. Cost of sample door and testing shall be borne by contractor.
- 11.6** Doors shall be fabricated to size in factory. Fabricated material shall be protected against any damage during transportation. Loading and unloading shall be carried out with utmost care. On receipt of material at site it shall be carefully examined to detect any damaged units/members. Arrangements shall be made for expeditious replacement of damage units or members. Materials found acceptable on inspection shall be repacked in crates and stored safely.
- 11.7** Just prior to installation, the doors shall be uncartered and stacked on edge on level bars and supported

evenly. The frame shall be fixed into position true to line and level using adequate number of fasteners of approved size and manufacture and in an approved manner. The holes in concrete /masonry member for housing anchor bolts shall be drilled with an electric drilling machine only.

11.8 Stainless steel ball bearing hinges, panic bars, door trims, fire rated hydraulic door closers, handles, tower bolts, lock and other fittings shall be provided as per hardware schedule for doors & windows provided in contract document and shall be got approved from Engineer-in-Charge. All Hardware's should have a minimum 02 Years of manufacturer warrantee from the date of supply. Hardware should be "CE" / "UL" certified with required fire ratings and relevant documents to this effect shall be produced at the time of approval of samples.

11.9 The design of fire check/rated doors and material to be used in their construction have to be such that the doors shall be capable of providing an effective barrier of desired rating.

11.10 Glazed Fire Check/Rated Doors/Window/Partition -

- a. Fire check/rated glazed door/window/fixed partition, shall be provided as per following specification.
- b. Non load bearing fixed frame for fire resistant glazed Partition for 120 minutes Fire Rating, should be made out to a profile made out of 1.6 mm thick galvanized steel sheet (Zinc coating not less than 120gm/ m²) as per test evidence suitable for fixing fire rated glass for 120 minutes of both integrity & radiation control (EW120) & minimum 20 minutes of insulation (EI20).The profile has to be fixed to the supporting construction by means of anchor fasteners of size M10 x 80, every 150 mm from the edges and every 500 mm (approximately) c/c. The frame shall be filled with mineral wool insulation of density min 96kg/m³ or with PU foam of required density to achieve the desired fire rating and finished with an approved fire-resistant primer or Powder coating of not less than 30 microns in desired shade as per the directions of Engineer - in- charge.
- c. Fire resistant door frame having built in rebate made out of 1.6 mm thick GI sheet (Zinc coating not less than 120gm/ m²) suitable for mounting 120 minutes Fire Rated Glazed Door Shutters. The frame shall be filled with Mineral wool insulation having density min 120 Kg/m³ or with PU foam of required density to achieve the desired fire rating. The frame will have a provision of G.I. Anchor fasteners 14 nos. (5 each on vertical style & 4 on horizontal style of size M10 x 80) suitable for fixing in the opening along with Factory made Template for SS Ball Bearing Hinges of Size 100x89x3mm for fixing of fire rated glazed shutter. The frame shall be finished with an approved fire-resistant primer or Powder coating of not less than 30 microns in desired shade as per the directions of Engineer - in- charge.
- d. Glazed fire resistant door shutters should be 60 mm thick with suitable mounting on door frame, consisting of vertical styles, top rail & side rail 60 mm x 60 mm wide and bottom rail of 110 mm x 60 mm made out of 1.6mm thick G.I. sheet (zinc coating not less than 120gm/m²) duly filled mineral wool insulation having density min 96 kg/ m³ or with PU foam of required density to achieve the desired fire rating and fixing with necessary stainless steel ball bearing hinges of size 100x89x3mm of approved make, including applying a coat of approved fire resistant primer or powder coating not less than 30 micron etc. all complete as per direction of Engineer-in-charge. Glazed fire-resistant door shutters should be having 120 minutes Fire Rating confirming to IS:3614 (Part II) or EN1634-1:1999, tested and certified as

per laboratory approved by Engineer-in-charge.

- e. Providing and fixing glazing in fire resistant door shutters, fixed panels & partitions etc., with G.I. beading made out of 1.6 mm thick G.I. sheet (zinc coating not less than 120 gm/m²) of size 20 x 33 mm screwed with M4 x 38 mm SS screws at distance 75 mm from the edges and 150 mm c/c , including applying a coat of approved fire resistant primer/ powder coating of not less than 30 micron on G.I. beading, & special ceramic tape of 5 x 20 mm size etc. complete in all respect as per NBC 2016, IS 16231 (Part 3):2016 and as per direction of Engineer-in-charge with bidirectional interlayered glass of required thickness having 120 minutes of fire resistance both integrity & radiation control (EW120) and minimum 20 minutes of insulation (EI20). The manufacturer has to give test report/certification of fire rated glass and the glass should have the stamp showing the value of E, EW & EI. The glass shall be tested in approved NABL accredited lab or by any other accreditation body which operates in accordance with ISO/IEC 17011 and accredits labs as per ISO/IEC 17025 for testing and calibration scopes shall be eligible.

11.11 Metal Fire Check/Rated Doors-

- a) Metal Fire door shall be from ISO 9001:2015 certified manufacturer. The door must have been manufactured in accordance with IS 3614 with galvanized - GI sheet of GPSP Grade as per IS 277. All Fire doors must satisfy the requirement of latest NBC 2016 Part 4 for Fire & Life Safety guidelines. The Prototype sample of the door must carry a prior test certificate. The manufacturer must submit the copy of test evidence prior to start of production. The offered test certificate should either carries it's Validity or certificate must not be older than 5 years from CBRI / NABL Accredited Lab. All doors should be finished with Powder coating (minimum 60 micron) in desired regular RAL Shades.
- b) Door frame shall be Single rebate profile made out of minimum 1.20 mm thick galvanized steel sheet with a factory pre-punched groove so as to accommodate fire seal size (minimum 10x4mm). Frames should be mitered, butt jointed and field assembled with self-tab. Frames shall have in built grooved sealing system and shall be site fitted with fire rated EPDM gasket as standard. All provision should be mortised, drilled and tapped for receiving appropriate hardware. Frames shall be filled with fire rated puff. Frames should be provided with back plate for anchor fasteners for installation on a finished plastered wall opening.
- c) Door leaf should be fully flush double skin insulated door. Door leaf must be manufactured from minimum 1.2 mm thick galvanized steel sheet. The internal construction of the door should be rigid reinforcement pads for receiving appropriate hardware. The infill material shall be resin bonded honeycomb core. The infill material shall be 96 kg/m³ high density mineral wool insulation material with PU foam of required density to achieve the desired fire rating. Intumescent seals 15 x 1.5 mm to be provided. The edges should be interlocked with a bending radius of 1.4 mm. For Double leaf doors astragal has to be provided on meeting stile for both active and inactive leaf. Vision panels wherever required should be provided with specified shape and sizes of glass (bidirectional interlayered fire rated glass of required thickness).

11.12 FIRE RATED HARDWARE FOR FIRE CHECK DOORS:

All hardware for fire check/rated doors shall also be fire rated and shall have certification from UL/CE. Following specifications for the hardware of the fire rated/check doors and windows shall be followed:

- a) **DOOR CLOSER:** Extruded aluminum body Heavy duty Fire Rated Door Closers with full body cover. The Door Closers should be spring adjustable type 2-6, Non handed with back check. The door closer shall have 10 years mechanical warranty from the manufacturer and complies with EN 1154- for 50000 cycles + A1: 2002 CE Certified. (Make: DormaTS89, Hormann HDC35, Geze TS5000, Hafele DCL-97).
- b) **BUTT HINGES:** 5 Knuckle, 2 bearing butt hinges size 4" x 3" x 3mm, in SS 304 and in satin stainless steel as per EN 1935, CE Marked suitable for door weights upto 120kgs (Make: DORMA 3090F, HORMANN, GEZE OR HAFELE).
- c) **VISION PANEL:** Unless otherwise specified, bidirectional interlayered glass of 15 mm thickness shall be used.
- d) **GRAVITY COORDINATOR:** Door coordinator /sequencer for the double leaf doors (Make – Dorma SR390, Hormann, Geze 013525, and Hafele).
- e) **PANIC BAR-SINGLE POINT:** Panic bar / latch (Single point) suitable for single / active leaf of door of make-Hafele-903.10.625/ Dorma-PHCR/ Geze-8026301 or Hormann XDB5760SV.
- f) **PANIC BAR-TWO POINT OR DOUBLE POINT:** Panic bar / latch (Two point or Double point) with vertical rod and top and bottom latch suitable for double doors or inactive leaf of door of make-Hafele-903.10.625/ Dorma-PHCR/ Geze-8026302 or Hormann XDB5120SV.
- g) **EXTERNAL TRIM:** External trim on back side of the Panic Latch of make-Hafele-901.02.401/ Dorma-PHCR-2905/ Geze-8026306 or Hormann
- h) **ELECTROMAGNETIC HOLD OPEN-**Electro Magnetic hold open device for holding the door in open condition EM with armature plate with 24v DC of make-Dorma EM 500G/ Geze/ Hafele.
- i) **EM LOCK FOR HOLD OPEN DOOR-** Holding force of 1200 lbs EM Lock with 1200 ALH and EM 1200 2ALH with armature receiving plate, surface mounted 12/24 vDC including armature plate holder of make – Dorma/ Geze/ Hormann and Hafele.
- j) **DOOR LOCK:** 55mm backset, 20mm square for end prepared for euro profile cylinder including strike plate. and EPC 70mm Length both side key operation & Escutcheons in SSS Finish (Make: DORMA 288a/ Hormann/ Geze).
- k) **FLUSH BOLT:** DORMA lever action flush bolt with 19mm projecting bolt (length 172 mm or 300 mm as per direction of engineer in charge) in satin chrome of make-Dorma/Hormann/Geze.
- l) **FLOOR SOCKET:** Spring loaded dust excluding floor socket with fixing accessories, in satin Chrome finish of make-Dorma/Hormann/Geze.
- m) **DOOR BOTTOM SEAL:** Automatic Door Bottom Seal, Heavy Duty, Face Mounted Version, spring loaded to lift clear of the floor as soon as the door leaf is opened, suitable to be used on Fire and smoke check doors, Seal Material = Silicon, Finish = Anodized Satin

Clear, Length = 48" in satin clear finish (Make-Dorma/Hormann/Geze)

- n) **DELTA SEAL:** Delta Seal for acoustic, fire and smoke protection, suitable for wooden and steel frames, self-adhesive, Finish = Black, in black finish of make-Dorma/ Hormann/ Geze.
- o) **PA BRACKET:** Parallel arm bracket suitable for surface mounted door closer for fixing of door closer in silver finish of make-Dorma/ Hormann/Geze.
- p) **ARMOR PLATE:** Armour plate with smoothed edges and rounded corners flush face with fixing screws, having height 1000mm and thickness 1.2 mm in SS 304 grade in satin stainless steel. Length=5mm short of the shutter width of make DORMA/ Hormann/ GEZE).
- q) **PUSH PLATE:** Push plate with smoothed edges and rounded corners flush face with fixing screws, of size 150 x 400 x 1.2 mm in SS 304 grade in satin stainless steel (Make: Hormann, Dorma, Geze).
- r) **SIGN PLATES:** Male/Female/Disable sign plate for WC application with fixing screws size 150x150x1.2 mm, rounded corners in SS 304 satin stainless-steel finish with marking in black (Make: Hormann, Dorma, Geze).
- s) **MOP PLATE:** Mop plate with smoothed edges and rounded corners flush face with fixing screws, of height 150mm and thickness 0.9mm in SS 304 grade in satin stainless steel. Length=5mm short of the shutter width. Max door width =1200mm (Make: DORMA, Hormann, GEZE).
- t) **KICK PLATE:** Kick plate with smoothed edges and rounded corners flush face with fixing screws, of height 300mm and thickness 1.2 mm in SS 304 grade in satin stainless steel. Length=5mm short of the shutter width (Make: DORMA, Hormann, GEZE).
- u) **PULL HANDLE:**
 - i. D type 300mm long CTC, 22mm Dia Pair of pull handle in SS 304 B/B fixing of Make – Dorma TGDI300/ Hormann PD12/ Geze 98163036.
 - ii. Offset type D handle of 450mm long CTC, 25mm Dia pair of handles in SS 304 B/B fixing of make-Dorma TGDI/ Hormann/ Geze 98163179.
 - iii. FLUSH PULL HANDLE: Stainless steel Flush Pull handle with fixing of screw at flush with surface of doors of make-Dorma/Hormann/ Geze.
 - iv. Pull Handle: 25mm dia, 300 mm long in cranked / square shape stainless steel (Grade 304) satin finish pull handle (Hafele 903.05.700, Dorma 9125409, Geze 8133006 or equivalent make) with necessary screws etc.
- v) Door Stoppers: Stainless Steel (grade 304) wall mounted or hanging floor door stoppers (Hormann, Dorma, Geze) in stainless steel satin finish with necessary ss screws etc.
- w) Sliding Door Bolt: 250x16mm Stainless steel (Grade 304) satin finish sliding door bolts of superior quality with necessary SS screws etc.

- x) Mortice Latch: Brushed finished 100mm mortice latch in stainless steel satin/polished finish with euro deadlock (Coin release) (Hafele-903.92.586, Dorma-XLH5071, Geze-8012101) with rose rings and pair of stainless steel (grade 304) lever handles with necessary SS screws etc.
- y) Tower Bolt: Stainless steel (Grade 304) tower bolts (Hafele 903.05.700, Dorma 9125409, Geze 8133006) with necessary SS screws etc. complete.

12.0 ALUMINIUM ALLOY WORK:

- (a) Before taking up any procurement/construction activity, shop drawings (for fixing of all kind of Aluminum Works, showing all hardware) shall be prepared and submitted for obtaining approval from Engineer-in-Charge.
- (b) Minimum weight of aluminum section for door, windows and ventilators shall be as per relevant standards.
- (c) Kiln seasoned hard wood shall be filled inside door frames on hinged side and top of frames wherever hydraulic door closers are to be provided.
- (d) Frames shall be fixed with dash fastener of minimum size 10 x 100 mm as per approved shop drawings.
- (e) Gap between aluminum door/windows frame / uPVC window and adjacent RCC / masonry work shall be filled by providing weather silicon sealant over backer rod of approved quality as per direction of Engineer-in-Charge.
- (f) The material for the work shall be procured from the approved manufacturer as per list of preferred make for materials mentioned in this contract document. The Contractor shall procure and submit samples of various materials to be used in the work for the approval of Engineer-in-Charge and no work shall commence before such samples are approved. Samples of un-anodized as well as polyester powder coated aluminum sections, microwave cured EPDM gaskets, glass, stainless steel screws, anchor fasteners, hardware and any other material or components requiring approval of samples, in opinion of Engineer-in-Charge, shall be submitted for the approval as mentioned above. The above samples shall be retained as standards of materials and workmanship.
- (g) Aluminum sections to be used for various works shall be appropriate to meet technical, structural, functional and aesthetic considerations. Aluminum work for doors, windows, ventilators and partitions etc. shall be with extruded built up standard tubular sections/ appropriate Z sections and other sections of approved make conforming to IS: 733 and IS: 1285 as applicable, fixing with dash fasteners of required dia and size, including necessary filling up the gaps at junctions, i.e. at top, bottom and sides with required EPDM rubber/ neoprene gasket etc. Aluminum sections shall be smooth, rust free, straight, mitered and jointed mechanically wherever required including cleat angle, Aluminum snap beading for glazing / paneling, C.P. brass / stainless steel screws, all complete as per architectural drawings and the directions of Engineer-in-charge. Polyester powder coated aluminum (minimum thickness of polyester powder coating of 50 micron) section shall be used. Hinges/ pivots, provision for fixing of fittings, EPDM rubber / neoprene gasket shall be provided wherever required. The polyester powder coating shall be carried out in a factory / workshop approved

by engineer-in-charge.

- (h)** Glass in Windows/Ventilators: Glazing in windows, ventilators etc. shall be Double glazed hermetically sealed with 6 mm thick toughened glass both sides, having 12 mm air gap, including providing EPDM gasket, perforated aluminum spacers, desiccants, sealant (Both primary and secondary sealant) etc. as per specifications, drawings and direction of Engineer-in-charge complete. The DGU unit shall have visible Light transmittance (VLT) of minimum 65%, Light reflection internal - less than or equal to 23%, Light reflection external - less than or equal to 23 %, SHGC- less than or equal to 0.6 and U value - less than or equal to 2.5 W/m² degree K.
- (i)** Frameless glass partition and doors: Frameless glass partition and doors shall be made out of 12 mm thick (minimum) toughened glass of approved brand and manufacture, including providing and fixing top & bottom pivot & double action hydraulic floor spring, fixing arrangement and making necessary holes etc. for fixing required fittings, all complete as per direction of Engineer-in-charge.
- (j)** Hydraulic floor spring: It shall be double action hydraulic floor spring (Make- Dorma TS80, Geze TS550NV, Hormann) conforming to IS : 6315, having brand logo embossed on the body / plate with double spring mechanism and door weight upto 125 kg, for doors, cover plates with brass pivot and single piece M.S. sheet outer box with slide plate etc.
- (k)** Mortice Latch & lock: It shall be of Brass 100 mm mortice latch and lock with 6 levers without pair of handles of best make of approved quality for aluminum doors.
- (l)** Fabrication: The factory for fabrication and coating of windows/doors/frameworks shall be got approved from Engineer-charge. The fabrication unit should have experience of having done similar work of similar cost in 7 years prior to date of submission of proposal by contractor.
- (m)** All joints shall be accurately fabricated and be hairline in appearance. The finished surface shall be free from visible defects. All the windows/ventilators/doors shall be factory made and shall be brought to site for assembly and fixing.
- (n)** All hardware used shall conform to the relevant specifications mentioned in door window hardware schedule and as per samples approved by the Engineer-in-Charge. Design, quality, type, number and fixing of hardware shall be generally in accordance with shop drawings and as approved by the Engineer-in-Charge before use.
- (o)** All doors, windows, ventilators and glazing etc. shall be made water tight with microwave cured EPDM gaskets and weather silicone sealants to the satisfaction of the Engineer-in-Charge.
- (p)** The corners of the frame being fabricated to the true right angles. Both the fixed frames and openable shutter frames shall be fabricated out of sections cut to required length, mitered and mechanically jointed for satisfactory performance. All members shall be accurately machine milled and fitted to form hairline joints. The jointing accessories such as aluminum cleats, stainless steel screws etc. shall not to cause any bi-metallic reaction by providing separators, wherever required. Vertical members of the aluminum frame work shall be embedded in the floors, wherever required, by cutting and making good of the floor.

(q) FIXING OF ALUMINIUM FRAME WORK

- i. The screws used for fixing fixed aluminum frames of the aluminum windows to masonry walls / RCC members and aluminum members to other aluminum members shall be of stainless steel of approved make and quality and of stainless-steel grade 304. Threads of machine screws used shall conform to requirement of I.S. 4218.
- ii. For the aluminum windows, the gap between the aluminum frames and the R.C.C / Masonry and also any gaps in the various sections shall be filled with weather silicone sealant DC 795 of Dow Corning or equivalent in the required bite size, to ensure water tightness including providing and fixing backer rod, wherever required. The weather silicone sealant shall be of such approved colour and composition that it would not stain or streak the masonry / R.C.C. work. It should not sag or flow and shall not set hard or dry out under any conditions of weather and shall be tooled properly. The weather silicone sealant shall be used as per the manufacturer's specifications and shall be of approved colour and shade. Any excess sealant shall be removed / cleared.
- iii. Fixing of glass panes shall be designed in such a way that replacing damaged / broken glass pans is easily possible without having to remove or damage any members or interior finishing materials.

(r) PROTECTIONS AND CLEANING

- a) All glass pans shall be retained within aluminum framing by use of exterior grade microwave cured EPDM gaskets. Use of glazing or caulking compounds around the perimeter of glass will not be permitted. There shall be no whistling or rattling. Before installation of glass, Contractor shall ensure the following:
 - All glazing rebates shall be square, to plumb, true to plane, dry and free from dust.
 - Glass edge shall be clean and cut to exact size and grounded
- b) Glass of specified thickness in doors, windows, ventilators and fixed glazing etc. shall be of approved make and standard quality conforming to C.P.W.D. Specifications

13.0 FLOORING, MARBLE, CLADDING WORK:

All flooring work and cladding work in Granite, Tile, Marble, Stones, Wooden, PVC, Vinyl etc. in general shall be carried out as per CPWD Specifications 2019, Volume-I & II with revisions/ amendments / correction slips upto last date of bid submission (including extensions if any). The tiles / stones shall be as specified in the schedule of finishes and architectural drawings provided with tender document. The tiles / stones shall be of approved colours and shades and will be laid in pattern as per approved architectural drawings or shop drawings. Nothing extra shall be paid for laying tiles / different stones in specific design/pattern. The tiles shall be of first quality of approved make and nothing extra shall be paid for use of cut/sawn tiles in the work. Schedule of finishes mentioned in tender documents shall be followed in case of deviation/different detailing is shown in Architectural Drawings. Before taking up any procurement/construction activity, shop drawings shall be prepared and submitted for obtaining approval from Engineer-in-Charge.

13.1 Proper gradient shall be given to flooring for toilets, verandah, kitchen, courtyard, corridors etc. so

that the wash water flows towards the direction of floor trap. Any reverse slop if found, these shall be made good by the contractor by ripping open and repairing the floor/grading concrete and nothing shall be paid for such rectifications.

- 13.2** Samples of flooring material are to be deposited well in advance to the Engineer-in-Charge for approval. Approved samples should be kept at site with the Engineer-in-Charge and the same shall not be removed except with the written permission of Engineer-in-Charge.
- 13.3** The samples shall be submitted along with the following details:
- a) Three representative samples for each type of flooring/cladding specified.
 - b) Details of physical characteristics such as dimensional tolerances (within the specified limits), water absorption, compressive strength, Mohs Hardness, Specific gravity with reference to IS or International standards.
 - c) Source of supply and confirmation of availability in full quantity and uniformity of colour, tone and textures.
 - d) Company profile of Suppliers.
- 13.4** The Engineer-in-Charge or his representative may, if required, visit the source of supply of the various materials (Granite/Stones/Marble/Tiles/Cladding etc.) to assess the quality as well as availability of the material in the required quantities.
- 13.5** The entire supply for each type of granite/stone slabs shall be procured preferably from one location (in one quarry), and supplied preferably, in one lot to keep variations to the minimum. The Contractor shall also segregate and sort the slabs according to colour, shade, texture and size of grains etc. to keep variation(s) in stones used at any one floor to the minimum. Any slab with variation in the colour, shade, texture and size of grains etc., not acceptable to the Engineer-in-Charge, shall not be used in the work and shall be removed and replaced by the Contractor. Nothing extra shall be payable on these accounts.
- 13.6** Based on the samples approved by the Engineer-in-Charge for various flooring and dado / cladding materials as specified hereinafter, the contractor shall prepare mock up(s) at site of work for approval of quality of workmanship and material specified. If the quality of the workmanship and the material is as per the required standards and approved by the Engineer-in-Charge, the mock up shall be allowed as part of the work. Otherwise, it shall be dismantled by the contractor as directed by the Engineer-in-Charge and taken away from the site of the work at his own cost. The mock up(s) so made shall be kept till completion of respective works for reference.
- 13.7** The material (Granite/Stones/Marble/Tiles/Cladding etc.) shall be transported to site well packed in boxes or otherwise. These shall be handled carefully to prevent any damage. Granite stone slabs shall be individually packed in cardboard paper. The various types of stones and tiles, procured shall be free of any surface defect or any edge damage. The damaged (Stones/Marble/Tiles/Cladding etc.) shall not be allowed to be used in the work. So, the contractor shall procure additional quantity of the stone and tiles to cover such contingencies. The stone slabs shall not be waxed or touched up with dyes / colours.

13.8 The following tolerances shall be allowed in the dimension of granite stone slab:

- a) Length \pm 1mm
- b) Width \pm 1mm
- c) Thickness - 1mm
- d) Angularity at corners \pm 0.25%

The stone (slab and tiles) not meeting the above tolerance limits shall be rejected and not permitted to be used in the work. Nothing extra shall be payable on this account.

13.9 Stones slabs shall have uniform thicknesses within the tolerance limits and linear items like treads, sills and jambs, coping, risers, urinal partitions, kitchen / wash basin platforms, vanity counters, facias and other similar locations etc. shall have edge polished calibrated thickness i.e. exposed edges shall have edge polished uniform thickness throughout the length of the work.

13.10 The flooring work shall be carried out as per the architectural drawings in design and pattern (geometric, abstract etc.) and in linear and / or curvilinear portions and in combination with stones of different colour and shade and ceramic tiles etc. For the flooring portions curved in plan, the stone slabs (at the edge) shall be cut to the required profile and shape as per the architectural drawings. Nothing extra shall be payable on this account and any consequent wastages and incidental charges on such accounts shall be deemed to be included in the cost.

13.11 The granite slabs used for providing and fixing in the sills, soffits and jambs of doors, windows, ventilators and similar locations shall be in single piece unless otherwise directed by the Engineer-in-Charge. Wherever stone slab other than in single piece is allowed to be fixed, the joints shall be provided as per the architectural drawings and as per the directions of the Engineer-in-Charge. In the cabin areas, the joints in sills shall preferably be provided in line with the partition wall. Depending on the number of joints, as far as possible, the stone slabs shall be procured and fixed in slabs of equal lengths as per the architectural drawings and as directed by Engineer-in-Charge.

13.12 The specifications for dressing, laying, curing, finishing etc. for the granite stone flooring shall be same as that of works for the Marble flooring, skirting and risers of steps under Flooring Sub Head of the CPWD Specifications. The wall lining / veneer work with granite stone shall be as per the CPWD Specifications for Marble work Sub Head.

13.13 All the tiles (flooring/wall lining/Skirting/dado) shall be fixed with quick set tile adhesive (of make pidilite, ardex endure, weber) of minimum thickness of 6 mm. Also joints of flooring tiles having 3 mm width shall be grouted using epoxy grout (of pidilite, ardex endure, weber) mix of 0.70 kg of organic coated filler of desired shade (0.10 kg of hardener and 0.20 kg of resin per kg).

13.14 Wet stone/granite wall cladding (in interior) shall be fixed in average 20 mm thick cement mortar in 1:3 (1 cement: 3 coarse sand), with copper pins 7.5 cm long, 6 mm diameter for securing adjacent stones in stone wall lining.

13.15 Unless specified otherwise, all stone/granite/marble in flooring shall be laid on 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade.

- 13.16** Unless otherwise specified, all stone/granite/marble in skirting/wall lining/dado shall be fixed on 20 mm (average) thick base of cement mortar 1:3 (1 cement : 3 coarse sand) and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade.
- 13.17** For flooring work, the joints between the different types of flooring shall be located as per the architectural drawings. Also, the Contractor shall maintain the uniform level of the finished flooring of the different types unless specifically mentioned on the architectural drawings.
- 13.18** All the flooring works specified under this sub-head shall be adequately protected by a layer of plaster of paris which shall be laid over a 400 micron PVC film. The protective layer shall be maintained throughout the execution of works and removed just before handing over of the site.
- 13.19** One piece Granite stone for treads / risers in staircase shall be used including rounding of nose.
- 13.20** POP protection layer shall be laid on all finished floors for protection from damage during execution of other items of work in that area which shall be removed and cleaned just before handing over of the premises.
- 13.21** For the skirting in the enclosures with curvilinear profiles, the (Stones/Marble/Tiles/Cladding etc.) shall be cut to the required size and the shape to match the profile and/ or the joints as per the architectural drawings. Similarly, the skirting shall be fixed in a manner as to flush or work / project from the finished face of the wall as per the architectural drawings and as directed by the Engineer – in– Charge. Any chasing of the masonry works required for such fixing is deemed to be included in the cost of masonry.
- 13.22** Granite stone tiles and slabs shall be pre polished (mirror polished), eggshell polished, flame finished or given any other surface treatment as specified in finishing schedule or architectural drawings and as directed by the Engineer-in-Charge.
- 13.23** Machine polishing and cutting to required size shall be done with water (as lubricant) only. Sawing shall also be done preferably with water as lubricant but as a special case, the Engineer-in-Charge may permit, at his discretion, oil or kerosene as lubricant subject to all kerosene or oil in the body and surface of tiles / slabs being thoroughly dried in ovens. Tiles / slabs with stains or patches due to the use of oil or otherwise, either before or after installation, shall be rejected and shall be replaced by the Contractor at his own cost.
- 13.24** The exposed cut edges of the Kota Stone slab in risers and treads along its width (sides of the risers and treads of the steps i.e. along the shorter dimensions of the Kota stone slab for the risers and treads) shall be polished in a workmanlike manner. The top exposed edge of the Kota stone skirting shall also be polished in a workmanlike manner.
- 13.25** Nosing / edge moulding shall be provided to the front edge of the Kota stone slab treads along its length i.e. along the longer dimensions of the Kota stone slab, as per the architectural drawings.
- 13.26** Tactile tile such as directional, warning or hazardous (for vision impaired persons as per standards) shall be of size 300x300x15 mm {10 mm base + (5mm ± 0.5mm) thick raised portion} having water absorption less than 0.5% and conforming to IS: 15622 of approved make in all colours (preferably yellow) and shades for indoor floors, should be laid on 20mm thick base of cement

mortar 1:4 (1cement : 4 coarse sand) in all shapes & patterns including grouting the joints with white cement mixed with matching pigments etc. as per harmonized guidelines and space standards for barrier free built environments for persons with disability and elderly persons issued by Ministry of Urban Development, Govt. of India.

13.27 The following tactile indicators in Stainless Steel (Grade 316) of approved design and color shall be provided as per the relevant standards and requirements–

(i) Circular Stud Tactile Indicator with Diamond Pattern on Top

- Internal Dia : 25 mm
- External Dia : 35 mm
- Thickness : 4.5mm

(ii) Directional Strip with Diamond Pattern on Top

- Internal Length : 250-275 mm
- External Length : 280-300 mm
- Thickness : 4.5mm

The additional features for tactile indicators shall correspond as below –

(i) This shall be anti-rust and high resistance to pitting and corrosion.

(ii) This shall be Finished to ensure high luminance, with minimum 30% luminance contrast so that the vision impaired (not blind) can detect the indicators.

(iii) This shall be Machined with top surface with diamond matrix to provide excellent slip resistance and to fit snugly against the face of the flooring into which they are fixed.

(iv) The fixing shall be done by Drilling and fit with adhesive over the respective surface.

(v) They shall be strongly anchored to the ground to prevent the tactile indicators from loosening. The Tactile shall be cold forged from one piece of metal i.e. without any welding. The ribbed shanks of the tactile indicators allow the indicators to be strongly fitted to the flooring and withstand rough usage.

13.28 50 mm wide Yellow colour, self adhesive 'EDGE STRIPS' of approved make shall be provided on risers of staircase to help persons with visual disabilities and elderly. 25 mm wide high intensity Anti-Skid reflective tape of approved make on edges of treads of staircase shall be provided.

13.29 Wooden Flooring: It shall consist 15mm thick AC-4 grade laminate wooden flooring of 0.2 mm thick direct laminate on top of especially developed substrate core (density fiber board) of plank size as per manufacturer's specification having smart lock, joint tongue and groove construction including ceiling of top of skirting with 4 mm thick teakwood lipping. The underlayer has to be a 0.2 mm thick alkali resistant polyethylene sheet of density 30-32 kg per m³ on top to secure the floor. The work shall be carried out as per manufacturer's specification or installation procedure and as per directions of Engineer in Charge.

13.30 Engineered Wooden Flooring with plank width of 185mm / 135mm and length of 1800mm / 2100mm and top layer up to 3mm Oak natural Veneer. Surface of Top layer is pre finished with

several layer of UV hardened Acrylic lacquer, free from Formaldehyde and solvents. Flooring plank shall be interlocked using Plank Loc locking system in a glue less floating manner. Engineered wood planks shall be a composition of 3 layer of Pine wood with direction of each layer oriented at right angle to the adjacent layer of natural strain in Lacquer and Non-Beveled /Beveled in length and width as specified by the Engineer-in-charge. Manufacturing Plant / Product should have FSC certificate and adhere to stringent emission standards.

14.0 ROOFING WORK:

All roofing work in general shall be carried out as per CPWD Specifications 2019, Volume-I & II with revisions/ amendments / correction slips upto last date of bid submission (including extensions if any). Schedule of finishes mentioned in tender documents shall be followed in case of deviation/different detailing is shown in Drawings. Before taking up any procurement/construction activity, shop drawings shall be prepared and submitted for obtaining approval from Engineer-in-Charge.

14.1 Calcium Silicate False Ceiling Tiles:

It shall be 15 mm thick densified tegular edged ecofriendly light weight calcium silicate anti – microbial bio-safe coated false ceiling tiles (confirming to JIS-Z2801 and ASTM G-21) of approved texture of size 595 x 595 mm in true horizontal level suspended on interlocking Metal T-Grid of hot dipped galvanised iron section of 0.33mm thick (galvanized @ 120 grams per sqm including both sides) comprising of main-T runners of size 24x38 mm of length 3000 mm, Cross - T of size 24x32 mm of length 1200 mm and secondary intermediate cross-T of size 24x32 mm of length 600mm to form grid module of size 600 x 600 mm, suspended from ceiling using galvanized mild steel items (galvanizing @ 80 grams per sqm) i.e. 12x50 mm long dash fasteners, 6 mm dia fully threaded hanger rod upto 1000 mm length and L-shape level adjuster of size 75x25x25x1.6 mm fixed with grid and Z cleat of size 25x37x25x1.6mm thick with precut hole on both 25 mm flange to pierce into 12x50mm or even bigger size dash fasteners if required, fixed with Galvanised iron perimeter wall angle of size 24x24x0.40 mm of length 3000 mm to be fixed on periphery wall / partition with the help of plastic rawl plugs at 450mm center to center and 40 mm long dry wall S.S screws. The work shall be carried out as per specifications, drawing and as per directions of the Engineer-in-Charge. Note: - The calcium silicate anti –microbial bio-safe coated false ceiling tiles shall have NRC value of 0.10-0.15 (Minimum), light reflection > 85%, non-combustible as per B.S. 476 part IV, 100% humidity resistance and also having thermal conductivity of 0.048-0.052 w/m⁰K as per ECBC Code 2007 and ASTM 518-1991.

14.2 Metal False Ceiling Tile:

Providing and fixing GI Clip in Metal Ceiling System of 600x600 mm module which includes providing and fixing 'C' wall angle of size 20x30x20 mm made of 0.5 mm thick pre painted steel along the perimeter of the room with help of nylon sleeves and wooden screws at 300 mm center to centre, suspending the main C carrier of size 10x38x10 mm made of G.I steel 0.7 mm thick from the soffit with help of soffit cleat 37x27x25x1.6 mm, rawl plugs of size 38x12 mm and C carrier suspension clip and main carrier bracket at 1000 mm c/c. Inverted triangle shaped Spring Tee having height of 24 mm and width of 34 mm made of GI steel 0.45 mm thick is then fixed to the main C carrier and in direction perpendicular to it at 600 mm centers with help of suspension brackets. Wherever the main C carrier and spring T have to join, C carrier and spring T connectors

have to be used. All sections to be galvanized @ 120 gms/sqm (both side inclusive), fixing with clip in tiles into spring T with : GI Metal Ceiling Clip in plain Beveled edge global white color tiles of size 600x600 and 0.5 mm thick with 25 mm height, made of G I sheet having galvanizing of 100 gms/ sqm (both sides inclusive) and 20% perforation area with 1.8 mm dia holes and having NRC of 0.5, electro statically polyester powder coated of thickness 60 microns (minimum), including factory painted after bending and perforation..

14.3 Mineral Fibre False Ceiling Tiles:

It shall be 19 mm thick of size 595X595mm of approved texture, design and pattern. The tiles shall be confirming to ISO 4 according to norm ISO 14644-1:2015, having Humidity Resistance (RH) of $\geq 99\%$, $NRC \geq 0.7$, Light Reflectance 85-90%, thermal Conductivity $k = 0.052- 0.057$ w/m K, Fire Performance A2-s1.d0 with Anti- Bacterial coating, adhering to Clean room requirement of Class 100 as per US Fed Standard 209 E and washability requirement of 500 wash cycles as per ASTM 4828 and with Recycled content of minimum 70%. Tiles shall be suspended in true horizontal level on interlocking T-Grid of hot dipped all round galvanized iron section of 0.38 mm thick (galvanized @120 gsm) comprising of main T runners of 15x38 mm of length 3000 mm, cross T of size 15x38mm of length 1200 mm and secondary intermediate cross T of size 15x38 mm of length 600 mm to form grid module of size 600x600 mm suspended from ceiling using galvanized mild steel item (galvanised @80gsm) 50 mm long 8mm outer diameter M-6 dash fasteners, 6 mm diameter fully threaded hanger rod upto 1000 mm length and L-shape level adjuster of size 80x30x0.6 mm, spaced at 1200 mm centre to centre along main 'T'. The system should rest on periphery walls /partitions with the help of GI perimeter wall angle of size 24x24X3000 mm made of 0.40 mm thick sheet, to be fixed to the wall with help of plastic rawl plug at 450 mm centre to centre & 40 mm long dry wall S.S. crews. The exposed bottom portion of all T-sections used in false ceiling support system shall be pre-painted with polyester baked paint, for all heights.

14.4 Calcium Silicate Board:

It shall be 8 mm thick Calcium Silicate Board made with Calcareous & Siliceous materials reinforced with cellulose fiber manufactured through autoclaving process, fixed on framework made of special section, power pressed from M.S. sheets and galvanised with zinc coating of 120 gms/ sqm (both side inclusive) as per IS : 277 and consisting of angle cleat of size 25mm wide x 1.6mm thick with flanges of 27mm and 37mm, at 1200mm c/c, one flange fixed to the ceiling with dash fastener 12.5mm dia x 50mm long with 6mm dia bolts, other flange of cleat fixed to the angle hangers of 25 x10 x0.50mm of required length with nuts & bolts of required size and other end of angle hanger fixed with intermediate G.I chanel 45 x15 x 0.90mm running at the spacing of 1200 mm c/c, to which the ceiling section 0.5mm thick bottom wedge of 80mm with tapered flanges of 26 mm each having lips of 10.5mm, at 450mm c/c, shall be fixed in a direction perpendicular to G.I intermediate channel with connecting clip made out of 2.64mm dia x 230mm long G.I wire at every junction, including fixing perimeter channels 0.50mm thick 27mm high having flanges of 20mm and 30mm long, the perimeter of ceiling fixed to wall/ partitions with the help of Rawl plugs at 450mm centre, with 25mm long dry wall screws @ 230mm interval, including fixing of Calcium Silicate Board to ceiling section and perimeter channels with the help of dry wall screws of size 3.5 x25mm at 230mm c/c, including jointing & finishing to a flush finish of tapered and square edges of the board with recommended jointing compounds, jointing tapes, finishing with jointing compounds in three layers covering up to 150mm on both sides of joints and two coats of primer suitable for boards, all as per manufacture's specification.

14.5 Static-conductive Flexible Vinyl flooring:

Static-conductive Flexible Vinyl floor (non-directional homogeneous) covering shall be having thickness of 2 mm (minimum) as per EN 428, Weight ≤ 3100 gms/sqm as per EN 430, electrical resistance of $104 \leq R_t \leq 106$ Fire rating class Bfl-s1 as per EN 13 501-1, Static electrical propensity < 2 kV as per EN 1815, Slip resistance wet : ramp test with oil (1) of class R10 as per DIN 51 130, Wear resistance of ≤ 2.0 as per EN 660.2, wear group 'P' as per NF189, binder content of type -I as per ISO 10582, dimensional stability of ≤ 0.4 as per EN 434, Indentation ~ 0.03 (< 0.10) mm as per standard ISO 24343 - 1, thermal conductivity of 0.25 W/m.K as per EN 12524, color fastness rating of ≥ 6 degree as per EN 20105-B02, Product should confirm to FloorScore® Indoor Air Quality Certified ($\leq 10 \mu\text{g} / \text{m}^3$ as per ISO 16000-6), performance (ok) in castor chair test (type W) as per ISO 4918 (EN 425), anti-bacterial activity ($> 99\%$ inhibits growth as per ISO 22196). The product shall be classified as class 34-43 as per EN 685. Installation- It is important to ensure the subfloor on which the sheet is being laid is smooth, flat, hard and free from moisture, grease etc. In case of uneven subfloor the same should be levelled using self-levelling compound. IPS Vitrified/ceramic/ mosaic tiles do not provide zero levelled sub floor. The moisture present in the subfloor should be less than 8% before installation of the floor. The vinyl flooring sheet should be installed with coving profile & adhesive recommended by Vinyl Flooring manufacturer. The floor finish should terminate at the room perimeter passing over a concealed coving profile and continuing up to the wall for 100mm and connected to copper strip for grounding; copper grounding strips (0.05mm thick, 50 mm width) should be laid on floor underneath conductive vinyl flooring roll. The joints in the flooring should be sealed by using a PVC welding rod of matching colour to be supplied by the manufacturer, using a hot air gun for fusion of welding rod with flooring for seamless installation.

14.6 Homogeneous vinyl wall covering:

Homogeneous vinyl wall covering shall be in 1 mm thickness (minimum), weight less than 2000 gms/sqm as per EN 430, Fire rating class Bs2-d0 as per EN 13 501-1, binder content of type -I as per ISO 10582, dimensional stability of ≤ 0.4 as per EN 434, color fastness rating of ≥ 6 degree as per EN 20105-B02, Product should confirm to FloorScore® Indoor Air Quality Certified ($\leq 10 \mu\text{g} / \text{m}^3$ as per ISO 16000-6), anti-bacterial activity ($> 99\%$ inhibits growth as per ISO 22196). The product should be homogeneous and single layered. The product shall have excellent chemical 143 resistance as per EN 423. Installation - Installation of Vinyl Wall Covering 1.00mm thick over smooth wall surface including fixing with adhesive complete as per drawing & as directed by Engineer-in-charge. It is important to ensure the Wall on which the sheet is being pasted is smooth, flat, hard and free from moisture, grease etc

14.7 Aluminum U Baffle Ceiling: Baffle Ceiling System, comprises of baffle width of 50mm and height of 100mm manufactured out of 0.6mm thick Coil Coated Aluminium of alloy AA 3105 at a module of 200mm. The length of the panel shall be up to 2400mm. The sizes may be customized as per direction of Engineer-in-charge. Nothing extra shall be payable on this account. The baffle shall be manufactured on high speed, high precision roll forming machine to ensure the flatness and to avoid the failure of metal at corners which may occur normally on press brake machine. The coil is coated on a continuous paint line double baked and shall be stove enamelled in a continuous coil coating process of the approved colour on the exposed side and the reverse side with polyester primer. The U Baffle ceiling panels shall be mounted on coil coated customised Hat type Aluminium carrier of size 60mm x 30mm x 0.9mm thick. The customised carrier shall be suitable

for both torsion spring based & standard fixed Baffle panels. The carrier shall be suspended with M6 Threaded rod hangers spaced at 1200mm c/c. The baffle ceiling system should meet the required standards for Green Pro certification and should qualify as green product.

14.8 Wooden Slats Ceiling: Non FR made out of pinewood fibreboards, Melamine finish, perforated wooden grooved slats L8-2 - (2mm grooves @ 8mm centers) / L16-2 - (2mm Slats @16mm pitch) / L32-2 - (2mm grooves @ 32mm centres) /L64-2 - (2mm grooves @ 64mm centers), backlined with acoustical fleece, tongue-groove edge for a seamless look, FR grade, of lineal dimension size 128mmx 2440mm x 16mm thick having density 800Kg /m³, weight 10 Kgs/m², shall be installed by using suspended ceiling system. The wooden slat shall have NRC \geq 0.75, Light reflectance of 75%, Green (RC %) – 25, Hygiene category (VoC, Clean room) – Low Class 1, Antisag, resistant to Ball-Impact properties. The ceiling system shall include GI Wall channel(WC25) having thickness 0.45mm, length 3600mm, unequal flanges of 20 & 30mm and web of 25mm to be fixed along the perimeters of the wall with nylon sleeves and suitable fasteners at every 300mm centers. Suspended Main channels (MC45) having thickness 0.9mm, length 3600mm, equal flanges of 15mm and web 45mm from the soffit at every 1200mm centers with Suspender angle (SA25) having thickness 0.45mm, length 3600mm, unequal flanges of 25 & 10mm. GI Cross channel (CC25) having thickness 0.45mm, length 3600mm, knurled web of 50mm, depth of 25mm and equal flanges of 9.5mm is fastened to the Main channel (MC45) in the direction perpendicular to the Main Channel (MC45) at every 600mm centers. Aluminium core cross channel (CC18) having 0.5mm thick, 15mm & 27mm width, height 18mm, flanges of 7mm and length 2500mm is then fixed to the Cross channel (CC25) with the help of metal fasteners in direction perpendicular to the cross Channel at every 400mm centers. Slats of size 128mm x 2430mm x 16mm thick in then fixed perpendicular to CC18 with suitable edge & centre brackets.

14.9 Channeled Flutes perforated panels of width 128mm, thickness of 16mm and length 2440 mm or as per finishing schedule or as per drawings or as decided by engineer in charge, made of a high density particle board substrate with a laminated facing as per the wooden / white finish and a woven fleece layer on the reverse side. The boards shall have a special perforation pattern where the visible surface has a “Helmholtz” fluted perforation of 4mm width and 28mm of visible panel each. The panels shall provide a minimum sag resistance of RH90 and a fire rating class of 1 as per Part 7 of BS 476. The edges of the panels shall be “tongue-and-grooved” to receive special clips for installation. The back of the perforated panel shall have Soundtex Make sound absorbing non-woven acoustical fleece. The panels shall be mounted on special aluminium splines using clips approved by the Engineer-in-Charge. INSTALLATION: Installation shall be with GI Section of 50mmx50mm or as approved by the Engineer-in-Charge on the solid wall/Ceiling horizontally using screws and plugs at spacing of 600mm centre-to-centre. Screw the aluminium extruded keel for Flutes (GTPT001) over the lowest and second GI Section at an on-center distance of 600mm. Install the first set of wooden panels by inserting the clips for border Flutes (GTPT002) and insert the groove of the panel into the projecting flange of the aluminium clip. Continue installing rows of panels by inserting the tongue into the groove of the earlier inserted panel and progressively installing clips for inside Flutes (GTPT003) into the next keel till the actual height is achieved. Use clips for border Flutes (GTPT002) to finish off the installation. Finish off the edges using wooden moulding of matching colour.

14.10 Aluminium grid Ceiling System shall be of 600x600 mm (perforated/non-perforated tiles made out of 0.7 mm thick aluminum sheet) having NRC of 0.7, electro statically polyester powder coated of thickness 60 microns (minimum), including factory painted after bending and perforation. The system includes 'C' wall angle of size 20x30x20 mm made of 0.5 mm thick pre

painted steel along the perimeter of the room with help of nylon sleeves and wooden screws at 300 mm center to centre, suspending the main C carrier of size 10x38x10 mm made of GI 0.7 mm thick from the soffit with help of soffit cleat 37x27x25x1.6 mm, rawl plugs of size 38x12 mm and C carrier suspension clip and main carrier bracket at 1000 mm c/c. Inverted triangle shaped Spring Tee having height of 24 mm and width of 34 mm made of GI 0.45 mm thick is then fixed to the main C carrier and in direction perpendicular to it at 600 mm centers with help of suspension brackets. Wherever the main C carrier and spring T have to join, C carrier and spring T connectors have to be used. All sections to be polyester powder coated (both side inclusive), fixing with clip in tiles into spring T.

14.11 Bamboo Baffle Ceiling – It shall be made of phenol bonded strand woven compressed Bamboo. The overall panel has a width of size 1800 mm and length of size of 2400 mm. The panel shall be comprising of customized bamboo rafter of thickness 16mm with a height of 65mm and a center spacing of 70 mm. Customized bamboo rafters shall be in approved color/texture/finish. The panels shall be coated with seven layers of UV rays absorbing termite resistance anti-yellowing acrylic-based clear PU coating system having a film formation thickness of nearly 0.55mm to 1.15 mm and deposition equals in a range of 95gms to 135gms per sqm. The baffles need to be arranged and fixed in a way to form a panel with a customized C-bracketing channel along with accessories that automatically control the center-to-center distance, and to have the flexibility to match the length as per the site requirements. The entire panel is to be mounted on powder coated MS grid having wall thickness to 1.6mm. The bamboo shall have a minimum density of 1000 Kg/Cum and minimum hardness of 1000 kgf, all complete as per the direction of Engineer In-Charge.

14.12 Khurras shall be of 45x45 cm with average minimum thickness of 5 cm cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 20 mm nominal size) over P.V.C. sheet 1mx1mx400micron, finished with 12mm cement plaster 1:3 (1 cement : 3 coarse sand) and a coat of neat cement, rounding the edges.

14.13 At inlet mouth of rain water pipe, cast iron grating 15 cm diameter and weighing not less than 440 grams shall be provided.

14.14 Rain Water Pipes - All the RWP pipes shall be PVC Pipes (including with required fittings and clamps) exposed on walls / in the shafts to be executed as per CPWD specification 2009.

15.0 FINISHING WORK:

15.1 All internal AAC walls shall be finished with 12 mm thick (average) premixed formulated one coat gypsum lightweight plaster having additives and light weight aggregates as vermiculite/ perlite respectively conforming to IS: 2547 (Part - 1 & II) 1976, applied on hacked / uneven background such as bare brick/ block/ RCC work on walls & ceiling at all floors and locations, finished in smooth line and level etc. complete.

15.2 All brick wall shall be finished with 12mm (1 cement:6 coarse sand) thick cement plaster and 15mm (1 cement:6 coarse sand) cement plaster on rough side. The contractor may use ready-mix plaster of approved make in place of cement plaster and nothing extra shall be paid on this account. No plastering to be done at Ceiling.

15.3 All junctions of concrete and masonry work and other locations shall be provided with approved galvanized chicken wire mesh (24-gauge 12 mm sizes) fixing in position with galvanized wire nails

as per specifications or providing grooves of required size at the junctions, all complete as per direction of Engineer-in-charge.

- 15.4** Necessary drip course shall be provided in Chajja, Balcony, Projecting Roof, Beams etc.
- 15.5** All the internal surfaces including exposed ceiling (non false ceiling areas) shall be finished with 2 mm thick cement based wall putty or POP, one coat of cement primer and two or more coats of paints specified in finishing schedule.
- 15.6** Application of paints shall be done with mechanical equipments. Mechanical sanding machine (for scrubbing & preparation of surface) shall be used by the contractor.
- 15.7** In case of painting over old work / new work, the contractor shall give proper notice to the Engineer-in-charge after the surface is prepared & before applying of primer coat / paint. The Engineer-in-charge shall either approve the surface thus prepared or ask the contractor to rectify the defects pointed. Only after approval by Engineer-in-charge, the priming / painting coat shall be applied.
- 15.8** Anti-Bacterial Paint: Low VOC, highly washable, water based, abrasion resistant (over 4000 cycles) sanitizing and anti-bacterial coating Ultra satin shall be applied as per finishing schedule to all kind of surface and enhancing protection against bacteria for Hygienic environment and conforming to JIS Z 2801:2100 test Protocols for Anti- Bacterial Coatings test. The material should be reactive curing acrylic resin water-based coating. One coat of water based acrylic primer shall be applied before application of two coats of water based anti-bacterial coating. (Approved make: JOTUN/OIKOS/Liquide Plastic/Construction Specialty).
- 15.9** All the steel work shall be applied two or more coats of synthetic enamel paint over a coat of suitable primer of approved brand and manufacture with ready mixed red oxide zinc chromatic on steel / iron works having VOC content less than 250 grams/litre.
- 15.10** Water repellent coat: 2 to 3 coats of Silicone based water repellent, anti-algal paint of approved shade, complete as per manufacturer's specifications, shall be applied on stone cladding.

16.0 STAINLESS STEEL WORK:

Stainless steel of grade SS 316 grade railings and grills shall be provided as per architectural design in Balconies, staircases, steps, Ramps corridors and in other common circulation area as indicated in drawings and in accordance with provisions of NBC 2016, and as per Schedule of railing.

Unless otherwise specified, stainless steel generally shall be of SS 316. Lower grades shall not be used. Before taking up any procurement/construction activity, shop drawings shall be prepared and submitted for obtaining approval from Engineer-in-Charge.

Factory-made stainless-steel railing shall be provided with SS 316 grade stainless steel of 50 mm dia. of 18 gauge handrail with adequate rods parallel to handrail, balusters, flanges, end caps, newel posts with caps etc. complete as per approved drawings and direction of Engineer-in-charge.

Surface finish of all the stainless-steel materials will be in 240 grit satin finish / matt finish. All stainless-steel material will have to be coated by a solution of Inox to avoid finger in prints and avoidance of settlement of environment / atmospheric dust. Stainless steel railing, both sides in staircase and external ramp with double handrail shall be used for barrier free accessibility requirements with adequate SS balusters, runners etc as per approved architectural drawing. Fixing shall be done by stainless steel expansion bolts of approved size and make as per Engineer-in-Charge and welding to be done by using organ welding rods and the surface being duly finished and cleaned by K2 passivation, which is nitric acid plus florinc acid solution treatment by which the chances of corrosion will be eliminated and any burn out makes on the metal will also be eliminated.

17.0 Structural Steel Work:

17.1 Scope of work for the contractor in respect of structural steel work shall cover, but shall not be limited to the following:

- (i) Structural steel work (in built up/ rolled/tubular sections or combination thereof) in all structural steel trusses and structural steel frameworks for façade/roof wherever specified, structural steel members/element in composite structural works consisting of structural steel and RCC in combination, deck slab, miscellaneous structural (e.g. for creepers, plants, columns/beams/slabs/pergola of pavilions etc.).
- (ii) Preparation and submission of complete detailed shop fabrication drawings based on the architectural and structural design and drawings including revision in same as per directions of Engineer-in-charge.
- (iii) Submission of revised structural design, with calculations and detailed fabrication drawings, in case any substitution is required in the designed sections with prior approval of Engineer in charge.
- (iv) Submission of detailed erection plan/methodology for all structural members of structural steel structure, compatible with the details of fabrication. Also, complete drawings & phase wise instructions for all the activities required to erect steel structure in final position, shall be submitted.
- (v) Submission of details of specialized agency for steel fabrication in workshop and erection at site of structural steel work, which the contractor proposes to associate for structural steel work. The agency for fabrication of steel members in workshop and agency for erection of these steel members at site should preferably be same. The specialized agency should satisfy the experience requirements as stipulated in bid document elsewhere. Details should include experience of specialized agency in similar structural steel works, financial capabilities, location of workshop, fabrication facilities available in fabrication workshop etc.
- (vi) Procurement and testing of all raw structural steel materials in lots for fabrication taking into account wastage margin etc., including storage and upkeep of the materials
- (vii) Fabrication of the steel works in accordance with the approved fabrication drawings, including all shop assembling, matching and marking. Design, manufacture/fabrication and

provision of all jigs, fixings, manipulators etc. required for the fabrication.

- (viii) Suitably marking, bundling and packing for transport of all fabricated materials.
- (ix) Preparing and furnishing detailed bill of materials, drawing Office dispatch lists, Bolts
- (x) Lists and any other lists of bought out items required in connection with the fabrication of the structural steelwork.
- (xi) Loading and transporting all fabricated steelwork and field connection materials including site unloading and erection of structure in final position with all bolts, nuts, insert plate etc.
- (xii) The contractor shall provide general assistance during complete erection for solving any problem related to fabrication or site assembling of the structural steelwork. The contractor shall ensure the presence of the qualified and experienced Erection Engineer during complete erection work at site.
- (xiii) All major/ minor modifications of the fabricated steel structures, as directed by the Engineer-in-charge, including but not limited to the following:
 - a) Removal of bends, kinks, twists etc. for parts damaged during transportation and handling.
 - b) Cutting, chipping, filling, grinding etc. if required or preparation and finishing of site connections.
 - c) Reaming of holes for use of higher size bolt if required.
 - d) Re-fabrication of parts damaged beyond repair during transport and handling or re-fabrication of parts which are incorrectly fabricated.
 - e) Fabrication of parts omitted during fabrications by error, or subsequently found necessary.
 - f) Drilling of hole, with prior approval of Engineer-in-charge, which are either not drilled at all or are drilled in incorrect location during fabrication. Drilling of holes for connections of all structural members shall otherwise be done in fabrication workshop only.
- (xiv) Carry out tests in accordance with the related Specification which will be inspected by Engineer-in-charge.
- (xv) Details of erection equipment machinery including capacity & specifications, tools, tackles etc. to be used for erection purpose.
- (xvi) Necessary formwork & staging required for erection of structural members including design of formwork for all the anticipated loads.
- (xvii) All procedures and tests on welds as per specifications and welded parts to ensure the strength requirements of joints.

- 17.2 Submittals:** On commencement of the work pertaining to steel structure, the Contractor shall submit the following in two sets:
- a. Detailed baseline program, material procurement schedule, shop/working drawings, submission of samples, process/methodology of fabrication & delivery to site storage yard and erection at site for the approval of the Engineer-in-charge.
 - b. Complete fabrication drawings, schedule of quantity, cutting lists, bolt lists, welding schedules.
 - c. Results of any tests, as and when conducted and as required by the Engineer-in-charge.
 - d. Manufacturer's mill test reports/certificates in respect of steel materials, bolts, nuts and electrodes etc. as may be applicable.
 - e. A detailed list of all Plant & Equipment such as cranes, derricks, winches, welding sets, all consumables, grinding and hole drilling machine etc. their make, model, present condition and location, available to the contractor and the ones he will employ on the job to maintain the progress of work in accordance with the contract.
 - f. The total number of experienced personnel of each category like fitters, welders, riggers etc., which he intends to deploy on the work / project.
- 17.3** The Engineer-in-charge reserves the right to make changes in the design drawings even after release for preparation of shop drawings to reflect addition, omission & modifications in data/details and requirements. Contractor shall consider such changes as part of these specifications and the contract and no extra claims shall be entertained on this account.
- 17.4** Design and drawings will show as appropriate the salient dimensions of structural members.
- 17.5** No detailed shop drawings will be accepted for examination by the Engineer-in-charge unless these have first been completely checked by the contractor's qualified structural engineer. The contractor shall check and ensure that detailing of connections is carefully planned to obtain ease in erection of structures, including field bolting or field connection of temporary structure to permanent structure. Any temporary structure which is used for erection or launching purpose and required to be welded to permanent structural works shall be accounted for in fabrication drawings. Permission shall be obtained before welding or holing is done in permanent structures other than as shown in design drawings or approved fabrication drawings. In case of field bolted connection between temporary structure and permanent structural works, all necessary holes provision shall be left during fabrication in shop.
- 17.6** No fabrication work shall be started by the contractor without approval of Engineer-in-charge on the relevant drawings. Approval by the Engineer-in-charge of any of the drawings shall not relieve the contractor of his responsibility of workmanship, fit of parts, details, materials and errors or omissions of any work.
- 17.7** The contractor shall furnish three sets of prints of shop drawings as advance drawing (for

approval) and four set of prints of all approved final shop drawings along with soft copy in CD/Pen Drive for field use and record purpose.

17.8 The drawings prepared by the Contractor and all subsequent revisions thereof shall be at the cost of the Contractor and no separate payments shall be made for the same. Revisions shall incorporate all modifications, field changes, substitutions etc. effected.

17.9 All the drawings shall be prepared in metric units. The drawings should preferably be of A-2 or A-1 standard size, and the details shown therein shall be clear and legible. These drawings shall include but shall not be limited to the following:

- a. Assembly drawings, giving exact sizes of the sections to be used and identification marks of the various section's members.
- b. Dimensional drawings of base plans, anchorage detail of bearing bolts location etc.
- c. Complete quantity schedule of materials and detailed drawings of all sections.
- d. Detailed shop drawings for proper co-ordination with the concrete components to which the steel members shall be connected, as required.
- e. Any other drawings or calculations that may be required for proper completion of the works and clarification of the works or substituted parts thereof.
- f. All 'as-built' drawings in 4 prints and 1 plot on Garware film or equivalent and on CD.

17.10 Applicable Codes of Practice:

The design and execution of works shall be as per relevant Indian standards. All materials to be supplied by the Contractor shall conform to relevant Indian Standards as approved by the Engineer-in-charge.

17.11 Materials

- a. Structural Steel materials required for the work shall be free from imperfections, mill scales, slag intrusions, laminations, pittings, rusts etc. that may impair strength, durability and appearance. All materials shall be of tested quality only. Test Certificates in respect of each consignment shall be submitted to Engineer-in-charge before use in work. Whenever the materials are permitted for procurement from identified stocks, a random sample shall be tested at an approved laboratory, as directed by the Engineer-in-charge.
- b. Structural steel shall be of yield stress of 250 MPa conforming to grade A of IS: 2062 and Tubular steel shall conform to yield stress 310 Mpa of IS: 1161 for circular section & IS: 4923 for RHS / SHS.
- c. Structural steel for the work shall comply as follows –
 - For ISMB, ISMC, ISA (Angles) : IS 2062 Grade E250 A/B
 - For Flats : IS 2062 Grade E250 A/B
 - For Plates : IS 2062 Grade E250BR/ E350BR
 - For universal columns/ Beams : BSEN 10025 S275JR/ S275J0/S355J0

- Ordinary Black Bolt : Grade 4.6 (IS: 1367- part 3)
 - High Strength Bolt : Grade 8.8 (IS:1367-part 3, IS:3757,IS: 4000)
 - Chequered Plate (min. 6mm Thk) : IS: 3502 (Grade A)
 - Anchor Bolts, Nuts, Washers : IS: 2062 (Grade 4.6), and IS:5624
 - Steel Grating : IS: 2062 (Grade A)
 - Rail : IS: 3443
- d. Grating, Handrail, Ladder, Insert Plates with lugs, Anchor Bolts including nuts and washers shall be galvanized.
- e. Shop connections shall be welded, and all welds shall be continuous fillet / butt structural welds. Where galvanizing is specified, seal welding is required at all shop connections prior to hot-dip galvanizing. Welding after galvanizing shall not be permitted generally. But from construction point of view, if openings in gratings are provided after erection, galvanizing spray shall be used on cut & welded surfaces.
- f. Field connections may be welded or bolted. However, bolted connections shall be preferred over welded connections. .
- g. Adequate provision shall be made in structural arrangement for installation and successful implementation façade cleaning system for all building blocks.

17.12 STORAGE OF MATERIALS

- a. All materials shall be so stored as to prevent deterioration, and to ensure the preservation of their quality and fitness for the work. If required by the Engineer-in-charge, the materials shall be stored under cover and suitably painted for the protection against weather condition. Any material, which has deteriorated or has been damaged shall be removed from site and replaced by new members, as directed by the Engineer-in-charge at no extra cost and time.
- b. The steel to be used in fabrication shall be stored in a separate stack clear of the ground section wise and lengthwise.
- c. The storage area shall be kept clean and properly drained. Structural steel shall be so stored and handled in such a manner that members are not subjected to excessive stresses and damage. Girders and beams shall be placed in upright position. Long members shall be supported on closely spaced skids to avoid unacceptable deflection.
- d. The Contractor shall have a suitable shop storage yard at his own premises for storing the fabricated steel structures and other materials. The yard shall have proper facilities such as drainage and lighting including access for cranes, trailers and other heavy equipments.
- e. All Shop / field connection materials, shop paints etc. shall be stored on racks and platforms, off the ground in a properly covered building by the contractor.
- f. The contractor shall make proper arrangement for sand blasting of steel sections so that these sand blasted materials may be used for fabrication wherever required.

17.13 Handling and Storing of Materials:

- a. Suitable area for storage of structures and components shall be located near the site of work. The access road should be free from water logging during the working period and the storage area should be on levelled and firm ground.
- b. The store should be provided with adequate handling equipments e.g. road mobile crane, gantries, derricks, chain pulley blocks, winch of capacity as required. Stacking area should be planned and have racks, stands sleeper, access tracks, etc., and properly lighted.
- c. Storage should be planned to suit erection work sequence and avoid damage or distortion. Excessively rusted, bent or damaged steel shall be rejected. Methods of storage and handling steel, whether fabricated or not shall be subject to the approval of the Engineer in charge.
- d. Fabricated materials are to be stored with erection marks visible, such as not to come into contact with earth surface or water and should be accessible to handling equipment.
- e. Small fitting hand tools are to be kept in containers in covered stores.
- f. All materials, consumables, including raw steel or fabricated material shall be stored specification-wise and size-wise above the ground upon platforms, skids or other supports. It shall be kept free from dirt and other foreign matter and shall be protected as far as possible from corrosion and distortion. The electrodes shall be stored specification-wise and shall be kept in dry warm condition in properly designed racks. The bolts, nuts, washers and other fasteners shall be stored on racks above the ground with protective oil coating in gunny bags. The paint shall be stored under cover in air-tight containers.
- g. IS:7293 and IS:7969 dealing with handling of materials and equipments for safe working should be followed. Safety nuts and bolts as directed are to be used while working. The Contractor shall be held responsible for loss or damage to any material provided by the Department while in his care or for any damage to such material resulting from his work.

17.14 Shop Assembly: The steelwork shall be temporarily shop assembled, as necessary, so that the accuracy of fit may be checked before dispatch. The parts shall be shop assembled with a sufficient number of parallel drifts to bring and keep the parts in place. Since parts drilled or punched, with templates having steel bushes shall be similar and, as such, interchangeable, such steelwork may be shop erected in part only, as agreed by the Engineer-in-charge.

17.15 Erection Marking: Each fabricated member, whether assembled prior to dispatch or not so assembled, shall bear an erection mark, which will help to identify the member and its position in respect of the whole structure, to facilitate re-erection at site. These erection marks shall be suitably incorporated in the shop detail and erection drawings.

17.16 Formwork: The formwork shall be properly designed, substantially built and maintained for all anticipated loads. The Contractor, if required, shall submit plans for approval to the Engineer in Charge. Approval of the plans, however, shall not relieve the Contractor of his responsibility.

17.17 Assembling:

- a. The parts shall be accurately assembled as shown on the drawings and match marks shall be followed. The material shall be carefully handled so that no parts will be bent, broken or otherwise damaged. Hammering which will injure or distort the members shall not be done. Bearing surface or surfaces to be in permanent contact shall be cleaned, before the members are assembled.
- b. The truss spans shall be erected on blocking, so placed as to give the proper camber. The blocking shall be left in place until the tendon chord splices are fully riveted and all other truss connections pinned and bolted. Bolts in splices of butt joints of compression members and bolts in railings shall not be driven until the span has been swung.
- c. All joint surface for bolted connections including bolts, nuts, washers shall be free from scale, dirt, burrs, other foreign materials and defects that would prevent solid seating of parts. The slope of surface of bolted parts in contact with bolt head and nut shall not exceed 1 in 20, plane normal to bolt axis, otherwise suitable tapered washer shall be used.
- d. All fasteners shall have a washer under nut or bolt head whichever is turned in tightening.
- e. Any connection to be bolted shall be secured in close contact with service bolts or with a sufficient number of permanent bolts before the rivets are driven or before the connections are finally bolted. Joints shall normally be made by filling not less than 50 percent of holes with service bolts and barrel drifts in the ratio 4:1. The service bolts are to be fully tightened up as soon as the joint is assembled. Connections to be made by close tolerance bolts shall be completed as soon as practicable after assembly.

17.18 Transportation & Handling

- a. Before the shop assembling is dismantled, all members and sections shall be appropriately marked with paint or grooved with their identification numbers as detailed in shop drawings.
- b. The Contractor shall transport the fabricated structural steel materials to work site, with all necessary field connection materials, in such sequence as will permit the most efficient and economical performance of the erection work. As per scheduled programme, the Engineer-in-charge may, at his discretion prescribe or control the sequence of delivery of materials.
- c. Fabricated parts shall be handled in such a way-that no damage is caused to the components. Measures shall be taken to minimize damage to the protective treatment on the steelwork. All work shall be protected from damage in transit. Particular care shall be taken to stiffen free ends, prevent permanent distortion and adequately protect all machined surfaces. All bolts, nuts, washers, screws, small plates and articles generally shall be suitably packed and identified.

17.19 Field Bolts:

- a. Contractor shall supply the full number of bolts, nuts and washers and other necessary fittings required completing the work, together with the additional bolts, nuts and washers totaling to 10% of the requirement subject to minimum of 10 Nos.
- b. At the time of assembly, the surfaces in contact shall be free of paint or any other applied finish, oil, dirt, loose rust, loose scale, burrs and other defects which would prevent solid

seating of the parts or would interfere with the development of friction between them.

- c. If any other surface condition, including a machined surface, is specified, it shall be the responsibility of the Contractor to work within the slip factor specified for the particular case.
- d. Each bolt and nut shall be assembled with washers of appropriate shape, quality and number in cases where plane parallel surfaces are involved. Such washers shall be placed under the bolt head or the nut, whichever is to be rotated during the tightening operation. The rotated nut or bolt head shall be tightened against a surface normal to the bolt axis, and the appropriate tapered washer shall be, used when the surfaces are not parallel. The angle between the bolt axis and the surface under the non-rotating component (i.e. the bolt head or the nut) shall be $90 + 3$ degree. For angles outside these limits, a tapered washer shall be placed under the non-rotating component. Tapered washers shall be correctly positioned.
- e. No gasket or other flexible material shall be placed between the holes. The holes in parts to be joined shall be sufficiently well aligned to permit bolts to be freely placed in position. Driving of bolts is not permitted. The nuts shall be placed so that the identification marks are clearly visible after tightening. Nut and bolts shall always be tightened in a staggered pattern and where there are more than four bolts in any one joint, they shall be tightened from the centre of the joint outwards.
- f. If, after final tightening, a nut or bolt is slackened off for any reason, the bolt, nut and washer or washers shall be discarded and not used again.

17.20 Tightening of bolts:

- a. Bolted connection joints with high strength friction grip bolts shall be inspected for compliance of codal requirements.
- b. The Engineer shall observe the installation and tightening of bolts to ensure that correct tightening procedure is used and shall determine that all bolts are tightened. Regardless of tightening method used, tightening of bolts in a joint should commence at the most rigidly fixed or stiffest point and progress towards the free edges, both in initial snugging and in final tightening.
- c. The tightness of bolts in connection shall be checked by inspection wrench, which can be torque wrench, power wrench or calibrated wrench. Tightness of 10 per cent bolts, but not less than two bolts, selected at random in each connection shall be checked by applying inspection torque. If no nut or bolt head is turned by this application, connection can be accepted as properly tightened, but if any nut or head has turned all bolts shall be checked and, if necessary, re-tightened.

17.21 Erection of Steel Structures:

- i. The Contractor shall erect the structural steel, remove the temporary construction, and do all the work required to complete the, construction included in the contract in accordance with the drawings and the specifications and to the entire satisfaction of the Engineer.
- ii. The Contractor shall submit erection plans prepared by the fabricator, showing a method and

procedure of erection, compatible with the details of fabrication.

- iii. A detailed scheme must be prepared showing stage-wise activities, with complete drawings and working phase wise instructions. This should be based on detailed stagewise calculation and take into account specifications and capacity of erection equipment machinery, tools, tackles to be used and temporary working loads as per Codal provisions.
- iv. The scheme should be based on site conditions e.g. hydrology, rainfall intensity, soil and sub-soil conditions, temperature and climatic conditions and available working space, etc.
- v. The scheme should indicate precisely the type of temporary fasteners to be used as also the minimum percentage of permanent fasteners to be fitted during the stage erection. The working drawings should give clearly the temporary jigs, fixtures, clamps, spacer supports, etc.
- vi. The contractor shall supply and erect all necessary false work and staging and shall supply all labour, tools, erection plant and other materials necessary to carry out the work complete in all respects.
- vii. Prior to actual commencement of erection all equipment, machinery, tools, tackles, ropes, etc. need to be tested to ensure their efficient working. Frequent visual inspection is essential in vulnerable areas to detect displacements, distress, drainages, etc.
- viii. Deflection and vibratory tests shall be conducted in respect of supporting structures, launching truss, cranes etc. as also the structure under erection and unusual observations reviewed, looseness of fittings are to be noted.
- ix. For welded structures, welders' qualifications and skill are to be checked as per standard norms. Non-destructive tests of joints as per Engineer in charge's directives are to be carried out.
- x. Safety requirements should conform to IS: 7205, IS:7273 and IS:7269 as applicable and should be a consideration of safety, economy and rapidity.
- xi. Erection work should start with complete resources mobilized as per latest approved drawings and after a thorough survey of foundations and other related structural work. In case of work of magnitude, maximum mechanization is to be adopted.
- xii. The structure should be divided into erectable modules as per the scheme. This should be pre-assembled in a suitable yard/platform and its matching with members of the adjacent module checked by trial assembly before erection.
- xiii. The structure shall be set out to the required lines and levels. The stocks and masses are to be carefully preserved. The steelwork should be erected, adjusted and completed in the required position to the specified line and levels with sufficient drifts and bolts. Packing materials are to be available to maintain this condition. Organized "Quality Surveillance" checks need to be exercised frequently.
- xiv. Before starting work, the Contractor shall obtain necessary approval of the Engineer in

charge as to the method adopted for erection, the number and character of tools and plants. The approval of the Engineer in charge shall not relieve the Contractor of his responsibility for the safety of his method or equipment or from carrying out the work fully in accordance with the drawings and specifications.

- xv. During the progress of work, the Contractor shall have a competent Engineer or foreman in charge of the work, who shall be adequately experienced in steel erection and acceptable to the Engineer in Charge.

17.22 Painting at Site:

- a) Surfaces which will be inaccessible after site assembly shall receive the full specified protective treatment before assembly. Surfaces which will be in contact after site assembly shall receive a coat of paint (in addition to any shop primer) and shall be brought together while the paint is still wet. Damaged or deteriorated paint surfaces shall be first made good with the same type of coat as the shop coat. Where steel has received a metal coating in the shop, this coating shall be completed on site so as to be continuous over any welds, bolts and site rivets. Specified protective final painting treatment shall be completed after erection.
- b) All the load bearing exposed structural steel members (e.g. Beams/Columns/Truss etc.) consisting of members of built up sections made by mild steel plates as well as of standard/rolled steel sections of various sizes shall be applied with single pack factory blended (free from asbestos & Glass fibres) vermiculite and portland cement based, fire resistant material mixed with the required solvent/ water and designed for the fire protection of interior/exterior structural steel members as per manufacturer design & specification to required thickness sufficient to obtain **fire resistance/ rating of required/appropriate duration as per NBC 2016**. The exposed visible areas should be trowel finish. The plaster application shall be carried out through certified applicator / licensee of the manufacturer. The product shall adhere to the steel surface and should comply with latest provisions contained in UL-263 and BS-476 part 20/21 (for load bearing section). Before applying the material on surface of structural member, any metal mesh required to bond the material should be applied as per manufacturer specification. All lots / bags of blended material should have certification stamp from independent third-party laboratories like Warrington Fire Research Lab (UK) / UL (USA). (Approved make: NEWKEM / GRACE/SOPREMA).

17.23 STRUCTURAL STEELWORK SPECIFICATION FOR WELDED STRUCTURE:

- a. This Specification covers the supply, fabrication transportation and erection at site of welded structural steelwork, including the supply of approved consumables, electrodes, wires and other materials required for fabrication and field connections of all structural steelwork covered under the scope of the Specification. The shear connector studs if required or specified in the drawing shall also be welded in the shop.
- b. **Workmanship:** All workmanship shall be in accordance with the best practices in modern structural steel works. Accuracy shall be maintained in the manufacture of every part of the work. The contractor shall not proceed with any welding until the Engineer-in-charge has approved his welding plan, which shall include all information's on welding procedures, equipment, additives and preheating during welding operation, Details of non-destructive

testing methods, precautions with regard to welding shrinkage, possible treatment of completed welds by grinding, procedure and programme of welding sequence etc.

- c. **Templates:** Templates used throughout the work shall be of Steel. In cases where actual materials have been used as templates for drilling similar pieces, the Engineer-in-charge shall decide whether such materials are fit to be used as parts of the finished structure.
- d. **Straightening:** All materials shall be straight and free from twists, and if necessary, before being worked, shall be straightened and/or flattened by pressure, unless required to be of curvilinear form. Fusion faces and the surrounding surfaces within 50mm of the welds shall be free from all mill scale and free from oil, paint or any substance which might affect the quality of the welds or impede the quality/progress of welding. These shall be free from irregularities, which would interfere with the deposition of the specified size of weld or be the cause of defects. All mill scale within 50mm of welds shall be removed prior to welding, either by pickling followed by thorough power wire brushing, or by other approved methods. If preparation or cutting of the fusion faces is necessary, the same shall be carried out by shearing, chipping, gas cutting or flame gouging. Where hand gas cutting or hand gouging is employed, the blowpipe or gouging blowpipe shall be properly guided.
- e. **Shearing, Cutting and Planning:** Cutting shall be done automatically. Cutting by shearing machine may be used for plates not exceeding 10 mm in thickness provided that the plate edges be fully enclosed in a weld. For Plates above 10mm, CNC plasma cutting shall be used provided a smooth and regular surface free from cracks and notches is secured. Chipping of edges of plates, wherever necessary, shall be done without damaging the parent metal. Chipped edges shall be ground to a neat finish and sharp corners and hammered rough faces shall be rounded off. The edges and ends of all cut/sheared plates shall be planed/ground. Edge preparation for welding may be done by machine-controlled flame cutting, with edges free from burrs should be clean and straight. The butting surfaces at all joints of girders shall be planed so as to butt in close contact throughout the finished joint. The edges shall be prepared, with an automatically controlled flame cutting torch, correctly to the shape, size and dimensions of the groove, prescribed in the design and fabrication drawings. In case of U-groove joints, the edges shall be prepared with an automatic false cutting torch in two phases, following a bevel out with a gouging pass or by machining. The welding surfaces shall be smooth, uniform and free from fins, tears, notches or any other defects, which may adversely affect welding, and shall be free of loose scale, slag, rust, grease, paint, moisture or any other foreign material.
- f. **Assembly for Welding:** Parts to be welded shall be properly assembled and held firmly in position by means of jigs and clamps prior to and during welding.
- g. **Welding Procedure:** All welding procedures shall be submitted to the Engineer-in-charge for approval, well before starting fabrication. The welding procedures shall be arranged by the Contractor to suit the details of the joints, as indicated in the drawings, and the position at which welding has to be carried out. Welding procedure shall cover the following:

- i. Type and size of electrodes
- ii. Current and (for automatic submerged arc welding) arc voltage
- iii. Length of run per electrode; or (for automatic welding) speed of travel
- iv. Number and arrangement of runs in multi run welds
- v. Position of welding
- vi. Preparation and set-up of parts
- vii. Welding sequence
- viii. Pre or post heating
- ix. Any other relevant information.
- x. Welding of 20 mm and more thick plates shall be done by beveling of edge to be welded.

The welding procedures shall be so arranged that distortion and shrinkage stresses are reduced to the minimum. Any weld found defective shall be removed, by using either chipping hammer or gouging torch, in such a manner that parent material is not injured in any way. Welding shall not be carried out when temperature is below 10 degrees Celsius or surface is wet or during periods of strong winds unless the work and the welder is adequately protected.

- h. **Welding:** The welding shall conform to code, IS: 816 (1969) and IS: 9595 (1980) and other applicable codes and standards, unless otherwise specified. As much work as possible shall be welded in shops and the layout and sequence of operations shall be so arranged as to eliminate distortion and shrinkage stresses. All electrodes/ wires / flux shall be kept under dry conditions. Any electrode / wires /flux damaged by moisture shall not be used unless it is guaranteed by the manufacturer that, when it is properly dried, there will be no detrimental effect. Any electrode, which has part of its flux coating broken away or is otherwise damaged, shall be rejected. Any electrode /wires/ flux older than six (6) months from the date of manufacture shall not be used. Batch certificates for electrodes/ wires /flux shall be submitted by the Contractor.
- i. **Plate Construction:** Automatic metal arc welding or sub merged arc welding shall be employed for fabrication of all members. Metal Inert gas welding may be done for short length where access to the location of the weld does not permit metal arc welding subject to approval of Engineer-in-charge.
- j. **Accuracy of Fit-Up:** Parts to be fillet welded shall be brought into as close contact as practicable, and the gap due to faulty workmanship or incorrect fit-up shall not exceed 1.5mm. If greater separation occurs at any position, the size of fillet weld shall be increased at such positions by the amount of the gap.
- k. **Jigs and Manipulators:** Jigs and manipulators shall be used, where practicable, and shall be designed to facilitate welding and to ensure that all welds are easily accessible to the operators.
- l. **Ends of Butt-Welded Joints:** The ends of butt joints shall be welded so as to provide full throat thickness. This may be done by the use of extension pieces, cross-runs or other approved means.

- m. **Weld Face and Reinforcement of Butt welds** : The weld face shall, at all places, be deposited projecting the surface of the parent metal. Where a flush surface is required, the surplus metal shall be dressed off.
- n. **Testing of Butt Welds** : Butt-welded joints are to be radio graphically tested (or Phased Array ultrasonic Testing) by the Contractor at his own cost in the presence of the engineer in charge or his authorized representative, if desired by the engineer in charge. If such tests indicate the joints to be defective, the cost of rectification of defective welds shall also be borne by the Contractor. The agency for testing of welds shall be specified for approval by engineer-in-charge.
- o. **Minimum Leg Length & Throat Thickness in Fillet Welds**: The minimum leg length of a fillet weld as deposited shall be not less than the specified size as per codal provisions. In no case shall a concave weld be deposited, unless specifically permitted. Where permitted, the leg length shall be increased above that specified length, so that the resultant throat thickness is as great as would have been obtained by the deposition of a flat-faced weld of the specified leg length.
- p. **Dislodging**: After making each run of welding, all slag shall be thoroughly removed and the surface cleaned.
- q. **Quality of Welds**: The weld metal, as deposited (including tack welds), shall be free from-cracks, slag inclusions, porosity, cavities and other deposition faults. The weld metal shall be properly fused with the parent metal without under cutting or overlapping at the toes of the weld. The surface of the weld shall have a uniform consistent contour and regular appearance.
- r. **Weather Conditions**: Welding shall not be done under weather conditions, which might adversely affect the efficiency of welding.
- s. **Qualification and Testing of Welders**: The Contractor shall satisfy the Engineer-in-charge that the welders are suitable for the work for which they will be employed, and shall produce evidence to the effect that welders, have satisfactorily completed appropriate tests, as described in IS:817 Part I (1992). The Engineer-in-charge may, at his own discretion, order periodic tests of the welders and/or of the welds produced by them. Such tests shall be at the expense of the Contractor.
- t. **Supervision**: The Contractor shall employ competent welding supervisors to ensure that the standard of workmanship and the quality of the materials comply with the requirements laid down in this document.
- u. **Machining of Butts and Bases**: Splices and butt joints of compression members, depending on contact for stress transmission, shall be accurately machined over the whole section. In column bases, the ends of shafts together with the attached gussets, angles. channels etc., after bolting and/or welding together as the case may be, shall be accurately

machined so that the parts connected butt over the entire surface of contact. Care shall be taken that connecting angles or channels are fixed with such accuracy that they are not reduced in thickness by machining by more than 0.8mm.

17.24 Requirement of Welded Joints: Apart from the requirements of welding specified under the above sub clauses, sections above, the Contractor shall ensure the following requirements in the welded joints.

- i) Strength-quality with parent metal.
- ii) Absence of defects
- iii) Corrosion resistance of the weld shall not be less than that of parent material in an aggressive environment.

17.25 Studs: Studs shall be used at interface of in-situ deck slab and plate girder to transfer the longitudinal shear.

17.26 Welding of stud shear connectors: Unless otherwise provided the stud shear connectors shall be fusion welded to the plate girder using stud welding machine as per the manufacturer's instructions. No other type of welding shall be permitted. The stud and the surface to which studs are welded shall be free from scale, moisture, rust and other foreign material. The stud base shall not be painted, galvanized or cadmium plated prior to welding. Welding shall not be carried out when temperature is below 10 degrees Celsius or surface is wet or during periods of strong winds unless the work and the welder is adequately protected. The welds shall be visually free from cracks and shall be capable of developing at least the nominal ultimate strength of studs. The procedural trial for welding the stud shall be carried out when specified by the Engineer-in-charge.

17.27 STRUCTURAL STEEL WORK - QUALITY CONTROL & TESTING REQUIREMENTS

- a. The contractor shall himself inspect all materials and shop work to satisfy the specified tolerance limits and quality norms before the same are inspected by Engineer-in-charge or his authorized representative.
- b. All materials, equipment and work of erection shall be subject to the inspection of the engineer in charge who shall be provided with all facilities including labour and tools required at all reasonable times. Any work found defective is liable to be rejected.
- c. No protective treatment shall be applied to the work until the appropriate inspection and testing has been carried out. The stage inspection shall be carried out for all operations so as to ensure the correctness of fabrication and good quality. Plate Girder dimensions and camber, if any, shall not be finally checked until all welding and heating operations are completed and the member has cooled to a uniform temperature.
- d. Testing of material: All the materials shall be tested for mechanical and chemical properties as per various relevant IS codes as may be applicable and shall conform to requirements specified. The cost of these tests shall be borne by the contractor.
- e. Rivets, bolts, nuts, washers, welding consumables, steel forging, casting and stainless steel shall be tested for mechanical and chemical properties as per the appropriate IS Code.

- f. Rolling and cutting tolerance shall be as per relevant CPWD specifications or Indian Standards. The thickness check measurements for the plate and rolled sections shall be taken at not less than 15 mm from edge. For plates thicker than 25mm, Check for laminations in plates shall be carried out by ultra-sonic testing or any other specified methods.
- g. Steelwork shall be inspected for surface defects and exposed edge laminations during fabrication and blast cleaning. Significant edge laminations found shall be reported to the Engineer in charge for his decision. Chipping, grinding, machining or ultrasonic testing shall be used to determine depth of imperfection.
- h. Bolted connections: Bolts and bolted connection joints with high strength bolts shall be inspected and tested according to IS: 4000. The alignment of plates at all bolted splice joints and welded butt joints shall be checked for compliance with codal requirements.
- i. Welding and welding consumables: Welding procedure, welded connection and testing shall be in compliance with codal requirements. All facilities necessary for stage inspection during welding and on completion shall be provided to the Engineer in Charge or his authorized representatives. Adequate means of identification either by identification mark or other record shall be provided to enable each weld to be traced to the welder(s) by whom it was carried out.
- j. The contractor shall through appropriate planning and continuous measurements in the workshop and the erection at site, ensure that the tolerance specified below are strictly adhered to. Tolerances in dimensions of components of fabricated structural steel work shall be specified on the drawings and shall be subject to the approval of the Engineer before fabrication.
- k. Dimensional & Weight Tolerance: The dimensional and weight tolerance for rolled shapes shall be in accordance with IS: 1852, 808 etc. The acceptable limits of straightness for rolled or fabricated members as per IS: 7215.
- l. The structural steel shall comply in all respects with the requirements of approved drawings and relevant codes and specifications and shall be procured from approved manufacturers only. It may be noted that quality of raw steel used for fabrication shall be essence of the contract & shall be strictly conforming to specified standard. Steel sections to be supplied by the manufacturers shall be tested as per codal provisions at the manufacturer's premises before dispatch. The contractor on receipt of supply in his fabrication shop shall carry out necessary control tests including ultrasonic testing as per codal requirements and verify them with the list received from manufacturers. The rejected lot shall not be used and rejected lot shall be immediately removed from fabrication shop. Only steel passed in all tests shall be used for fabrication.
- m. The contractor shall supply information in the technical package regarding source / manufacturers from where procurement of steel is proposed.
- n. Fabricator agency shall have in house facilities for all testing of weld, as detailed in this tender document.

17.28 Payment Stages:

- a. Procurement & testing of steel materials on receipt in fabrication workshop against documentary evidence of purchase from approved supplier subject to a maximum of quantities as indicated in approved fabrication drawing and also as indicated in schedule: 35% of estimated cost of corresponding Structural Steel work.
- b. On completion of fabrication of all steel work quantities and testing of fabricated members and its approval by Engineer in charge: 20% of estimated cost of corresponding Structural Steel work.
- c. On successful test assembly in workshop, checking of camber etc. and its approval by Engineer in charge: 5% of estimated cost of corresponding Structural Steel work.
- d. On transportation and receipt of fabricated material in good condition at erection site and approval of Engineer in charge regarding physical receipt of fabricated materials in good condition: 10% of Estimated cost of corresponding Structural Steel work.
- e. After final erection of the steel plate girder and aligning them in proper position over the respective supports, fixing of bracings, etc. and its approval by Engineer in charge: 30% of Estimated cost of corresponding Structural Steel work.

Note: - If the fabrication workshop is outside the site of work, the payment for item in (a), (b) & (c) above shall be made against the Bank Guarantee duly executed in a form acceptable to the Engineer-in-charge for an amount equivalent to the payment. The payment for item (d) above shall be against an indemnity bond duly executed in a form acceptable to the Engineer-in-charge. The Bank Guarantee shall initially be valid for a minimum six months. It should be subsequently extended from time to time depending upon the progress of work. The Bank Guarantee shall be released to the extent to the fabricated material reaches the work site and on completion of activity (e) in good condition and certified by Engineer in charge to this effect.

18.0 WATER PROOFING & INSULATION WORK:

All Waterproofing works in general shall be carried out as per the waterproofing schedule provided in the contract document.

For waterproofing of works below plinth/ground/road level complete envelope/box shall be ensured with Pre-applied HDPE waterproofing membrane post applied SBS based self-adhesive waterproofing membrane.

- 18.1** Basically, all the RCC works shall be given waterproofing treatment by adding the cementitious integral crystalline admixture of make KRYTONE, PENETRON, XYPEX @ 0.80% (minimum) to the weight of cement content per cubic meter of concrete) or higher as recommended by the manufacturer's specification in reinforced cement concrete at site of work. The material shall meet the requirements as specified in ACI-212-3R-2010 i.e. by reducing permeability of concrete by more than 90%, compared with control concrete as per DIN 1048 and resistant to 16 bar hydrostatic pressure. The crystalline admixture shall be capable of self-healing of cracks up to a width of 0.50mm. The intension is to use integral cementitious crystalline admixture to all RCC works requiring the water proofing treatment. The product performance shall carry guarantee for 10 years

against any leakage.

- 18.2** Pre-applied waterproofing membrane of minimum 1.5 mm thick (with bare HDPE membrane thickness of 1.0 mm or more) flexible sheets of make SIKA, Saint Gobain, SOPREMA or equivalent shall be used for waterproofing treatment below horizontal surface of foundations or underground structures exposed to soil (e.g. grade slab, raft, footing, lift pit base, UG tank, etc.). The Membrane shall conform to following properties (minimum)- i) Puncture resistance of >1100N as per ASTM E 154, ii) Tensile strength of >27 Mpa as per ASTM D 412, iii) Resistance to hydrostatic head of >70m As per ASTM D 5385, iv) Elongation of >500% as per ASTM D 412, v) Peel adhesion to concrete of >1000 N/m as per ASTM D 903. The pre-applied, fully bonded HDPE sheet membrane shall be loosely laid on PCC. The fully bonded HDPE sheet membrane shall consist of a high-performance PE film, self-adhesive polymer layer and unique particulate layer with pressure sensitive adhesive, which bonds fully to the poured concrete above it. The membrane shall have minimum of 75mm side laps and end laps which shall be sealed with double sided adhesive tape. Third party test report from NABL accredited approved laboratory along with MTC of product should be submitted. Test report should not be older than 5 years. All detailing components of the system has to be compatible with the proposed waterproofing membrane and has to be manufactured and supplied by the manufacturer of waterproofing membrane. The system shall be installed as per manufacturer's specification and executed by manufacturer's certified applicators (in house team) after successful mock-up at site etc.
- 18.3** Post applied minimum 1.5 mm thick SBS based self-adhesive waterproofing membrane of make SIKA, Saint Gobain, Soprema or equivalent shall be used on vertical sides of foundation system or underground structures exposed to soil (e.g. lift pit walls, retaining walls without weep holes, walls in continuation with the foundations, UG tank etc.). the membrane shall be topped with HDPE cross laminated film. The installation involves cleaning the surface, priming the surface with cold applied bituminous primer@4-6 sqm. /litre, properly sealing the joints & maintaining 75 mm overlap between the membrane selvedge & 100 mm overlap on the end joints of the membrane over the slab etc. complete. The self-adhesive membrane shall have following minimum properties: (i) Tensile strength (ASTM D 412) : > 5 N/mm² , (ii) Resistance to Hydrostatic Head (ASTM D 5385) : > 70 m, (iii) Tear Resistance (ASTM D 624) : > 30 N/mm² , (iv) Puncture Resistance (ASTM E 154) : > 350 N/mm², (v) Lap adhesion (ASTM D 1876) : > 2000 N/mm. the membrane shall be protected by spot bonding 7-8mm thick dimpled HDPE protection board, spot bonded onto the self-adhesive membrane with liquid mastic which shall be applied prior to backfilling. The backfilling shall be done within 2-3 days of fixing protection board.
- 18.4** Waterproofing on terrace slabs shall consist: i) **A(Surface Preparation):** Mechanically grinding of substrate so as to achieve surface free of dust, loose particles. All cracks to be treated by cutting a groove and sealing cracks with Polymer modified cement mortar. Making coving with 1:3 cement mortar modified with 10% SBR polymer. Providing and laying reinforcing mesh on all horizontal and vertical members of termination points and cracks. **B) (Waterproofing Membrane) :** Supplying and installing spray/ roller applied a high performance, low odour, one-part, fast curing, high solids, cold applied polyurethane elastomer waterproof membrane over uniform surface. The material shall be pure polyurethane with DFT of 1.5mm and consumption of 2.2 - 2.4 Kg/Sqm. It should not contain bitumen or tar and should not bleed or stain and should have following minimum properties: i) Solid % Vol: > 85 ii) Tensile Strength > 2 Mpa, iii) Elongation > 400%, iv) Tear Strength > 10 N/mm shall be applied as per manufacturer specification. Foam Insulation avg 50mm thick on the terrace having density 45-50 kg/m³, Thermal conductivity 0.020-0.030 W/mK, closed cell content of >90%, Fire resistance conforming to Class - B2 to be applied as per the

manufacturer's recommendations applied over the RCC slab and on the vertical surfaces on the parapet walls upto 300mm above FFL, etc. complete. D) **PU Sealer coat over PUF** : Supplying and installing spray/ roller applied a high performance, low odour, one-part, fast curing, high solids, cold applied polyurethane elastomer waterproof membrane over uniform surface. The material shall be pure polyurethane with consumption of 1.5 Kg/Sqm. It should not contain bitumen or tar and should not bleed or stain and should have following minimum properties: i) Solid % Vol: > 85, ii) Tensile Strength > 2 Mpa, iii) Elongation > 400%, iv) Tear Strength > 10 N/mm shall be applied as per manufacturer specification. E) **Protection Geotextile Membrane**: Providing and laying geotextile membrane of 200 GSM as a separation layer. Geotextile membrane shall be overlapped by 50mm and spot bonded. F) **Protection screed**: Providing & laying avg 100mm protective screed of M20 grade with slope 1:100 containing 100% virgin polypropylene fibers @ 0.9 Kg per Cum with a broom finish, well compacted, curing for 7 days etc. complete. The screed shall be laid in panels with 10mm wide construction joint and filling the panel joints with PU Sealant.

- 18.5** Water proofing treatment to vertical and horizontal surfaces in all internal wet areas of building (e.g. Toilets/Kitchens/AHU/balconies etc.) shall be done with two-component, high elasticity acrylic modified cementitious coating system (make SIKA, Saint Gobain, Soprema or equivalent) made from best quality Portland cement, properly selected & graded aggregates additives & acrylic emulsion polymer as a binder. The product consumption shall be at least @ 2kg/sqm. The coating system must have the following characteristics: i) Powder to Liquid Ratio 2:1, ii) Bond Strength with concrete > 2 Mpa, iii) Elongation > 200% an shall be applied as per manufacturer specification. The coating shall be continued to the entire horizontal area and should be terminated at 300mm above the floor finish level complete as per manufacturer's specification. The coating shall be followed by providing and applying 15 mm thick Protective mortar of (1 Cement: 4 Coarse Sand) mixed with integral waterproofing compound of approved make as per manufacturer's specifications. All systems shall be installed by authorized applicators (in house team of manufacturer) as per manufacturer's recommendations and includes all lead and lift for all materials and labor.
- 18.6** Water proofing of UGT & OHWT: It shall be treated on internal vertical and horizontal surfaces with two-component, high elasticity acrylic modified cementitious coating system (make SIKA, Saint Gobain, Soprema or equivalent) made from best quality Portland cement, properly selected & graded aggregates additives & acrylic emulsion polymer as a binder. The product consumption shall be atleast @ 2kg/sqm. The coating system must have the following characteristics: i) Powder to Liquid Ratio 2:1, ii) Bond Strength with concrete > 2 Mpa, iii) Elongation > 200% an shall be applied as per manufacturer specification. The coating shall be followed by providing and applying 15 mm thick Protective mortar of (1 Cement: 4 Coarse Sand) mixed with integral waterproofing compound of approved make as per manufacturer's specifications. The plaster shall be applied 2 coats of Food grade epoxy coating – two component, water-based epoxy resin having anti-algae, antifungal, Nontoxic, hygiene cum damp-proof coating Certified by CFTRI, having mixing Ratio (Base: Hardener: Water) – 1:1:1 to be applied @ 3 - 4 sqm / Kg, as per manufacturer's specification. All systems shall be installed by authorized applicators (in house team of manufacturer) as per manufacturer's recommendations and includes all lead and lift for all materials and labor.
- 18.7** Waterproofing of STP: It shall be treated on internal vertical and horizontal surfaces with two-component, high elasticity acrylic modified cementitious coating system (make SIKA, Saint Gobain, Soprema or equivalent) made from best quality Portland cement, properly selected & graded aggregates additives & acrylic emulsion polymer as a binder. The product consumption shall be at least @ 2kg/sqm. The coating system must have the following characteristics: i) Powder to Liquid

Ratio 2:1, ii) Bond Strength with concrete > 2 Mpa, iii) Elongation > 200% and shall be applied as per manufacturer specification. The coating shall be followed by providing and applying 15 mm thick Protective mortar of (1 Cement: 4 Coarse Sand) mixed with integral waterproofing compound of approved make as per manufacturer's specifications. The plaster shall be applied 2 coats of Coal Tar epoxy coating – two-part, composed of best quality dehydrated coal tar, liquid epoxy resins and curing agent, properly selected & graded inert fillers, additives and solvent. It is used as an anticorrosive & protective coating for concrete as well as steel structure because it has excellent chemical resistance properties in atmosphere or in contact with chemical solutions such as effluents, sewage, salty water and organic / inorganic acids & alkalis. It is most suitable for structures in submerged conditions to be applied @ 3 – 4 m²/ kg for 2 coats @ 250 – 300-micron DFT. All systems shall be installed by authorized applicators (in house team of manufacturer) as per manufacturer's recommendations and includes all lead and lift for all materials and labor.

18.8 Waterproofing – Retention Pond:

(i) Protection layer

- a) The layer that shall be laid shall compose of a geotextile felt NT fibers of polypropylene is 100% pure, needle punched, resistant microorganisms, weight 800 gm/sqm or higher depending on the regularity of the support.

(ii) Waterproofing Membrane

- a) Over the geotextile protection layer TPO based waterproofing membrane (make SIKA, Saint Gobain, Soprema or equivalent) shall be laid loosely giving an overlap of 10 to 15 cm at the edges.
- b) Laying of synthetic membrane made from TPO shall be by co-extrusion method. The upper surface (light green) shall be treated against UV rays - the underside (black) is highly resistant to puncture and perforation by roots. Any tears in the light green upper layer (signal-layer) of the membrane can be seen immediately due to the difference in colour between the two sides. A glass fibre sheet is positioned between the two layers. The raw materials used to produce TPO membranes are obtained by mixing modified polyolefins with different additives by means of a process that creates a paste which is later transformed into granules. This combination gives the synthetic membranes the following specifications:

(i) Tensile strength	> 9 N/mm ²	UNI EN 527-3
(ii) Breaking strength	≥ 550%	UNI EN 527-3
(iii) Static Puncture Resistance	≥ 1350 N	UNI EN 12236
(iv) Cold bending	≤ -40 °C	UNI EN 495-5
(v) Water permeability	< 10 ⁻⁶ m ³ m ⁻² d ⁻¹	UNI EN 14150

- c) Overlaps of waterproofing membrane are carried out in dry conditions using leister automatic welder, or leister hot air gun. On vertical support: an intermediate fixation is to be given at least every 4,00 m of height using pre-punched galvanized bar.

(iii) Anchoring Trench

- a) For securing the membrane in the anchoring trench shall be dug outside of pond approximately 300-500mm from the edge, with square or trapezoid sections to a minimum dimension of 50x50 cm with a horizontal crest platform of 100 cm.
- b) The membrane should lap into the trench and after laying the membrane, the trench to be filled with aggregates (concrete or round gravel) cast in situ, further covering it using soil over the liner.

19.0 ROAD WORK:

- 19.1** All roads will be cement concrete roads, as per MORTH specifications (Latest edition), laid over sub grade duly prepared with power roller of required thickness as per design. Irrespective of whether shown in drawings or mentioned in tender document, all the drainage, signages (Informative, Mandatory, Regulatory etc.) other works associated with road works shall be provided as per relevant standards and specification MORTH Specifications for Road and bridge work (Latest edition). The edges of roads should be at least 20 cm above the adjoining ground level. The work shall be carried out using MORTH Specifications for Road and bridge work (Latest edition).
- 19.2** Covered/open parking areas shall be provided as per requirement with 80 mm thick multicolored Paver blocks of grade M-40 made of C&D waste ingredients by block making machine with vibratory compaction laid in required pattern with in-built directional markers, over 50mm thick compacted bed of coarse sand, filling the joints with fine sand etc. Roofing shall be of RCC/Galvalume supported on RCC/Steel structure. The solar photo voltaic panels shall be installed over the roofing of parking areas.
- 19.3** As far as possible cross drainage should be taken under the road and at right angle to it. NP-3 pipes of dia not less than 300 mm and as per design requirement shall provided at a interval of not more than 60 meter with a longitudinal slope as per design slope. At the head of cross drain catch pits of adequate size to collect stones, soil and rubbish and to prevent scour has to be provided. The floor of the catch pit should be deeper than the sill of pipe culvert by at least 0.3 meter.
- 19.4** Control of seepage flow below road: whenever seepage flow is expected /likely to exists, or seepage zone is at depth less than 0.9 m from sub grade level, longitudinal perforated pipe drain of adequate dia of PVC in trench filled with filtered material and geo textile shall be constructed to intercept the seepage flow. Necessary arrangement to collect the water from perforated pipe drain and diverting by using pipes of PVC/RCC NP-3 of adequate dia shall be made.
- 19.5** Sub grade: It shall be prepared and consolidated with power road roller of 8-to-12-ton capacity after excavating earth to an average of 22.5 cm depth, dressing to camber and consolidating with road roller including making well the undulations etc. and re-rolling the sub grade and disposal of surplus earth.
- 19.6** Granular Sub-Base: Construction of granular sub-base shall be, by providing close graded Material conforming to specifications, mixing in a mechanical mix plant at OMC, carriage of mixed material by tippers to work site, for all leads & lifts, spreading in uniform layers of specified thickness with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per specifications and directions of Engineer-in-Charge.

With material conforming to Grade-I (size range 75 mm to 0.075 mm) having CBR Value-30.

- 19.7** PCC of minimum thickness of 100 mm of grade M-10 with minimum cement content of 220 kg/cum shall be provided over granular sub-base and below CC pavement on roads.
- 19.8** Cement Concrete Pavement: Cement concrete pavement (minimum thickness of 150 mm) of design mix M-30 grade (with minimum cement content as 350 kg/cum) with ready mix concrete shall be laid in roads/ taxi tracks/ runways, shall be laid and finished with screed board vibrator , vacuum dewatering process and finally finished by floating, brooming with wire brush etc. complete as per specifications and directions of Engineer-in-charge, levelling to required slope/ camber, finishing with required texture, including steel form work with sturdy M.S. channel sections, curing, making provision for contraction/ expansion, construction & longitudinal joints (10 mm wide x 50 mm deep) by groove cutting machine, providing and filling joints with approved joint filler and sealants.
- 19.9** Factory made Kerb stone: It shall be of M-25 grade cement (made by using ingredients from C & D waste) shall be provided at or near ground level in position to the required line, level and curvature jointed with cement mortar 1:3 (1cement: 3 coarse sand) as per drawings including making joints with or without grooves (thickness of joints except at sharp curve shall not to more than 5mm) including making drainage opening wherever required complete etc. If the C&D waste product are unavailable in market, the conventional products may be used by the contractor at no extra cost to department.
- 19.10** RCC Perforated Drain Covers: Factory made precast RCC perforated or non-perforated drain covers having concrete of strength not less than M-30, of required sizes for road side drains/underground utility shaft or duct, shall be provided. These should be properly reinforced to carry the desired load.
- 19.11** Grass Pavers: It shall be green honeycomb panels with self-anchoring pegs, made of high impact resistant HDPE. Each grass paver should be of 330mm x 330 mm and 35 mm in height consisting of four floral shaped structure of 125mm open cell and nine round cell opening of 45 mm dia. Each of the open cell are connected with a web like structure for strength and stability. Base of the panel is equipped with a slot opening for drainage and four round struts for anchoring purpose. The Grass Paver to have interlock system to lock each other. The Grass Paver should have compressive strength of minimum 150 tons/sq mt, capable to take the load of the fire tender. The panel should have high level of porosity greater than 90%, porous for Grass, shrubs and low planters. Laying to be done on 50 mm sand bed over well compacted subbase/WBM as per manufacturer specifications.
- 19.12** Road Surface marking: It shall be done with two or more coats to give uniform finish with ready mixed thermoplastic reflective paint conforming to IS: 164, on white/yellow shade, including cleaning the surface of all dirt, scales, oil, grease and foreign material etc.
- 19.13** Retro Reflective Overhead Signage Boards: It shall consist manufacturing, supplying and fixing made up of 2 mm thick aluminium sheet, face to be fully covered with high intensity and encapsulated lens type heat activated retro reflective sheeting conforming to type - III of ASTM-D-4956-01 as approved by Engineer-in-charge, letters, borders etc. as per IRC : 67-2001 in silver white with blue colour back ground and with high intensity grade, pasted on substrate by pressure sensitive adhesive backing which shall be activated by applying pressure conforming to class II of

ASTM-D-4956-01 and fixing the same to the plate of structural frame work by means of suitable sized aluminium alloys, rivets or bolts & nuts @ 300 mm centre to centre all along the periphery as well as in two vertical rows along with theft resistant measures, including the cost of painting with two or more coats of epoxy paint in grey colour on the back side of aluminium sheet including appropriate priming coat. The process includes rounding off the corners, lowering down the structural frame work from the gantry, fixing and erecting the same in position all complete as per drawings, specification.

20.0 SIGNAGES:

Signages inside/outside buildings shall be as per NBC 2016 guidelines and of approved design and make with LED backlit. Each room shall be provided with Name Boards, Numbering of rooms, Signages etc. Indicative list is given in schedule of signages. The contractor shall prepare the detailed shop drawing in compliance to the NBC 2016 guidelines and Harmonized Guidelines & Standards for Universal Accessibility in India 2021 (available on CPWD Website) of Ministry of Housing and Urban Affairs, Government of India.

20.1 Signage works include providing and fixing Building Entrance signage / Tactile Layout / Emergency Evacuation Layout on the wall or with any other required structure. Each signboard to be fixed strictly as per the Harmonised Guidelines & Space Standards for Barrier Free Built Environment for persons with Disability, issued By MOUD, Govt. of India, and as as per approved drawings and complete as per the directions of Engineer - In - Charge.

21.0 Sanitary Installations and Water Supply:

21.1 General:

- a) All the work in general shall be carried out as per CPWD Specifications 2019, Volume-I & II with revisions/ amendments / correction slips upto last date of submission of bid. The work shall be in conformity with the Bye-laws, Regulations and Standards of the local authorities concerned. The contractor shall be responsible for the protection of the sanitary and water supply fittings, other fittings and fixtures against pilferage and breakage during the period of installation and thereafter until the building/work is handed over. The Plumbing / Sanitary System shall comprise of following:
 - i. Sanitary pipes, fittings and fixtures.
 - ii. Internal and external water supply.
 - iii. Internal and external drainage.
 - iv. Approval from local authorities, if any.
 - v. Balancing, testing & commissioning.
 - vi. Test reports and completion drawings.
- b) UPVC pipes shall be having thermal stability for hot & cold-water supply including all UPVC plain & brass threaded fittings. Also, jointing of pipes & fittings with push fit connections and testing of joints shall be done as per direction of Engineer-in-Charge.
- c) All Storm pipes/ NP2 RCC pipes shall be complete with fittings. The laying of pipes shall be laid with all norms.
- d) The provision of floor trap, floor drain, gully trap, manhole, valves etc. as specified in the

tendered drawings and bid document (if any) are the minimum quantity. Contractor has to provide in the building(s) and campus, adequate quantity of these items for effective operation of services.

- e) All concealed work shall include cutting chases and making good the walls etc.
- f) Dual piping system shall be provided wherever recycled water is used for flushing. Separate pipe lines for hot and cold-water supply shall be provided. Pipe lines and their accessories shall be of approved make.
- g) Plumbing shall have provision for Geysers, water purifier, washing machines, Dish washers, cage washers or any other equipment as per functional requirement.
- h) Piping has to be done such that water meter maybe provided with individual buildings at a designated location.
- i) In toilets and other waste water disposal areas sanitary pipe lines shall be suspended from the floor stabs i.e. the floor slabs should not be depressed on account of accommodating sanitary lines. These overhanging sanitary lines shall be camouflaged by moisture resistant false ceiling.
- j) Plumbing system shall be designed and provided as per the functional requirements of the buildings.
- k) Double stack system shall be followed. All sewerage to be connected to one stack and all drainage to be connected to other stack
- l) Water supply and sanitary fittings shall be provided as per the functional and architectural requirements.
- m) Pipes shall be duly fixed to the wall by bracket. All pipes shall be fixed with clamps at maximum 1.00 m spacing.
- n) All drainage in balconies shall have their inlets in plan. All drainage through balconies shall be connected to Rain Water Harvesting.
- o) Utility balcony drainage shall be suitably treated and shall be not connected to Rain Water Harvesting System.

21.2 Internal water supply line-

- a) For buildings, the stacks shall be provided in shafts which shall be covered with weather proof doors and accessible for maintenance.
- b) Fittings e.g. Pillar cocks, angle cocks, two way bib cocks with health faucet, long body bib cocks, wall mixture, overhead shower, towel rod of 600mm, corner glass shelf along with other miscellaneous fittings like bottle trap, floor trap, waste couplings, liquid soap

dispenser, toilet paper holder etc. shall be provided as per approved make and model and as per the direction of Engineer-in-Charge. The contractor has to provide all fixtures and fittings for functional suitability.

- c) Terrace Tank- RCC water storage tank for Service tank, Fire Fighting, Treated/domestic Water shall be provided of adequate capacity with suitable water proofing treatment with all the accessories e.g. float valve, scour valve, CI cover with locking arrangement etc. complete. The inlet of service tank shall be connected from this firefighting tank in such a way that the over flow firefighting shall flow to the service tank (this means firefighting storage tank remains always full). The system should be conducive to Hydro Pneumatic system to be provided for all buildings.
- d) **UGT Storage:** Underground water tank storage of minimum 2 days of daily water demand shall be provided.
- e) **Water Distribution:**
- (i) **Domestic & Flushing water:** Distribution of domestic water shall be through variable speed hydro pneumatic pumping system installed at water supply pump room. Flushing water from domestic water supply line shall be pumped to Terrace Tank of Buildings by a variable speed hydro pneumatic pumping system.
 - (ii) **R.O. Water** – Localised RO units shall be provided in order to meet the work / project requirement.
 - (iii) Motorised Valve shall be provided at inlet of all Overhead Tanks. Pressure Reducing Valves shall be provided on distribution lines to maintain the pressure between 1.5 to 3.5 kg/cm².
- f) **Materials for Water Supply System:**
- i. Internal Toilets water supply - Stainless steel 316 grade pipe and fittings.
 - ii. Pipe under vertical in shaft and terrace for cold and hot water supply - Stainless steel 316 grade pipe and fittings.
 - iii. The pipes shall be Stainless Steel grade AISI 316 pipes confirming to relevant of JIS G 3448 and the press fittings shall confirm to JWWA G 116 for Press Connection system with leak before pressed function (LBP) showing penetration of water at the unpressed connection while filling the installation. The system should withstand working pressure of 15 kg/cm² and test pressure 25 kg/cm² at 30 minutes. Operating temperature shall be -20⁰C to 110⁰C.
 - iv. R.O Water Supply Pipe - Stainless steel 316 grade pipe and fittings.
 - v. R.O Water Storage Tank – It shall be made in SS-316 grade. Tank shall be insulated with 100 mm thick glass wool insulation not less than 80 kg/m² density & wrapping by 24g aluminum sheet.

- vi. Contractor shall provide adequate number of unions on all pipes to enable easy dismantling later when required. Unions shall be provided near each gunmetal valve, stop cock, or check valve and on straight runs as necessary at appropriate locations as required and/or directed by Engineer in charge. Flanged connections shall be provided on pipes as required or where shown on the drawings, all equipment connections as necessary and required or as directed, shall be made by the correct number and size of GI nuts, bolts & washers with 3 mm thick gasket. Where hot water or steam connections are made insertion gasket shall be of suitable high temperature grade and quality approved by Bolt hole dia for flanges shall conform to match the specification.
- vii. Valves upto 40 mm diameter shall be of screwed type Ball Valves with stainless steel balls, spindle, Teflon seating and gland packing tested to a hydraulic pressure of 20 kg/cm², and accompanying couplings and steel handles conforming to BS 5351. Valves 50 mm diameter and above shall be cast iron butterfly valve to be used for isolation. The valves shall be bubble tight, resilient seated suitable for flow in either direction and seal in both direction with accompanying flanges and steel handle. Butterfly valve shall be of best quality conforming to IS: 13095. Wherever specified non return valve (dual type check valve) shall be provided through which flow can occur in one direction only. It shall be single door swing check type of best quality. Each Butterfly and dual plate Check (NRV) Valve shall be provided with a pair of flanges screwed or welded to the main line and having the required number of galvanized nuts, bolts and washers of correct length.

21.3 'L' shaped Grab Bar made up of Heavy Duty stainless steel (grade 304) 40 mm (Outer dia with 3 mm thick sheet) dia seamless pipe, & 750 mm in vertical length & 900 mm in horizontal length including base plate and steel fasteners shall be provided in the toilets (for differentially abled persons) as per manufacturers specification, complete as per drawings and "Harmonized Guidelines & Space Standard for Barrier Free Environment issued by MOUD, Govt Of India" to make them Accessible for Persons with Disabilities.

21.4 'U' shaped Grab Bar made up of Heavy-Duty stainless steel (grade 304) of 750 mm in length & 40 mm dia (Outer dia with 3 mm thick sheet) seamless pipe including Hinge, base plate and steel fasteners, shall be provided in the toilets (for differentially abled persons) as per manufacturers specification, as per drawings and "Harmonized Guidelines & Space Standard for Barrier Free Environment issued by MOUD, Govt Of India" to make them Accessible for Persons with Disabilities.

21.5 Full size /length float mirror over wash basin slab to be provided over wooden backdrop of approved design.

21.6 Internal Sanitary Installation:

- (i) **Soil, Waste, Vent & Rainwater Pipes & Fittings:** Two pipe system as recommended in code of practice for soil and waste pipes as per (IS: 5329). Separate vertical stacks for **Soil pipes** (to carry the wastes from WC's & urinals) and **Waste pipes** (to carry the wastes from waste appliances e.g. showers, lavatory basins, kitchen sinks etc.) shall be provided.
- (ii) The soil, waste, vent pipes system shall include Horizontal soil, waste and vent pipes, and all fittings, joints, clamps, connections to fixtures, Floor and urinal traps, cleanout plugs, inlet fittings, UPVC Rain Water Pipes, Testing of all pipe lines.

- (iii) **Materials for Soil, Waste, Vent and Rain Water Pipe System:** Pipes used for Soil, Waste and Vent system shall be UPVC pipes. UPVC pipes shall be having thermal stability for hot & cold-water supply including all UPVC plain & brass threaded fittings. Also, jointing of pipes & fittings with push fit connections and testing of joints shall be done as per direction of Engineer-in-Charge.
- (iv) **Traps:** Floor traps where specified shall be siphon type full bore P or S type having a minimum 50 mm deep seal. The trap and waste pipes when buried below ground shall be set and encased in cement concrete blocks firmly supported on firm ground. The blocks shall be in 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal size). Contractor shall provide all necessary shuttering and centring for the blocks. Size of the block shall be 30x30 cms of the required depth. Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, Contractor shall provide a special type of floor or manhole inlet fitting fabricated from G.I. pipe without, with one, two or three inlet sockets welded on side to connect the waste pipe or joint between waste and inlet socket shall be lead caulked. Inlet shall be connected to a C.I. P or S trap. Floor and urinal traps shall be provided with 100 -150mm square or round Stainless-Steel gratings as approved with frame and rim of approved design and shape or as specified in the scope of work & approved by the Engineer in charge.
- (v) **Cleanout plugs:** Clean out plug for Soil, Waste or Rainwater pipes laid under floors shall be provided near pipe junctions bends, tees, “Ys” and on straight runs at such intervals as required as per site conditions. Cleanout plugs shall terminate flush with the floor levels. They shall be threaded and provided with key holes for opening. Cleanout plugs shall be with screwed G.I. socket. The socket shall be lead caulked to the drain pipes.

21.7 Sanitary Fittings and Fixtures: All Sanitary Ware & C.P Brass Fittings shall be low flow rate fixtures to meet the green rating requirement. Water closets with concealed dual flushing cistern shall be provided. Wash basin shall be over counter / wall hung as shown in drawings. Single lever basin mixer shall be provided with all wash basins. Urinal shall be provided with automatic sensor based flushing system. Indicative list of preferred Make & Model number of sanitary fixtures & C.P brass fittings is provided in schedule of sanitary fitting/fixtures.

21.8 Contractor shall furnish without cost all such accessories and fixing devices that are necessary and required but not supplied along with the Plumbing Fixtures & CP Fittings by the manufacturers as a part of the original and standard supply. All fittings and fixtures shall be fixed in a neat workmanlike manner true to level and heights shown on the drawings and in accordance with the manufacturer’s recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, tiling or terrace shall be made good at Contractor's cost. Fixing screws shall be half round head chromium plated brass screws with C.P. washers where necessary. Contractor shall seal all fixtures fixed near wall, marble and edges. With an approved type of poly-sulphide sealant appropriate for its application.

Piping & drainage works shall be tested as specified under the relevant specifications. Tests shall be performed in presence of the Engineer in charge. Entire drainage system shall be tested for water tightness and smoke tightness during and after completion of the installation. No portion of the system shall remain untested. Contractor must have adequate number of expandable rubber below plugs, manometers, smoke testing machines, pipe and fitting work test benches and any other

equipment necessary and required to conduct the tests. All materials and equipment found defective shall be replaced at contractor cost and whole work shall be tested to meet the requirements of the specifications. Contractor shall perform all such tests as may be necessary and required by the local authorities to meet municipal or other bye-laws in force. All water supply system shall be tested to hydrostatic pressure test of at least one and a half (1.5) times the maximum pressure but not less than 10 Kg/cm² for a period of not less than 8 hours. All leaks and defects in joints revealed during the testing shall be rectified and got approved at site by retest. Piping required subsequent to the above pressure test shall be retested in the same manner. System may be tested in sections and such sections shall be entirely retested on completion. In addition to the sectional testing carried out during the construction, contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakages and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes or failure of fittings, to the building, furniture & fixtures shall be made good by the contractor during the defect liability period without any cost. After commissioning of the water supply system, contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. Valves which do not effectively operate, shall be replaced by new ones at no extra cost and the same shall be tested as above.

21.9 Jointing & fixing:

- a) All Hubless centrifugally cast (Span) iron pipes shall be jointed with SS 304 grade coupling with EPDM rubber gasket joints as per requirement and specifications. All uPVC pipes & Fittings shall be jointed with solvent cement as per manufacturer's specifications and relevant I.S codes. All GI pipes & Fittings shall be threaded jointed. All pipes shall be tested after installation for a pressure equal to twice the maximum working pressure in the line as per manufacturer's specifications.
- b) Fittings shall conform to the same Indian Standard as for pipes. Pipes and fittings must be of matching IS Specification. Interchange of pipes of one standard with fittings on the other standard will not be permitted. Fittings shall be of the required degree of curvature with or without access door. Access door shall be made up with 3 mm thick insertion rubber washer and white lead. The bolts shall be lubricated with grease or white lead for easy removal later. The fixing shall be air and water tight. All vertical pipes shall be fixed by Galvanised clamps and galvanised angle brackets. Branch pipes shall be connected to the stack at the same angle as that of the fittings. No collars shall be used on vertical stacks. Each stack shall be terminated at top with a cowl (terminal guard). Horizontal pipes running along ceiling shall be fixed on galvanised structural adjustable clamps of special design shown on the drawings or as directed by engineer-in-charge. Horizontal pipes shall be laid to uniform slope and the clamps adjusted to the proper levels so that the pipes fully rest on them.
- c) All pipe clamps, supports and hangers shall be galvanised. Factory made pre-fabricated clamps shall be preferred. Contractor may fabricate the clamps of special nature and galvanise them after fabrication but before installation. All nuts, bolts, washers and other fasteners shall be factory galvanised. Clamps shall be of approved designs and fabricated from GI flats (which shall be galvanised after fabrication) of thickness and sizes as per drawings or contractor's shop drawings. Clamps shall be fixed in accordance to manufacturer's details/shop drawings to be submitted by the contractors. When required to be fixed on RCC columns, walls or beam they shall be fixed with approved type of galvanised expansion anchor fasteners (Dash fasteners) of approved design and size according to load. Structural

clamps e.g. trapeze or cluster hangers shall be fabricated by electro-welding from M.S. Structural members e.g. rods, angles, channels flats as per Contractor's shop drawing shall be galvanised after fabrication. All nuts, bolts and washers shall be galvanised. Galvanised slotted angle/channel supports on walls shall be provided wherever shown on drawings. Angles/channels shall be of sizes shown on drawings or specified in scope of work. Angles/channels shall be fixed to brick walls with bolts embedded in cement concrete blocks and to RCC walls with anchor fasteners mentioned above. The spacing of support bolts on support members fixed horizontally shall not exceed 1 m.

- 21.10 Disinfection of Piping System and Storage Tanks:** Before commissioning the water supply system, the contractor shall arrange to disinfect the entire system. The water storage tanks and pipes shall first be filled with water and thoroughly flushed out. The storage tanks shall then be filled with water again and disinfecting chemical containing chlorine added gradually while tanks are being filled to ensure thorough mixing. Sufficient chemical shall be used to give water a dose of 50 parts of chlorine to one million parts of water. If ordinary bleaching powder is used, the proportions will be 150 gm of powder to 1000 liters of water. The powder shall be mixed with water in the storage tank. If a proprietary brand of chemical is used, the proportions shall be specified by the manufacturer. When the storage tanks is full, the supply shall be stopped and all the taps on the distributing pipes are opened successively working progressively away from the storage tank. Each tap shall be closed when the water discharged begins to smell of chlorine. The storage tank shall then be filled up with water from supply pipe and added with more disinfecting chemical in the recommended proportions. The storage tank and pipe shall then remain charged at least for three hours. Finally, the tank and pipes shall be thoroughly flushed out before any water is used for domestic purpose. The pipe work shall be thoroughly flushed before supply is restored.
- 22.0 Lawn Hydrants:** Lawn hydrants shall be of 25mm size unless otherwise indicated. All hydrants shall be provided with gate valves and threaded nipple to receive hose pipes. Lawn hydrant valves shall be of approved make and design. Where called for lawn hydrants shall be located in masonry chambers of appropriate size.
- 22.1** All rates quoted are inclusive of cutting holes and chases in walls and floors and making good the same with cement mortar/concrete/water proofing of appropriate mix and strength as directed by the Engineer in charge. Contractor shall provide holes, sleeves, recesses in the concrete and masonry work as the work proceeds. All hot and cold-water supply pipes crossing masonry walls and floors shall be provided with G.I. pipe sleeves. The annular space between the pipe and sleeve shall be filled up with fire proof sealant after testing.
- 23.0 Drainage (External Water-Supply/Sewerage/Storm Water Drainage/Rain Water Harvesting System):** Dual piping system shall be provided, as required, where recycled water is used for flushing, horticulture, firefighting purposes and for cooling towers for chiller units. Inspection chambers/manholes/ gullies chambers/ valves and other accessories of approved specifications and make shall be provided considering all the site conditions and reduced level as per design parameters. As far as possible green and recyclable materials shall be preferred.
- a) The contractor shall carry out the works of sewer and storm water drainage system. All sewer and drainage line shall be laid at appropriate level below ground level. The work includes laying of sewer lines including excavations/backfilling, construction of manholes, drop connections etc. The work also includes laying storm water drainage pipeline including

excavation/backfilling, drainage lines and open drains to the required gradients and profiles, etc. All drainage work shall be done in accordance with the local municipal bye-laws. Location of all manholes, etc. shall be got approved from the engineer in charge. No drains or sewers shall be laid in the middle of road unless otherwise specifically directed by the Engineer in charge.

- b) The contractor shall design the rain water harvesting system and construct the same for entire campus in holistic manner. Rainwater harvesting system shall be designed and provided as appropriate to the site and as per Municipal byelaws and Central Ground Water Board norms. Gardens and lawns shall be irrigated in combination of Garden Hydrant System, Sprinkler Irrigation System & Rain Gun for Large Area. Other areas shall be irrigated using the appropriate system specified in the schedule of irrigation. The Main Distribution grid shall be HDPE pipes PE-100 (10kg/cm²) conforming to IS: 4984 and branch distribution system be with uPVC pressure pipes (10 kg/cm²) confirming to IS: 4985. Irrigation water from STP shall be pumped to Irrigation Grid by a variable speed hydro pneumatic pumping system located at STP pump room.
- c) The Sewerage system shall be HDPE DWC pipe SN 8 Grade conforming to IS 16098. Storm Water system shall be in RCC NP3 class pipe conforming to IS 458.
- d) Unless otherwise specified, minimum Depth of Sewer & Storm Water Line shall be 1.0 mtr below from ground level. Unless otherwise specified, minimum & maximum velocity of Sewer Pipe shall be 0.75 m/sec & 2.0 m/sec respectively. Unless otherwise specified, minimum & maximum velocity of Storm Water Pipe shall be 0.6 m/sec & 2.0 m/sec respectively. Manhole shall be built in brick masonry with Common burnt clay F.P.S. (non modular) bricks class designation 7.5 with cover and SFRC frame. Size and depth of manholes shall be as per NBC 2016 / CPWD specifications.
- e) Laying and jointing of HDPE pipes: Pipes are liable to be damaged in transit and not withstanding tests that may have been made before dispatch each pipe shall be examined carefully on arrival at site. Each pipe shall be rung with a wooden hammer or mallet and those that do not ring true and clear shall be rejected. Sound pipes shall be carefully stacked to prevent damage. All defective pipes should be segregated, marked in a conspicuous manner and their use in the works shall be prevented. The pipes shall be laid with sockets leading uphill and rest on solid and even foundations for the full length of the barrel. Socket holes shall be formed in the foundation sufficiently deep to allow the pipe jointer room to work right round the pipe and as short as practicable to admit the socket and allow the joint to be made. Where pipes are not bedded on concrete, the trench bottom shall be left slightly high and carefully bottomed up as pipe laying proceeds so that the pipe barrels rest on firm ground. If excavation has been carried too low it shall be made up with cement concrete at the Contractor's cost. If the bottom of the trench consists of rock or very hard ground that cannot be easily excavated to a smooth surface, the pipes shall be laid on cement concrete bed to ensure even bearing.
- f) Gully traps: Gully traps shall be fixed in cement concrete 1:4:8 (1 cement: 4 coarse sand: 8 stone aggregate 20 mm nominal Size) mix and a brick masonry chamber 30x30 cms (inside) in cement mortar 1:5 (1 cement: 3 coarse sand) with 15x15 cms grating (inside) and 30x30 cms C.I sealed cover and frame weighing not less than 7.0 kg (approx.).

- g) Masonry Chamber: All manholes, chambers and other such works as specified shall be constructed in brick masonry in cement mortar 1:4 (1 cement: 4 coarse sand) or as specified in the CPWD Specification. All manholes and chambers, etc. shall be supported on base of cement concrete of such thickness and mix as given in the CPWD Specification or shown on the drawings. All manholes shall be provided with cement concrete benching in 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal Size). The benching shall have a slope of 10 cms towards the channel. The depth of the channel shall be full diameter of the pipe. Benching shall be finished with a floating coat of neat cement. (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal Size) as per standard details. All manholes shall be plastered with 12/15 mm thick cement mortar 1:3 (1 cement: 3 coarse sand) and finished with a floating coat of neat cement inside. Manhole shall be plastered outside as above but with rough plaster mixed with water proofing compound. All manholes with depths greater than 1 meter shall be provided with plastic coated catch rings set in cement concrete vertically and staggered. All manholes shall be provided with steel Fibre reinforced plastic (SFRC) covers and frames and embedded in reinforced cement concrete slab. Weight of cover, frame and thickness of slab shall be as specified in the CPWD Specification. Cement concrete for pipe support: Wherever specified or shown on the drawings, all pipes shall be supported in bed all round or haunches. The thickness and mix of the concrete shall be given in the CPWD Specification.

24.0 Façade Work:

This specification covers the general requirements of external facade work (e.g. Structural Glazing, Curtain Wall, GRC Panel, ACP, Aluminum composite/Puff/sandwich Panels, Exterior Grade HPL etc.) including engineering design involving structural stability of system as a whole e.g. supply, fabrication, installation, testing, ensuring water tightness and maintenance etc. Work under this section shall be performed by specialized agency, who is regularly engaged in the engineering, fabrication, finishing and installation of façade work including glazing and sealing of glass etc. and having experience in similar works. The contractor shall submit-full details and credentials of specialized agency for verification and to demonstrate to the satisfaction of the Engineer-in-charge that he has successfully completed similar works over as per the CPWD guidelines. Only after written approval of engineer in charge, the contractor will engage such specialized agency for this work.

24.1 SCOPE OF WORK:

- a) The scope of work includes all labour, material, equipment and services as required for the complete design, engineering, testing, and fabrication, assembly, delivery, anchorage, installation and water tightness of the façade system. The façade system includes GRC/stone cladding, Unitised/Semi-unitised structural glazing, curtain wall, curtain glazing, skylight, aluminium louvers, Exterior grade HPL etc. anchorage including all primary and secondary anchor assemblies and supportive structural framing as required for securing the facade to the building structure. The scope of work also includes complete design, engineering, testing, fabrication, assembly, delivery, anchorage and installation of a suitable gondola/jib system for cleaning of the vertical glass/Stone/GRC facade.
- b) The contract documents define only the design intent and general performance requirements. The contractor is fully responsible for detailed design, structural calculations, shop drawings, procurement of materials, fabrication, installation, warranties, certifications and related documentation. The entire work shall be carried out strictly in accordance with the true intent

and meaning of the specification and drawings taken together regardless of whether the same may or may not be shown particularly on the drawings or described in the specification provided that the same can be reasonably inferred.

- c) Only suggestive sizes and details are proposed by the Engineer-in-charge that has a visual impact on facade. Contractor's fabrication / shop drawing will seek these suggestions and design the final construction details. The complete design of façade system will be submitted by contractor to engineer- in-charge for approval.
- d) The facade shall be designed, fabricated at works, supplied, delivered and installed in accordance with the shop drawings and samples of materials approved by the Engineer-in-charge and shall be constructed to meet the performance requirements and standards.
- e) In general, the façade system should be designed to suit the aesthetics and performance requirements, taking into consideration the necessary factors to suit fabrication and the site conditions for erection.
- f) The contractor shall strictly follow, at all stages of work, the stipulations contained in the Indian standard safety code and the provisions of the safety rules for ensuring safety of men and material. The successful bidder shall submit a safety plan for approval of the Employer. On approval of the same, the same shall be followed during the currency of the contract.
- g) The contractor must comply with all applicable local-building regulations and all the safety guidelines particularly specified for facade work as per relevant I.S codes.
- h) Shop and field materials and workmanship shall be subject to inspection of the Engineer-in-charge and his authorized representative at all time. Such inspections do not relieve the contractor from obligations to provide materials conforming to all requirements of the contract documents and industry standards for material quality.
- i) All approvals, instructions, permission, checking, review etc. whatsoever by the Engineer-in-charge shall not relieve the contractor of his responsibility and obligation regarding adequacy, correctness, completeness, safety, strength, quality, workmanship etc. of the facade system.
- j) Testing shall be done as per nomenclature of the DSR item of typical DGU Panel of approved size in factory and in field through an approved testing agency.

24.2 Façade System Description

- a) The contractor shall devise a suitable framing system for vertical/roof façade application keeping in view the performance characteristics and aesthetics requirements.
- b) The vertical/roof structural glazing system shall be fully unitized / Toggle based curtain wall or Semi-unitised and shall be designed to suit sealed insulated glass units (hereafter referred to as "IG unit"). Aesthetically the design of the glazing system shall provide a filtering envelope to the building/structure and provide a uniform appearance. The glazing system shall have flush glazed exterior joints both horizontal and vertical. The structural glazing system shall be designed to receive fixed glazing as well as structurally glazed openable vents with protection of the glass edges. The contractor shall take adequate measures to ensure the thermal performance of the glazing system under the increased solar radiation prevalent in the region.

No onsite sealant application will be permitted except for weather sealant in case of unitized system. The system shall comprise of factory prefabricated glazed vision and spandrel panels. The system should preferably permit re-glazing of vision panels from outside the building. The contractor should choose an approved system also keeping in view the various requirements arising during future maintenance during the life span of the glazing system.

- c) The structural glazing system shall be designed to allow for three-dimensional adjustments due to dead load, live load, wind load, seismic load and thermal movement. The framing system must be designed to provide adequate support for the IG units to prevent transfer of loads to the glazing below and to provide uniform support to both lites of the IG unit. Intermediate mullions should be of same size as that of outer mullions.
- d) The structural aspects of the structural glazing system must be carefully integrated with the glazing rabbet and drainage details to ensure proper performance. The structural glazing system shall be designed on the rain screen principle with provision for pressure equalization.
- e) The structural silicon sealant to be used in this structural glazing system shall be of such quality & designed to transfer wind, seismic, live and dead loads from the glass to the framed structure of the structural glazing.
- f) The design shall incorporate floor-to-floor noise isolators, fire and smoke stops between the floor slabs and sill flashing etc. as per the NBC of India and also of the best international practices.
- g) The façade system shall have spandrel panel (over solid surfaces e.g. columns, masonry wall etc.) of Aluminium composite panel or toughened glass backed by shadow box (made of Al assembly).

24.3 PERFORMANCE REQUIREMENTS FOR FAÇADE SYSTEM

(i) Façade System design parameters:

- a. The façade system and its components shall be designed to withstand dead loads and live loads caused by positive and negative wind loads acting normal to the plane of the façade system. Design wind loads shall be 1.74 Kpa design and proof load of 2.61 Kpa or as calculated in accordance with the relevant Indian standard. The contractor is required to submit the design calculation and weight of aluminium per meter. The system shall also be designed to withstand seismic forces as calculated in accordance with IS: 1893 (latest revision) under seismic zone IV.
- b. Apart from the above, the glass and the glazing system should also be designed to withstand a concentrated load of 100kg applied at any location so as to produce the maximum stresses in the glazing components. This load is envisaged to be encountered during cleaning of the glass facade.
- c. The stress on structural sealant shall not exceed 20 psi under any circumstances. Thermal breaks shall be considered unable to transfer shear stress for composite action of flexural members. Assume elements joined by thermal breaks to act separately.

(ii) Deflection:

- a. The deflection of any structural member in the plane normal to the glass surface when subjected to the specified loads shall not exceed $L/175$ of its clear span and shall be fully recoverable on withdrawal of the specified loads. Deflection of any framing member shall not exceed 19mm within any glass panel.
- b. Parallel to façade plane, deflection of a framing member when carrying full design load shall not exceed an amount reducing the glazing unit bite below 75% of the design dimension. It shall also not reduce the edge clearance to less than 3mm nor shall it damage or impair the function of any joint seals.
- c. The deflection of the horizontal member due to the weight of the glass shall be limited to 3mm or 25% of the design edge clearance of the glass or panel below whichever is less.
- d. Twisting or rotation of the horizontal member under dead load of glass shall be limited to 1° by calculation from the horizontal plane.
- e. There shall be no in plane raking.
- f. In case either lite of the IG unit develops crack, the remaining lite should be capable of supporting the entire load. The overall strength and deflection behaviour shall be calculated on the basis of the weakest lite.

(iii) **System assembly:**

The system assembly should accommodate the following without damage to the system, components or deterioration of seals.

- Movement within the system
- Movement between system and perimeter framing components.
- Dynamic loading and release of loads
- Deflection of structural support framing
- Tolerance of supporting components
- Shortening of building concrete structural columns
- Creep of concrete structural members
- Inter story drift
- A mid span slab edge deflection: of 25mm
- Accommodate building construction tolerance of +30mm. These tolerances are not cumulative.

(iv) **Water Tightness:**

Water penetration shall be defined as the appearance of uncontrolled water on inside face of any part of the structural glazing. No water leakage will be permitted when tested in accordance with ASTM E331. The test shall be carried out for duration of 15 minutes with a test pressure difference of 20% of design pressure with a minimum differential of 137 N / mm^2 and a maximum of 575 N / mm^2 . The minimum uniform water flow rate of $3.4\text{L/m}^2/\text{min}$.

24.4 LABORATORY TESTS FOR WATER INFILTRATION:

(i) Tests:

a) TESTS FOR WATER INFILTRATION:

- **Static Pressure Test:** No water infiltration shall occur when the mock-up is tested accordance with ASTM E-331 with the static pressure differential and the total time as specified.
- **Dynamic Pressure Test:** No water infiltration shall occur when the mock-up is tested in accordance with AAMA 501.1 with the dynamic pressure differential and the total time as specified.

(ii) FIELD MOCK – UP:

In the presence of representatives of Owner, Engineer-in-charge, Contractor, Installer and Manufacturers, the Testing Agency shall conduct field tests on each of the installed Mock-Ups in accordance with methods described in AAMA 501.2 "Filed Check of Metal Curtain Walls for Water Leakage" using the loads specified in "performance Criteria". Notice for testing to allow for witnessing test shall be given several weeks before. Approximately 50% of each Field Mock-Up shall be field water tested. All interior finishes including trims should be left off to allow for clear viewing.

(iii) REMEDIAL WORK:

If the Field test of any Mock-Up reveals leakage, points of entry and paths of flow of water shall be identified, analyzed, and necessary remedial work shall be established, subject to Engineer-in-charge's/ Employer's review and comment. Repairs and/or modifications shall be made to the entire mock-up based on these findings and, after adequate curing of all sealants, re-test to successful conclusion. Re-testing after remedial work shall be from 50 percent to 80 percent of the mock-up at the Engineer-in-charge's recommendation. The re-test area does not necessarily have to be exactly the same as the original test area of the mock-up.

24.5 METHOD STATEMENT FOR HOSE TESTING (ON SHORE) AT SITE: -

- STANDARD:** - AAMA 501.2 — 94 Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage.
- TEST AREA:** - Area (s) to be tested will be selected by the Engineer-in-charge accordance with the standard. The total area will be not more than that can be tested in one day. Testing shall be done at least one area of 100 square feet, in accordance with the test standard, or more, depending on the time, and availability of suitable access to the exterior. In case of failure the prescribed procedure for a reasonable time but not more than that can be completed on the same day shall be followed. The test will be supervised via two-way radio from the inside.
- EQUIPMENT:** - Testing equipments generally consists of the following and any other

equipments as required for carrying out the test

- The 'Monarch' nozzle with pressure gauge and valve as prescribed by AAMA and recommended by CWCT.
- Two-way headset radio for communication between engineers and the people in the cradle.

(iv) **Other Requirements:**

- a. (Optional) washing of the area as recommended in Paragraph 7.4 of the CWCT Standard.
- b. Visual checking of test area for snags, visible defects etc.
- c. A cradle or scaffolding on the exterior at the locations (s) of the test specimen (s) with an operator, a person to stabilise the cradle, a person to hold and point the nozzle, technical person to communicate between the people on the exterior and test engineer.
- d. Clean water in a minimum supply hose with approximately 4 bar pressure. Note that the pressure given for the test is with the water flowing, much higher actual pressure is necessary. Water pressure drops 1 bar for every 10m rise in height.
- e. Drying of test area and application and removal of tape if necessary, to locate leaks.

(v) **TEST CRITERIA: -**

Water will be sprayed at a pressure of 30 —35 psi (2.07-2.41 Bar) in accordance with the test standard. The flow rate will not be monitored. The nozzle will be held 30 cm. from the wall spraying 1.5m lengths back and forth along each joint, successively, for five minutes each, working from the bottom up. Joints are interfaces between materials, and where these are less than 120mm apart are to be considered one joint.

(vi) **TEST PROCEDURE**

- a) The initial area shall be the width of the cradle. The lowest horizontal joint will be wetted first, covering each 1.5m length in five minutes.
- b) Next the cradle will be positioned so that the first 1.5m above the bottom horizontal joint can be reached and each vertical will be sprayed in turn over a period of 5 minutes.
- c) The cradle will then be raised to test the next 1.5m and then the next horizontal and so on.

(vii) **LEAKAGE:**

If there is any leakage the test will be stopped and the procedure described in the Standard will be followed up to the time allowed. A compliance report suggesting any modification / corrective steps to be taken if any leakage was observed.

- 24.6 Air Infiltration:** When tested in accordance with ASTM E283, air infiltration shall not exceed 0.03 l/s/sqm. Of wall area, measured at a reference differential pressure across assembly of 200 Pa.
- 24.7 System internal drainage:** Drain water entering joints, condensation occurring in glazing channels, or route moisture occurring within the system to the exterior by a weep drainage network. Drained joint pressure equalised system which shall be 100% water-tight allowing no water to penetrate into the interior of the building. The system shall be designed such that water being drained in the system shall not cause any damage to the permanent works. The system shall not be face sealed and shall not rely on wet seals.
- 24.8 Expansion/Contraction:** The system shall provide for expansion and contraction within system components caused by a cyclical temperature range of 80⁰ Cover a 12hour period without causing any detrimental effect to the system components.
- 24.9 Test for structural performance:** When tested in accordance with; ASTM E330, the glazing system shall conform to the performance requirements.
- 24.10 Special instructions:** Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of the system will not be permitted.
- 24.11 HEAT SOAKING OF GLASS:** To minimize nickel sulphide (NIS) fractures at site, heat soaking test is to be conducted within the factory. Minimizing NiS fractures at site is mainly about making sure that fractures happen within the factory rather than at site after installation. Heat soaking tempered glass is the most-common form of ensuring that the chance of NiS infected panes leaving the factory is minimized. The goal during heat soaking is to induce breakage at the factory to avoid on site breakage after installation. It is heating /tempering of glass to 280⁰ C for 24 to 48 hours over temperature gradients to induce fracture. Due to inherent safety and security benefits it is highly recommended for tempered glass to be heat-soaked.

24.12 PRODUCTS/MATERIALS

(i) **Glass:** Standard certification requirements are as under :

- a) Float glass : ASTM C 1036
- b) Tempered/ Toughened Glass: Toughened / Tempered glass shall be examined by the glass manufacturer to detect and discard any glass which exceed the following tolerance: 1.5mm bow in 600mm; 3mm bow in 1500mm; 6mm bow in 3000mm; 9mm bow in 4500mm. Where, the strengthening process results in essentially parallel ripples or waves, the deviation from flatness at any peak shall not exceed 0.13mm, and the difference between adjacent peaks shall not exceed 0.13mm. Where bow tolerance and wave tolerance differ, the stricter requirements shall govern. Direction of ripples shall be consistent and in conformance with architectural design. Following test shall be carried out by the glass processor at his own cost as per following provisions and the test report shall be submitted.

Thickness	Impact strength	Fragmentation	Surface Compression	Bending Strength
IS 2835-1987	IS-2553-PART-I	IS-2553-PART-1	ASTM C-1048-90	DIN 1249-PART:12

- c) Laminated glass: ASTM C 1172. The laminated glass shall comprise of two glasses of equal thickness as per design and bonded with a poly vinyl butyral (PVB) interlayer, meeting criteria of ANSI Z97.1 for safety glazing. The PVB interlayer shall be minimum 0.38mm thick. No deviation will be accepted with respect to the PVB interlayer. Laminated Glass Units shall comply to EN12543.
- d) Glazing unit for Insulated Glazed Unit for vertical/slant wall façade shall be as: Glass assemble shall be : 6mm external glass heat strengthened + 12 mm air gap + 6mm clear fully tempered glass. Glass performance data for insulated glazed unit shall be:
- Visible Light transmittance (VLT) of minimum 60%
 - Light reflection internal - less than or equal to 15%,
 - Light reflection external - less than or equal to 15 %,
 - SHGC- less than or equal to 0.37 and
 - U value - less than or equal to 1.5 W/m² degree K
- e) Glazing unit for façade of roof shall be: 8mm clear fully tempered glass + 1.52mm PVB + 8mm clear fully tempered glass. Glass performance shall be:
- Visible Light transmittance (VLT) of minimum 65%
 - Light reflection internal - less than or equal to 23%,
 - Light reflection external - less than or equal to 23 %,
 - SHGC- Less than or equal to 0.24 and
 - U value - Less than or equal to 3.6 W/m² degree K
- f) Single glazed unit in façade, shall be 8 mm thick clear heat strengthened glass having following properties:
- Visible Light transmittance (VLT) of minimum 65%
 - Light reflection internal - Less than or equal to 15%,
 - Light reflection external - Less than or equal to 15 %,
 - U value - Less than or equal to 5.6 W/m² degree K
- g) General Requirements for all types of Glass: All base supply float/coated glass are to comply with the requirement of BS EN 572 parts 1, 2 and 3 or ASTM C1036 and assessed for optical and visual faults as described in BS EN 572-2. Spot faults shall not be no worse than category C. There will be no linear / extended faults. Optical faults shall be within the limits set in BS EN 572-2.
- h) Fully Toughened / Heat Strengthened Glass: It shall comply with the requirements of EN12150 or ASTM 1048 or EN 1863 -1 for heat treated Soda Lime Silicate Safety Glass. The residual surface compressive stress in the heat strengthened glass shall be

below 52N/mm² when measured by GASP in accordance with ASTM F218-95 (2000) or > 69 N/mm² for Fully Toughened glass.

- i) Insulating glazed units: Hermetically sealed insulated glazed unit shall comply with BS5713 or EN 1279. Primary seal shall be of poly-isobutylene located between glass and spacer (Lisec / Alupro/ Profil glass or equivalent) providing a continuous vapor proof barrier of a minimum width of 2mm and a secondary two-part silicone sealant of approved make extending around the perimeter of the unit. The insulating glass unit shall be certified under a program approved by the sealed insulating glass manufacturer's association (SIGMA) providing third party validation of compliance to ASTM E 773 & E 774. All glass quality shall be glazing as per relevant ASTM standards.
 - j) Coating: Method of coating shall be of vacuum (sputtering) deposition. This coating is applied to control the solar heat gain and enhance the energy performance and comfort level of the building. The coating shall meet the requirements of ASTM C 1376-97 or EN 1096 part 2 and satisfy the thermal performance of the facade.
 - k) Performance requirements: Probability of breakage of glass shall not exceed 8/1000 for vertical glass upon first application of design pressures or due to anticipated thermal stresses.
- (ii) **GRC Panel Cladding:** GRC panel cladding in façade shall be typically 30 mm thick. The panel shall be made of 53 Grade White Cement, Quartz, fine silica sand, alkali resistant glass fiber, super plasticizer, polymers and UV Resistant Synthetic inorganic pigment etc. The top coat shall be finished as approved by engineer-in-charge. The system performance test shall be mandatory to verify the design performance meeting the requirement as per technical specification including all material tests. The cladding shall be provided Water Repellent coating. Coating shall be done without changing the aesthetic view of the elevation. The panels shall be fixed in accordance with manufacture's recommendations to back up structure made of structural steel. The sizes of all the fixing assembly shall be worked out by contractor by designing for performance criteria (wind load, snow load, seismic load, deflection, strength etc.) mentioned in this document or prescribed by various standard/codes. The brackets shall have provision for movement to accommodate the movements due to seismic, thermal expansion, composite construction tolerances. GRC panels shall have Dry Density >1800 kg /Cum, GRC panels shall have Dry Density > 1800 kg/Cum, water absorption Less than 6% of dry weight by immersion over a period of 24 hours, Compressive strength:- > 400 Kg/cm² (M-40 Grade), Wet Transverse Strength :- > 7 N/mm, Abrasion Resistance:- Less than 2.0 for E.H.D, Thermal Conductivity:- 1.63W/MK at 3% Moisture Content 1.80 W/MK at 5%. The Contractor shall provide a data to confirm compliance with specific requirements for resistance and fire properties. The guarantee should be for a 10-year period against peeling chalking, fading, blistering, flaking, chipping and cracking and fire properties.
- (iii) **Louvers in external cladding:** Aluminium Louvers shall be of "Z " shape spaced at equivalent distance supported on the Aluminium grid work as shown in drawing. Louvers profile shall be fixed in accordance with the manufacture's specifications on back up structure made of structural steel/Extruded Aluminium sections as suggested in drawings. Panel shall be stove enamelled and finished with special three-layered coating system (consisting of first a

conversion layer of thickness 800-2000mg/sq mtr, a polyurethane basecoat of 16-20 microns, and a special top coat of polyamide particles of 8-12 microns thick to provide excellent abrasion and damage resistance) in a continuous coil coating process of the approved colour on the exposed side and the reverse side with epoxy. The sizes of all the fixing assembly shall be worked out by contractor by designing for performance criteria (wind load, snow load, seismic load, deflection, strength etc.) mentioned in this document or prescribed by various standard/codes. The brackets shall have provision for movement to accommodate the movements due to seismic, thermal expansion, composite construction tolerances. The purpose and intent of the louvers is to be functional with HVAC requirements. Hence the sealing of perimeter between the louvers and the carrying façade (part of façade above and below) should be air-tight. Panels will have movable louvers, and fixed louvers. The Contractor shall provide a data to confirm compliance with specific requirements for resistance and fire properties. The guarantee should be for a 10 year period against peeling and fading.

- (iv) **Exterior grade HPL:** It shall be provided as per requirement, in 8 mm thick suede finish exterior grade CLAD (High Pressure exterior compact Laminate of Greenlam, Merino, Fundermax) made with GLE technology & double layer UV protection process under high pressure from thermosetting phenolic resin treated exclusive & certified exterior grade decorative paper (UV resistant) on both side with high grade Kraft paper in between. Both the decorative and Kraft paper shall be made of virgin pulp. The clad should be resistant to water immersion through permissible increase on thickness and mass <0.60% and board should have density >1.35 kg/cm³. Clad should be flame retardant and fulfill the criteria of classification of B-s1, d0 of EN 13501-1. It shall have Anti-bacterial and anti-termite property as per JIS Z2801:2000, Chemical resistance, Scratch resistant, fire resistance, weather & climatic shock resistance. It should fulfill the criteria of FSC and Green Guard Gold certification and manufactured under EN438-2&3:2005 standard. Finish and colour of compact laminates should be finalised under direction of Engineer –in-charge. Clad should be installed on 25x50x1.8mm aluminum tube or approved tube size at 500mm c/c with L brackets. There will be special fixing treatment on all the corners sections. The clad will be fixed to Aluminum section with color match rivets through 8 mm drill hole in clad and 5 mm drill dia drill holes in Aluminum section. Rivets will be installed by automatic Rivet gun. Finish and colour of Interior clade should be approved under engineer-in-charge direction. The manufacturer should provide 10 years warranty certification on any manufacturing and moisture related defects.
- (v) Openable panel (IGU), side hung or top hung, shall be provided as per extant guidelines of NBC, Indian standards and local bodies. These panels shall be installed with all accessories and hardware for the openable panels as specified/required and of approved make such as heavy-duty stainless-steel friction hinges, minimum 4-point cremone locking sets with stainless steel plates, handles, buffers etc. including necessary stainless steel screw, nuts, fasteners, bolts, washers etc.
- (vi) **Galvalume roof cladding:** It consist of 0.65mm thick steel standing seam non-insulated single skin roofing of tata BlueScope or equivalent make in solid or metallic colours as approved by Engineer-in-charge. The sheet shall be made of 0.45 BMT with AZ150 coating with coating mass of 150g/m². The roofing sheet material shall accommodate the building movements, thermal expansion and seismic movements. Also, shall accommodate thermal

expansion resulting from surface temperature of 80-90 degree Celsius on roofing system without creating any additional stress. The panels shall be fixed in accordance with manufacture's recommendations to back up structure made of structural steel as suggested in drawings. The sizes of all the fixing assembly shall be worked out by contractor by designing for performance criteria (wind load, snow load, seismic load, deflection, strength etc.) mentioned in this document or prescribed by various standard/codes. The Contractor shall provide a data to confirm compliance with specific requirements for resistance and fire properties. The guarantee should be for a 10-year period against peeling, fading, blistering, flaking, chipping and fire properties.

(vii) Sealant:

a) The insulated glass unit shall have poly-Iso-butylene as primary sealant with low moisture vapour transmission rate and a structural silicone sealant for secondary seal. The secondary edge sealant shall conform to ASTM C 1369-97. The contractor shall indicate the classification of the edge sealant as per clause 5.0 of the ASTM C 1369. Structural flush glazed joints shall be a neutral cure high performance silicone sealant applied in accordance with the sealant manufacturer's instructions. Weather seal joints shall be a neutral cure medium modulus silicone sealant applied in accordance with the sealant manufacturer's instructions. Sealants shall be black color. Unexposed, low movement flashing joints shall be non-drying, non-skimming, non-oxidizing, non-bleeding glazing sealant meeting MMA 809.2. The sealant proposed by the contractor shall not bleed or stain under any circumstances. Contractor shall identify the sealant to be used along with the structural glazing system and submit detailed technical parameters of the sealant by way of the sealant manufacturer's printed data sheets. The Contractor will be responsible to carry out all the compatibility tests as listed below but not restricted to the following, with respect to the particular sealant from a laboratory approved by the engineer-in-charge. The following tests shall be carried out with respect to the sealant:

- ASTM C 794 Peel test
- ASTM C1135 -Test method for determining Tensile-Adhesion Properties of elastomeric sealant
- ASTM C-719 -Test method for adhesion and cohesion of elastomeric joint sealant under cyclic movement
- ASTM C-1087 -Compatibility test between the proposed structural silicone sealant and the finished aluminium extrusions (mullions and transom)

b) For all sealant proposed to be used for this work / project, the contractor shall submit a letter of certification from the sealant manufacturer stating that the sealant has been tested for adhesion and compatibility on production of samples of metals, glass and other glazing components and that all sealant details and application procedures shown on the shop drawings are acceptable for use.

c) To prevent excessive shelf life and facilitate the correlation of batches of sealant with panel production, silicone sealant generally shall be used in the sequence of their manufacture.

d) The structural glazing contractor shall obtain from the manufacturer and the supplier

written confirmation of that the material has not been subjected to temperatures in excess of 27 degree centigrade between manufacture and delivery to the contractor's factory. The contractor shall store all silicone sealant at or below 27 degrees centigrade up to the day of its application.

- e) Silicones which cure by different chemical reactions or which release different chemical by-products, e.g. acetic acid, alcohols, amines etc. during cure, should not come in contact to each other during fabrication, assembly and erection of the glazing system.
- f) All adjoining surfaces not to receive sealant shall be protected against staining by masking tape.

(viii) Other materials:

- a) The aluminium extrusions shall be 6063 alloy T6 temper conforming to ASTM 8221 or equivalent. They shall be clean, straight, with sharply defined edges and free from distortion and defects impairing appearance, strength and durability. It shall be of suitable wall thickness and profile for strength with respect to tension, shear and bending stresses, and lateral stability. The aluminum extrusions shall be coated with minimum 70% Kynar 500 based PVDF fluoropolymer resin coating (minimum 35micron thick) of approved color and shade to comply with AAMA 605.2-1980.
- b) Fixing bolts, screws and nuts, where in contact with aluminium, will be of stainless steel 304 grade Glazing tape for structural glazing shall be Norton or approved equivalent.
- c) All dissimilar metal surfaces shall be isolated to prevent anti galvanic action. Materials used for this purpose shall be non-absorptive type. Metal surfaces shall be separated in such a manner that metal does not move on metal.
- d) Aluminium surface in contact with mortar, concrete fireproofing, plaster, masonry and absorptive materials shall be coated with anti-galvanic moisture-barrier material and nothing extra will be paid for this.

(ix) Accessories:

- a) Extruded gaskets, weather stripping, extruded seals and spacers which do not come into contact with structural silicone sealant shall be of ethylene propylene diene monomer (EPDM). Where in parallel contact with structural silicone sealant, all gaskets, setting blocks and spacers other than foam glazing tapes shall be of heat-cured silicone rubber, chemically compatible with the silicone sealant and suitable for the specific purpose intended. All extruded gaskets, weather stripping and spacers other than foam glazing tapes shall have continuous mechanical engagement to framing members; any adhesive attachment is not acceptable. Unless otherwise approved, gaskets, weather stripping, extruded seals and spacers shall have a hardness of 40+5 durometer Shore A.
- b) The cladding system shall be constructed with (and shall maintain during its design life) a standard of seal which shall not result in any reduction of sound insulation performance. Gaskets, weather stripping and seals used to achieve the required weatherproofing and/or air tightness shall be selected to accommodate fully the range of dimensional tolerances

associated with fabrication and installation of the cladding system. Gaskets, weather stripping and seals shall be formed from materials capable of retaining their elastic qualities, dimensions and resistance to physical and chemical attack sufficient to maintain the full water tightness, air tightness and acoustic performance for the design life of the structural glazing system.

- c) Extruded gaskets, weather stripping, seals and spacers mechanically engaged by flutes or pockets extruded in framing member shall be installed without residual tension or extension. Dry lubricants may be used to reduce drag during installation of synthetic rubber extrusions and to induce compression so as to prevent gradual elastic shrinkage and retraction from their ends. Wet lubricants containing detergent shall not be used in any location from which spillage onto glass and aluminum surfaces cannot be immediately and completely removed at the factory. Concentrated detergents shall not be used for any purpose which may bring the liquid into contact with the coated surfaces of vision and spandrel glass.
- d) Setting blocks shall be dense heat-cured silicone rubber with a hardness of 80 to 90 durometer Shore A. Side blocks and anti-walking blocks shall be dense heat-cured silicone rubber with a hardness of 60 to 70 durometer Shore A.
- (x) **Flashing:** To prevent leakage, flashing shall be formed from either stainless steel or aluminium or sheer neoprene of 1.5mm thickness with joints tapped and sealed 150mm minimum. Flashing shall be provided on all sides of glazing where external glazing terminates and wherever else required to provide a completely watertight installation. Wherever visible, it shall have the matching finish of Aluminium.
- (xi) **Column closers:** The Contractor shall supply and install suitable closer section to seal up the gap between columns and / or walls, which abuts the line of the external glazing. The principal function of the closer piece shall be to provide a neat connection with the external glazing as well as a means of cutting off stray artificial light from the outer face of the column / wall. The column closer shall be installed in such a way as to provide a flexible connection to allow for tolerances, building/external glazing movements and dimensional differences between the external glazing and the column and / or wall face. The column closer shall also be designed in such a way as to allow the following:
- Easy removal for maintenance.
 - Installation after finishes are applied to the column / wall.
 - Easy removal of internal glazing units for cleaning/ maintenance replacement.
 - Compatibility with the requirements of the fire safety requirements.
- (xii) **Fire Stop:** At each floor edge, the required fire protection shall to be maintained between elements of structure by using fire stop insulation to give a minimum of 2 hours fire protection between floors including in front of columns or blank walls. The fire stop material is to be installed to completely seal up the void between the face of the structure and the glazing and shall fully comply with local Codes and Regulations. The fire stop material must be flexible to allow movement between the structure and the external glazing. The fire stop material shall be located and held in position in such a way so as to ensure integrity of the fire protection as well as preventing accidental damage or loss of materials. The Contractor is required to provide full details of all fire stop material including fire test certificates and confirmation of local Fire Service Bureau. Shop drawings shall also be submitted for approval showing the full

details of fire stops.

24.13 PROGRAMME OF WORK: The contractor shall submit a detailed program of work along with time schedule indicating the various items of work pertaining to the structural glazing work as below-

- Design and approval
- Shop drawings
- Submission of samples
- Mock-up
- Test reports
- Material co-ordination, ordering and delivery
- Fabrication
- Installation
- Inspection and remedial measures.

24.14 DESIGN CALCULATIONS:

- a. The contractor shall be responsible for the design of the facade system including all its various components like glass, sealant, framing system, gaskets, fixing and anchorages proposed by respective specialists. The contractor shall submit structural design calculations prepared in accordance with relevant Indian/International codes and standards as applicable. The design shall be carried out under the direct supervision of a professional engineer experienced in design of this type of work and licensed at the place where the work is located. Structural design shall include, but not limited to, computations for the justification of external facade sections and connections including fasteners, welds and anchorage assemblies.
- b. The contractor shall submit for Engineer-in-charge's approval all structural calculations with reference to structural properties and physical characteristics and dimensional limitations of the framing members of the facade system. The contractor shall also submit design calculations for all connections, the dimensions of all extrusions and complete data to be used for the work. Approval of structural calculations shall not relieve the contractor from any of the responsibilities and requirements specified therein.
- c. The contractor shall submit the, glass manufacturer's wind pressure analysis, seismic load analysis and thermal analysis showing that the specified maximum deflections and probabilities of breakage are not exceeded.

24.15 SHOP DRAWINGS

- a. The contractor shall submit shop drawings showing clearly the relationship of the structural glazing facade to the building structure, Mechanical and electrical systems, floor slabs and any other related works. They shall show the arrangement of components, instructions and explanatory details for the sequence of fabrication, assembly, erection and installation of all materials including the glass and de-glazing procedures. They shall include the following:
 - i. Plan, elevation and details required to fully describe the structural glazing system.
 - ii. System dimensions framed opening requirements and tolerances for squareness, corner offset and bows.
 - iii. Dimensional position of glass edge/face relative to the aluminium framing, full size junction details between mullion and transom and end details.

- iv. Isometric drawings of flashing, joints between transom and mullions, end details etc.
 - v. Expansion and contraction joint location and details.
 - vi. Weep and condensation drainage network
 - vii. Full size details including isometric drawing of sealing, flashing and jointing Methods
 - viii. Materials, type, size, location, spacing of all screws, bolts, weld; anchoring devices and all accessories.
 - ix. Die drawings for, all gaskets, extrusions
 - x. Relationship of edge members with architectural stone/ wall finish and flashing at joints.
- b. The contractor shall submit a fully detailed program for the presentation of shop drawings to the Engineer-in-charge for approval, and in no case shall the contractor proceed with any of these works without approved shop drawings.
- c. The contractor shall review and submit all shop drawings in a sequence consistent with the sequence of erection, installation and assembly of the various elements of the work. He shall be deemed to have determined and verified all materials, site measurements and construction criteria related thereto and to have checked the shop drawings for complete dimensional accuracy.
- d. Any approval by the Engineer-in-charge of the shop drawings shall not relieve the contractor of his responsibility for any deviation from the requirements of the contract unless he has specifically informed the engineer in writing of such deviation at the time of submission and the Engineer-in-charge has given written approval to the specific deviation.

24.16 SAMPLES

The contractor shall submit all samples at his own cost. Samples shall be submitted for approval well in advance of the date, on which the particular work involving the use of materials for which samples are submitted, is scheduled to begin. The work shall be carried out in accordance with the approved samples. The following shall be submitted:

- a) 2 samples of 600mm x 600mm in size illustrating pre-coated aluminium mullion and transom junction detail complete with glass skin and glazing materials illustrating edge and corner.
- b) 4 nos. 12" x 12" samples of each type of glass.
- c) 4 nos. 6" long samples of principal extrusions.
- d) 4 nos. manufacturer's samples of each type of aluminium finish.
- e) 4 nos. manufacturer's samples of each type of sealant
- f) 2 nos. manufacturer's samples of all accessories and hardware envisaged to be used for the structural glazing system.

24.17 MOCKUP: The contractor shall construct a mockup including intermediate and edge mullion, vision and spandrel panel. The mockup should illustrate component assembly including framing, glass, glazing materials, weep drainage system, attachments, anchors and perimeter sealant. Location for mockup will be at site approved in advance. Mockup will not remain as part of the work.

24.18 TEST REPORTS: The contractor shall arrange for all testing required with regard to this work at

his own cost, at such test laboratories in India or abroad as approved by the Engineer-in-charge. Apart from the tests carried out, the contractor shall substantiate engineering data and provide test results of previous tests, which purport to meet performance criteria and any other supportive data.

24.19 SOURCES: The contractor shall submit the name of the suppliers for the following items of work along with the shop drawings and samples.

- a. All components of the structural glazing system
- b. Aluminium extrusions
- c. Anodizing paint from manufacturer I authorized applicator
- d. Sealant
- e. Glass
- f. Hardware
- g. Gaskets
- h. Fasteners
- i. Anchorages

24.20 SUBMITTALS: The contractor shall submit 4(four) copies of the following documents pertaining to the engineering of the structural glazing using structural glazing system to the engineer for approval, review etc.

- a. Shop drawings
- b. Structural design calculations for aluminium framing, glass thickness and sealant byte sizes
- c. Calculations for deflection
- d. Test reports as per the performance requirements
- e. Special installation requirements, special procedures, safety precautions and perimeter conditions requiring special attention as stated by the manufacturer.
- f. Samples
- g. As-built drawings

24.21 ORDERING AND DELIVERY: Before commencement of any fabrication or ordering of any materials, goods or works, the contractor shall be required to submit shop drawings, samples etc. with all relevant details as to materials, sizes, manufacturer's printed specifications and all other details and information as desired by the engineer in charge. Mockup shall have to be approved by engineer-in-charge before placing final order for delivery of the approved products.

24.22 PRODUCT HANDLING: Handling of glass and aluminium frame, to be incorporated in to the facade system, shall be done with utmost care to avoid any damage or surface scratch. Field cutting of anodized components shall not be permitted.

24.23 LIGHTNING PROTECTION: Each complete frame shall be provided with a single bolt, to which the bonding conductor may be connected by the electrical contractor on site. The bolt shall be high tensile, size MB stainless steel, and shall be securely fastened to and in sound electrical connection with the frame. The bolt shall be supplied with two plain washers and locking washers and nuts, by which the bonding conductor will be connected to the bolt. The bolt shall be supplied and fixed at site.

24.24 FABRICATION & INSTALLATION: The façade work shall be fabricated and installed by experienced workmen having specialized skill in façade work/ structural glazing and strictly in accordance with the approved shop drawings. All welding shall be done by the heliarc process and

all exposed welds be grounded to minimum 100 grit finish.

24.25 PROTECTION:

- a) The contractor shall be responsible for all materials against damage from mechanical abuse and foreign matter during installation. A layer of clear transparent laquer based methacrylates or cellulose butyrate shall be applied on members before they are brought to site. The laquer shall be removed on completion of erection. On virtual completion and receiving instruction from the Engineer-in-charge, the Contractor shall remove all protective coverings, manufacturer's seals, labels etc. The contractor shall thoroughly clear the internal and external glazing area and members with cleaning solution recommended by the respective manufacturers. The Contractor shall ensure that the highest possible standards of material protection are maintained both in the fabrication and installation of the external glazing system. The Contractor shall ensure that all materials and completed panels are delivered to site without damage and that all components are fully protected. In this respect a method statement will be required describing the protection measures to be adopted when transporting material to site and hoisting it into the floors for final installation. Panels awaiting installation are to be stacked on pallets to a height to be stored separately on site for possible fabrication in-situ.
- b) All materials stored at site are to be protected in such a manner as to prevent damage from falling objects, dust, water and dirt. The material must be safe from mishandling or damage by any contractor/ agency/ sub-agency either in the pursuit or their own works or by their personnel.
- c) During installation, the Contractor shall provide protection to the external glazing to prevent the ingress of water from either rain or any other reasons. This protection shall be strong enough to withstand adverse wind conditions, and shall provide complete protection at the top level of the installation necessary to prevent the ingress of water into or behind the cladding.
- d) The external glazing shall be screened from weld splatter, spray-on fire proofing, concrete, alkaline masonry washes, paint and other deleterious substances. Any such soiling shall be promptly and completely removed. The design of protective screening shall be such as to provide adequate ventilation of the space between the glass and the protective screen and not to induce thermal stresses in the glass. In no case, the protective screening shall be placed in contact with the glass.
- e) The Contractor shall provide at each completed floor an internal protection of 1000 gauge heavy Polyethylene sheet suspended from the top of the external glazing at slab soffit and extending to the floor. These drop sheets must be maintained until all wet trades are completed on each floor.
- f) The fixing method for sheets is to be indicated in shop drawings and a sample approved by the Engineer-in-charge.

24.26 CLEANING

- a. The Contractor shall ensure that all actions are taken during Installation to eliminate the effects of corrosive substances on the finishes of the external glazing.

- b. The Contractor shall clean both internal and external surfaces to remove corrosive substances. The Internal surfaces of glass and aluminium frame are to be cleaned with compatible cleaning agents prior to the installation of the internal protective sheeting.
- c. The Contractor shall provide written verification that cleaning agents are compatible with aluminium, stainless steel, glass coatings, granite, glazing materials and sealants. In no case shall alkaline or abrasive agent be used to clean the surface. Care shall be taken during cleaning to avoid scratching of the surface by dirt particles.
- d. Prior to snagging inspections the Contractor shall remove the internal protection sheets and carry out a thorough cleaning of all glass, aluminium and spandrel panels as per the direction of Engineer-in-charge.
- e. The protective sheeting shall then be removed permanently provided that no other wet works or services work are required in the immediate vicinity of the external glazing. The Contractor shall also make good any physical drainage to the wall including scratches, dents, abrasions, pittings, etc., to the satisfaction of the Engineer-in-charge.
- f. Manufacturer's delivery or job marking on glass and adhesive for manufacturers cables shall be either a neutral or slightly acidic material and in no case shall such material be alkaline. Any staining of glass by alkaline material will be cause to rejection of the glass.
- g. After the installation of each panel of glass all markings and labels shall be carefully and completely removed from the panes. Thereafter no markings or labels of any sort shall be placed on the glass.
- h. Glazed openings shall be identified by suitable warning tapes or flags attached with a non-staining adhesive or other suitable means to the framing of the opening. Tapes or flags shall not be in contact with glass.
- i. Prior to the handing over of each floor to the Engineer-in-charge, the Contractor shall carry out a final cleaning of the external glazing. As soon as it is practically possible after the issuance of the occupation certificate for the building, the Contractor shall carry out a complete cleaning of the external face of the external glazing

24.27 REMOVAL OF IMPROPER WORK AND MATERIALS: Any materials/or works which, in the opinion of the Employer, are not in accordance with the specification, shop drawings and instructions shall be removed from the site immediately.

24.28 PERFORMANCE GUARANTEE: The contractor shall be solely responsible for the design including shop drawings and performance of the installed façade system. The installations shall be guaranteed by the contractor during the guarantee period for materials used, workmanship, water tightness (wherever specified), structural design, performance requirements and other requirements as given in the specifications. The contractor shall submit in the enclosed format a written guarantee for the same for a period of 10 years from the date of completion of the work.

24.29 MAINTENANCE MANUAL: On completion of the works, the contractor shall prepare a detailed maintenance manual for the structural glazing system. The manual should cover the following:

- a) Complete and detailed explanation of operating principles of the structural glazing system
Description of all the various components of the glazing system,
- b) Recommended Inspection schedule and periodic inspection procedure,
- c) Complete parts list,
- d) Instructions for proper cleaning procedures and routine maintenance of the facade including frequency,
- e) Cleaning products and their source
- f) Method statement for reglazing and replacement of component parts with appropriate drawings;

25. Acoustic Works: The specifications provided herein are the minimum requirements and the contractor has to comply with the NBC/ IEC/ BIS/ CPWD & other relevant International & National Standards of codes. The contractor shall provide copy of all relevant codes and standard to employer.

25.1. ACOUSTIC CLOUD CEILING – It shall be of 40 mm thickness manufactured from high density glass wool acoustic ceiling clouds with **Akutex FT** surface on both the sides. Edges are straight cut and painted. Shape & Size shall be – Square 1200x1200 mm; Rectangle – 2400x1200 & 1800x1200 mm; Circle – Dia 800mm & 1200mm; Hexagon 1200x1040 mm and other customized shapes. It shall have NRC ≥ 0.9 , Light Reflectance $\geq 85\%$, fire classification of class A2 s1 d0 according to EN/ISO 13501 -1, Re-cycled content of more than 70%, Free from Substances of Very High Concern (SVHC) above 100 ppm, humidity resistance for RH upto 95% at 30⁰ C without sagging/warping or delaminating. Product shall be certified under GRIHA or IGBC/LEED. (Preferred Make: Armstrong, Anutone, Ecophon-Saint Gobain)

25.2. Micro perforated GFR (Glass Fibre Reinforced) Gypsum Panels/Board- It shall be of 12.5 mm thickness with tapered edge along the length having *having 3x3mm square perforations @ 8.33mm pitch - 10.2 % open area. It shall have density ≥ 800 Kgs/ m³, weight ≥ 10 Kgs/m² fire classification of class A2 s1 d0 according to EN/ISO 13501 -1, NRC ≥ 0.9 , light reflectance $\geq 75\%$, low VOC, clean room class1 and fixed by using concealed ceiling system. The backing of board shall be of synthetic fibre of 50mm thick (1000 GSM Density) which shall be eco-friendly, healthy (does not itch) to achieve NRC of 0.9.* The concealed ceiling system shall include GI Wall channel having thickness 0.45mm, length 3600mm, unequal flanges of 20 & 30mm and web of 25mm should be fixed along the perimeters of the wall with nylon sleeves and suitable fasteners at every 300mm c/c. Suspended main channels should have thickness of 0.9mm, length 3600mm, equal flanges of 15mm and web of 45mm from the soffit at every 1200mm c/c with suspender angle having thickness 0.45mm, unequal flanges of 25 & 10mm. GI Cross channel should have thickness of 0.45mm, length 3600mm, knurled web 50mm, depth of 25mm and equal flanges 9.5mm and fastened to the main channel in the direction perpendicular to the main channel at every 600mm c/c. The tapered edge of the gypsum board to be finished with acoustical jointing compound. (Preferred Make: Armstrong, Anutone, Ecophon-Saint Gobain)

- 25.3. PRIMARY CEILING IN AREAS WITHOUT CONCRETE TERRACE FLOOR:** It shall be with 5 mm thick synthetic soundproofing membrane (high-density, polymer-based, asphalt-free, Rot-proof, Flexible, High elongation capacity, Hot and cold-resistant) sandwiched between the two (12.5mm thick) gypsum boards on MS pipe frame of size 100mm x 50mm x 4mm thickness at c/c distance 1500mm.(Preferred Make: Armstrong, Anutone, Ecophon-Saint Gobain)
- 25.4. ACOUSTIC WOODEN PERFORATED PANELS FOR WALL:** Wooden perforated Panel shall be made out of 16mm thick both side pre laminated high density MDF board of 700-750 kg density with acoustical transparent black fabric and synthetic acoustic infill/compressed rockwool tile (UL/CE certified, having density of 90kg/m³ confirming to IS8183). The infill to be held in position with chicken wire mesh. The system shall give NRC \geq 0.9. The final colour of the material and design (horizontal or vertical) should be approved by the Engineer-in-Charge. The panels shall be mounted on special aluminium splines using clips. The edge joint of the panels shall be connected through dowels to avoid any sagging or unevenness. Installation of panels should be on GI Channels of section of 50mm x 35mm x 1.0mm on 40 x 40 x 5mm GI angle Supports (1200 x 1200 mm c/c) fixed to solid wall having air gap as per shop drawings prepared by contractor and approved by Engineer-in-charge. GI panels fixed horizontally at spacing of 600mm centre to centre and screwed with aluminium extruded keel for perforated wood works with infill.(Preferred Make: Armstrong, Anutone, Ecophon-Saint Gobain)
- 25.5. COMPRESSED POLYESTER FIBRE ACOUSTICAL PANELS:** It shall be of 25 mm thickness consisting 10 mm thick acoustic polyester fire rated fibre pad pasted on 15 mm thick perforated wooden panels (size 600x600mm or 600x1200mm, density \geq 400kg/m³) by adhesive for rigid fixation. The Polyester fibre acoustic panels should be backed with black acoustic fleece and synthetic acoustic infill/compressed rockwool tile (UL/CE certified, having density of 90kg/m³ confirming to IS8183). The infill to be held in position with chicken wire mesh. The system shall give NRC \geq 0.9. All joints of Polyester fibre acoustic panel should have dowel connection to avoid any sagging /unevenness. The edges of the polyester fibre pad to be taper cut by special purpose machine to produce a ‘V’ joint at all four ends.The system shall be fixed on wall firmly in GI sections/accessories as per manufacturer’s specifications. The final colour of the material and design (horizontal or vertical) should be approved by the Engineer-in-Charge. (Preferred Make: Armstrong, Anutone, Ecophon-Saint Gobain)
- 25.6. ACOUSTIC GROOVED WOODEN CLADDING FOR WALL -** It shall consist of 16 mm thick wooden perforated panel (density of 700-800 kg/m³) of size 128x 2430mm with acoustical transparent black fabric and synthetic acoustic infill/compressed rockwool tile (UL/CE certified, having density of 90kg/m³ confirming to IS8183). The whole system shall have NRC \geq 0.9. The final colour of the material and design (horizontal or vertical) should be approved by the Engineer-in-Charge. The panels shall be connected through tongue-groove system for a seamless look to avoid any sagging or unevenness. The system shall be fixed on wall firmly in GI sections/accessories as per manufacturer’s specifications. The expansion joint at 3-5 metres shall be provided. Panels shall be tested as per IS:8225/ISO: 354/ASTM 423C.(Preferred Make: Armstrong, Anutone, Ecophon-Saint Gobain)
- 25.7. CARPET FLOORING WITH ACOUSTIC UNDERLAY:** Carpet shall be broadloom -Tufted cut pile, minimum Gauge 1/10 per inch, Pile material to be 100% Continuous Filament Nylon 6,6

Digital Injection Dyeing, Backing- Woven textile as per eTL, dimensions 400 cm as per ISO 3018, total thickness 10 mm, surface pile thickness 7.5 mm, Min 118 tufts per sq. inch (1800 tufts/100 cm²), carpet weight 3200 g/m², Pile yarn weight 1400 g/m², surface Pile density- min 5600 oz/ yd³, Soil protection technology inbuilt for Soil Repel, Soil Resist & Soil Release, Antimicrobial Properties technology for lifetime Anti-Microbial Treatment to control/ prevent Mold, Moldew & Odour, Texture Appearance Rating: As Per Hexapod Drum Test (ASTM-D5252 or equivalent Indian standard or International standard) Min. for Commercial Heavy usage & Constant Castor Chair usage as per EN 1307 or Equivalent, Anti-Static Property as per Static Electricity (AATCC-134) 20% R.H.,70° F should be ≤ 3.5 KV, Permanent Conductive Fiber. Manufacturers should certify 10 years Comprehensive Warranty for replacement in case of any manufacturing or latent defect. Acoustic insulation from impact noise 29db, acoustical absorption 0.30 aW, Suitable for heated floors as per ISO 8302 / equivalent Indian standard or International standard, Colour fastness to light ISO 105- B02 / equivalent Indian standard or International standard ≥6, Colour fastness to rubbing wet EN ISO 105-X12 / equivalent Indian standard or International standard ≥ 5, Colour fastness to rubbing dry EN ISO 105-X12 / equivalent Indian standard or International standard and minimum “4” rating or higher for colour loss using the AATCC Gray Scale (5= no change; 1= severe bleach stain). Fire Ratings: Smoke Density (NFPA-258-T or ASTM-E-662) should be Less Than 450 Flaming & Non-Flaming, Radiant Panel Test. As per Flammability (Radiant Panel ASTM-E-648) should be Class 1, Greater Than .45 Watts/cm², certified CE Labelling as per EN 14041; Certified Slip resistance as per EN 13893, Indoor climate Air Quality Green Label Plus Approved for GLP2860, Category 1Y, Environment Cradle to Cradle Certified as per silver certified. Additional Certification: NSF 140 & Declare Smart ® Certified for Interior Finishes. **Underlay:** -Fire retardant 10mm underlay roll, more than 90% closed cell- Negligible water/moisture absorption, operating temperature range 40 degree C to +115 degree C, Resistant to fungi and vermin growth, non-fibrous and nontoxic- Non-irritant. No risk of airborne fibres contaminating indoor air quality, Non- carcinogenic, Environment, Weather resistant and shock proof, emits non-toxic smoke, less than 5% shrinkage at 90% C for 24 hrs, Fire Characteristic-Surface spread of flame -Class 1 by BS 476 part 6 or 7, and as approved by Engineer In-charge.

25.8. Acoustic Spray: It shall be Smooth Trowel finish Cellulose Fiber insulation for acoustic management and meeting the required parameters which are as below:

(i) Acoustic performance

NRC ≥ 0.80
 Coating insulant - R 0.03 per mm (W/m·K)
 Minimum Thickness: 6mm

(ii) Other parameters

Bond strength : > 600 psf
 Compression strength : > 400 psf

26.0 HORTICULTURE & LANDSCAPE WORK: Contractor shall furnish all materials, labor and related terms necessary to complete the work indicated on drawing and specified here in.

26.1 MATERIALS:

- a) **Plant materials:**
- (i) Plant materials shall be well formed and shaped true to type, and free from disease, insects and defects such as knots, windburn, injuries, abrasion or disfigurement.
 - (ii) All plant materials shall be healthy, sound, and vigorous, free from plant disease, insect pests or their eggs, and shall have healthy, well-developed root systems.
 - (iii) All plants shall be hardy under climatic conditions similar to those in the locality of the work / project. No plant material will be accepted if branches are damaged or broken. All material must be protected from the sun and weather until planted.
 - (iv) Any nursery stock shall be inspected and approved by the Engineer-in-Charge.
 - (v) Plants shall be delivered with legible identification labels.
- b) **Topsoil:** Topsoil or good earth shall be a friable loam, typical of cultivated topsoil of the locality containing at least 2% of decayed organic matter (humus). It shall be taken from a well-drained arable site. It shall be free of subsoil, stones, earth clods, sticks, roots or other objectionable extraneous matter or debris. It shall contain no toxic material. No topsoil shall be delivered in a muddy condition. Good earth shall have Ph range 6.5 to 7.5
- c) **Manure (as locally available):** Dry farm yard manure shall be used. It shall be free from extraneous matter, harmful bacteria insects or chemicals.
- d) **Root System:** The root system shall be conducive to successful transplantation. Where necessary, the root-ball shall be preserved by support with hessian or other suitable material. On soils where retention of a good ball is not possible, the roots should be suitably protected in some other way which should not cause any damage to roots.
- e) **Condition:** Trees and shrubs shall be substantially free from pests and diseases, and shall be materially undamaged. Torn or lacerated roots shall be pruned before dispatch. No roots shall be subjected to adverse conditions, such as prolonged exposure to drying winds or subjection to water-logging, between lifting and delivery.
- f) **Supply and substitution:** Upon submission of evidence that certain materials including plant materials are not available, the contractor shall be permitted to substitute other material and plants, with an equitable adjustment of price. All substitutions shall be of the nearest equivalent species and variety to the original specified and shall be subject to the approval of the engineer-in-charge.
- g) **Packaging:** Packaging shall be adequate for the protection of the plants and such as to avoid heating or drying out.
- h) **Marking:** Each specimen of tree and shrub, or each bundle, shall be legibly labelled with the name of the supplier and the date of dispatch from the nursery, unless otherwise agreed.

26.2 TREES, ORNAMENTAL PLANTS & PALMS PLANTING:

- a. Trees should be supplied with adequate protection as approved. After delivery, if planting is not to be carried out immediately, balled plants should be placed cheek to cheek and the ball covered with sand to prevent drying out. Bare-rooted plants can be heeled in by placing the roots in a prepared trench and covering them with earth which should be watered into avoid air pockets round the roots.
- b. **Digging of Pits:** Tree pits shall be dug a minimum of three weeks prior to backfilling. The pit sizes shall be as specified further herein. It shall be replaced with soil mixture as specified further herein. While digging the pits, the top soil up to a depth of 30 cm may be kept aside, if found good (depending upon site conditions) and mixed with the rest of the soil. If the soil is bad below, it shall be replaced with the soil mixture as specified further herein. The bottom of the pit shall be forked to break up the sub-soil.
- c. **Backfilling:** If the excavated soil is normal, it shall be mixed with manure. River sand shall be added to the soil if it is heavy. However, if the soil is bad, the pit shall be refilled with imported good garden soil mixed with manure 2:1 by volume (2 parts of stacked volume of earth after 20% reduction: 1 part of stacked volume of manure after 8% reduction). The soil backfilled has to be watered through and gently pressed down a day previous to planting to make sure that it may not further settle down after planting. The rest 100mm shall be filled with manure. The soil shall be pressed down firmly by treading it down, leaving a shallow depression all around for watering.
- d. **Planting:** No tree pits shall be dug until final tree positions have been pegged out for approval. Care shall be taken that the plant sapling when planted is not buried deeper than in the nursery, or in the pot. Planting should not be carried out in water logged soil. Plant trees at the original soil depth; the soil marks on the stem are an indication of this and it should be maintained on the finished level, allowing for setting of the soil after planting. All plastic and other imperishable containers should be removed before planting. Any broken or damaged roots should be cut back to sound growth. The bottom of the planting pit should be covered with 50mm to 75mm of soil. Bare roots should be spread evenly in the planting pit; and small mound in the center of the pits on which the roots are placed will aid an even spread. Soil should be placed around the roots, gently shaking the tree to allow the soil particles to shift into the root system to ensure close contact with all roots and to prevent air pockets. Backfill soil should be firmed as filling proceeds, layer by layer, care being taken to avoid damaging the roots, as follows:
 - o Chlorpyrifos emulsifiable concentrate 0.2% shall be applied on walls of pit, and initially pit shall be filled to 200 depths with earth mixed Chlorpyrifos emulsifiable concentrate 0.2%. The balance earth shall be filled in with manure in proportion as specified further herein. Chlorpyrifos emulsifiable concentrate 0.2% shall be applied every 15 days.
- e. **Staking:** Newly planted trees must be held firmly although not rigidly by staking to prevent a pocket forming around the stem and newly formed fibrous roots being broken by mechanical pulling as the tree rocks.
- f. **Methods:** The main methods of staking shall be:

- i. A single vertical stake, 900mm longer than the clear stem of the tree, driven 600mm to 900mm into the soil.
 - ii. Two stakes as above driven firmly on either side of the tree with a cross-bar to which the stem is attached. Suitable for bare-rooted or balled material.
 - iii. A single stake driven in at an angle at 45° and leaning towards the prevailing wind, the stem just below the lowest branch being attached to the stake. Suitable for small bare-rooted or balled material.
 - iv. For plant material 3m to 4.50 m high with a single stem a three-wire adjustable guy system may be used in exposed situations.
 - v. The end of stake should be pointed and the lower 1.0m to 1.20m should be coated with a non-injurious wood preservative allowing at least 150mm above ground level.
- g. **Tying:** Each tree should be firmly secured to the stake so as to prevent excessive movement. Abrasion must be avoided by using a buffer, rubber or hessian, between the tree and stake. The tree should be secured at a point just below its lowest branch, and also just above ground level; normally two ties should be used for tree. These be adjusted or replaced to allow for growth.
- h. **Watering:** The contractor should allow for the adequate watering in of all newly planted trees and shrubs immediately after planting and he shall during the following growing seasons, keep the plant material well-watered.
- i. **Fertilizing:** Fertilizing shall be carried out by application in rotation of the following fertilizers, every 15 days from the beginning of the monsoon till the end of winter: - sludge of organic well-rotted dry farmyard manure or vermicomposting or approved organic manure as per directions of engineer-in-charge.

26.3 SHRUBS, GROUND COVERS, CREEPERS PLANTING IN PLANTERS AND BEDS

- a) All areas to be planted with shrubs shall be excavated, trenched to a depth of 600 mm, refilling it with finely mixed good black garden soil and excavated earth (after breaking the clods and mixing with sludge in the ratio as specified further herein. Backfill soil should be firmed as filling proceeds, layer by layer, care being taken to avoid to avoid damaging the roots, as follows:
 - o Chlorpyrifos emulsifiable concentrate 0.2% shall be applied on walls of pit. The balance earth shall be filled in a mixture with manure in proportion as specified further herein. Chlorpyrifos emulsifiable concentrate 0.2% concentration shall be applied every 15 days.
- b) Tall shrubs may need staking, which shall be provided if approved by the engineer-in-charge depending upon the conditions of individual plant specimen.
- c) For planting shrubs and ground cover shrubs in planters, good earth shall be mixed with sludge in the proportion as above and filled in planters.
- d) Positions of shrubs to be planted should be marked out in accordance with the planting plan. When shrubs are set out, precautions should be taken to prevent roots drying. Planting

holes (of sizes as specified further herein) should be excavated for longer shrubs. Polythene and other non-perishable containers should be removed and any badly damaged roots should be carefully pruned. The shrubs should then be set in holes so that the soil level, after settlement, will be at the original soil mark on the stem of the shrub. The hole should be backfilled to half pots depth and firmed by treading. The remainder of the soil can then be returned and again firmed by treading.

26.4 GRASS AREAS:

- a. Mixing earth and manure in proportion 8:1 and spreading to a thickness of 200mm.
- b. Fine dressing the ground (to levels specified).
- c. Grassing with selection No. 1 grass including watering and maintenance of the lawn for 60 days or more till the grass forms a thick lawn, free from weeds and fit for mowing including supplying good earth, if needed.
- d. In rows 5 cm apart in both directions
- e. Flooding the ground with water including making kiaries and dismantling the same.

26.5 GROUND COVER AND HERBAL PLANTS

- a) Pit Preparation: Preparing planting beds for ground covers by excavating and refilling the same with sweet earth mixed with manure 8:1 by volume (8 parts of stacked volume of earth after 20 % reduction: 1 part of stacked volume of manure after 8 % reduction), flooding with water, dressing including removal of rubbish and surplus earth if any with all leads and lifts; excluding cost of earth and manure. Unless otherwise specified, pit size shall be 0.15m x 0.15m x 0.30 m.
- b) Supply and plantation: Planting best quality ground covers of species and height as specified. All ground covers to be planted should be best quality pot-grown healthy ground covers inclusive of preparation and cultivation of ground cover beds as specified. All plants to be approved before planting.

26.6 CREEPERS

- a) Pit Preparation: Preparing planting beds for creepers by excavating and refilling the same with sweet earth mixed with manure 8:1 by volume (8 parts of stacked volume of earth after 20 % reduction: 1 part of stacked volume of manure after 8 % reduction), flooding with water, dressing including removal of rubbish and surplus earth if any with all leads and lifts; excluding cost of earth and manure. Unless otherwise specified, the pit size shall be 0.6m x 0.6m x 0.6m.
- b) Supply and plantation: Planting best quality creepers of species and height as specified. All ground covers to be planted should be best quality pot-grown healthy ground covers inclusive of preparation and cultivation of creeper beds as specified. All plants to be approved before planting.

27.0 MISCELLANEOUS: Following miscellaneous works shall be executed wherever required as per below mentioned specifications:

Anti-Termite Chemical Treatment: Post Constructional anti-termite treatment shall be with

Chloropyriphos/ lindane emulsifiable concentrate 20% with 1% concentration as per CPWD specification.

SCHEDULE '2'
Finishing Schedule, Door and Window schedule, Hardware Schedule

**SCHEDULE OF FINISHING
ADMINISTRATION DEPARTMENT BUILDING**

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
1	OPEN COURT YARD	RMC	N.A.	N.A.
2	RECEPTION & LOUNGE	18MM THICK PRE-POLISHED GRANITE FLOORING, WIDTH OF STONE TO BE 750MM, STONE SIZE MIN. 0.6 SQM WHEREVER SPACE PERMITS AS PER APPROVED DESIGN PATTERN IN MULTIPLE SHADES AS PER SPECIFICATIONS.	PRE-POLISHED GRANITE STONE SKIRTING WITH 2MM THICK WALLPUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	COMBINATION OF BAMBOO BAFFLE CEILING (90%) 16MM THICK, 65MM HIGH, SPACED 70MM APART WITH ACOUSTIC SPRAY & DARK GREY PLASTIC EMULSION PAINT ON RCC CEILING AND JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING (10%) WITH PLASTIC EMULSION PAINT OVER PUTTY IN THE PERIPHERY AS PER SPECIFICATIONS.
3	WAITING AREA, OTHER OFFICER'S ROOM, MULTIPURPOSE SPACE	MATT/GLOSS VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED DESIGN AND SHADE. (MINIMUM SIZE OF TILE TO BE 1200MM X 600MM)	VITRIFIED TILE SKIRTING WITH 2MM THICK WALLPUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
4	CHAIRMEN/ VICE CHAIRMEN ROOM/ DIRECTOR'S ROOM/ DEPUTY DIRECTOR'S ROOM	MATT/GLOSS VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED DESIGN AND SHADE. (MINIMUM SIZE OF TILE TO BE 1200MM X 600MM)	VITRIFIED TILE SKIRTING WITH 2MM THICK WALLPUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
5	BOARD/CONFERENCE ROOM	LAMINATE WOODEN (GRADE AC4)	12MM THICK PREMIXED GYPSUM PLASTER.	ALUMINUM U-BAFFLE CEILING WITH LINEAR

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
		FLOORING AAS PER SPECIFICATION AND AS PER APPROVED DESIGN.	WALLS TO HAVE WOODEN SLATS CLADDING UP TO 1200 MM HEIGHT AND 6 MM THICK HIGH-PRESSURE LAMINATES (HPL) OVER THE BASE OF PLYWOOD UP TO FALSE CEILING.	LIGHT FIXTURES. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
6	CANTEEN	18MM THICK GRANITE FLOORING, STONE SIZE MIN. 0.6 SQM WHEREVER SPACE PERMITS AS PER APPROVED SHADE, DESIGN, PATTERN AS PER SPECIFICATIONS.	GLAZED VITRIFIED TILES OF MINIMUM SIZE 1200MM x 600MM UPTO FALSE CEILING HEIGHT AS PER APPROVED DESIGN AND SHADES.	ALUMINUM U-BAFFLE CEILING WITH LINEAR LIGHT FIXTURES. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
7	PANTRY	MATT VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED SHADE AND DESIGN (SIZE MINIMUM 1200MM X 600MM)	GLAZED VITRIFIED TILES OF MINIMUM SIZE 1200MM x 600MM UPTO FALSE CEILING HEIGHT AS PER APPROVED DESIGN AND SHADES.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
8	INVENTORY STORE	25MM THICK, 600X600MM PRE-POLISHED KOTA STONE FLOORING	KOTA STONE SKIRTING AND 2MM THICK WALLPUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING	PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS ON CEILING
9	ELECTRICAL ROOM	25MM THICK, 600X600 MM PRE-POLISHED KOTA STONE FLOORING	KOTA STONE SKIRTING AND 2MM THICK WALLPUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING	PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS ON CEILING
10	CORRIDOR	18MM THICK PRE-POLISHED GRANITE FLOORING. MINIMUM WIDTH OF STONE TO BE 750MM, STONE SIZE MIN. 0.6 SQM WHEREVER SPACE PERMITS AS PER APPROVED DESIGN PATTERN AS PER	PRE-POLISHED GRANITE STONE SKIRTING WITH 2MM THICK WALLPUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
		SPECIFICATIONS.		PAINT OVER PUTTY AS PER SPECIFICATIONS.
11	TOILETS	MATT VITRIFIED TILES AS PER APPROVED DESIGN AND SIZE MINIMUM 600MM X 600MM.	GLAZED VITRIFIED TILES OF MINIMUM SIZE 1200MM x 600MM UPTO FALSE CEILING HEIGHT AS PER APPROVED DESIGN AND SHADES.	CALCIUM SILICATE CEILING TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY.
12	MAIN STAIRCASE	18MM THICK PRE-POLISHED GRANITE STONE (SINGLE LENGTH JOINT FREE X TREAD WIDTH) WITH HALF ROUND NOSING AND 4 NOS. STAINLESS STEEL INSERTS	WALL DADO WITH GRANITE STONE WITH TOP AND NOSE DULY ROUNDED TILL 1200 MM. ABOVE 1200MM: 12MM THICK PREMIXED GYPSUM PLASTER AND PLASTIC EMULSION PAINT ABOVE DADA	PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS
13	PASSENGER ELEVATOR CAR	18 MM THICK GRANITE IN 3 PIECES	STAINLESS STEEL SCRATCH RESISTANT.	LED PANEL
14	INSIDE SHAFTS	25MM THICK PRE-POLISHED KOTA	12MM THICK (1 CEMENT :4 COARSE SAND) CEMENT PLASTER WITH ACRYLIC DISTEMPER PAINT.	NA
15	ELEVATOR WALL FACIA	NA	ENTIRE WALL CLADDING GRANITE STONE WITH TOP AND NOSE DULY ROUNDED TILL 3000 MM INCLUDING ALL JAMBS AND UNDERSIDE OF LINTEL. TO BE DESIGNED WITH SS ELECTROPLATED COPPER/BRASS STRIPS 12MM X12MM AS PER DESIGN. ABOVE 3000MM: 12MM THICK PREMIXED GYPSUM PLASTER AND PLASTIC EMULSION PAINT	NA

OTHER IMPORTANT NOTES ON FINISHES:

1. SS 316 TACTILE STUDS AND STRIPS SHALL BE PROVIDED ON TOP OF FLOORING ALL AS PER UNIVERSAL ACCESS GUIDELINES.
2. ALL JOINTS IN GRANITE/TILES/STONE/MARBLE ETC. SHALL BE FILLED WITH EPOXY GROUT OF THE MATCHING SHADE AS APPROVED BY ENGINEER-IN-CHARGE
3. THICKNESS OF POP OR PUTTY, WHEREVER MENTIONED, SHALL BE 2MM.
4. SKIRTING SHALL BE FLUSHED WITH DADO.
5. UNLESS OTHERWISE SPECIFIED, HEIGHT OF SKIRTING SHALL BE 150 MM AND HEIGHT OF DADO SHALL BE 1200 MM INCLUDING SKIRTING.
6. UNLESS OTHERWISE SPECIFIED, SKIRTING SHALL BE MADE IN THE SAME MATERIAL AS THE FLOORING.
7. CALCIUM SILICATE BORDER OR GYPSUM BORDER WITH TILE SHALL BE PROVIDED AS PER DESIGN APPROVED BY ENGINEER-IN-CHARGE IN FORM OF SHOP DRAWING. THE BORDER SHALL BE PAINTED WITH PLASTIC EMULSION PAINT.
8. ALL EXPOSED STRUCTURAL STEEL MEMBERS SHALL BE COVERED WITH ADEQUATE VERMICULITE CEMENTITIOUS CLADDING TO ENSURE **FIRE RESISTANCE/RATING OF REQUIRED/APPROPRIATE DURATION AS PER NBC 2016.**
9. ACOUSTICAL CLADDING AS/ SPECS TO ACHIEVE DESIRED NOISE LEVEL OUTSIDE AHU, SHALL BE PROVIDED ON WALLS OF ALL AHU.
10. ALL PUBLIC AREAS ARE REQUIRED TO BE UNIVERSALLY ACCESSIBLE AND WHEREEVER REQUIRED AS PER ACCESSIBLE GUIDELINES, SS 316 TACTILE STUDS AND STRIPS SHALL BE PROVIDED IN FLOORING.
11. ALL AHU DOORS AND OPENINGS SHALL BE ACOUSTICALLY AND FIRE TREATED.
12. COUNTER IN TOILETS SHALL BE POLISHED, BEVELLED AND EDGE MOULDED 19 MM THICK GRANITE OF APPROVED SHADE.
13. ALL SILL, LINTEL AND JAMBS SHALL BE IN 18MM THICK GRANITE WITH HALF/FULL ROUND EDGE MOULDING AS PER APPROVED DESIGN.
14. ALL SHARED PARTITIONS TO BE OF 100MM THICK JOINTLESS CALCIUM SILICATE BOARD WITH INSULATION AND WITH PLASTIC EMULSION PAINT OVER PUTTY.
15. GLAZED PANELS WITHIN THE PARTITIONS AS INDICATED IN THE ARCHITECTURAL DRAWINGS OR AS REQUIRED BY THE DETAILED ENGINEERING TO BE PROVIDED
16. ALL ELECTRICAL DISTRIBUTION BOARDS SHALL BE WALL RECESSED IN A NICHE AND COVERED WITH AN AESTHETIC ENCLOSURE.

SCHEDULE '1B'

SCHEDULE OF FINISHING

WILDLIFE HEALTH MANAGEMENT AND DISEASES INVESTIGATION AND SURVEILLANCE BUILDING

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
1	RECEPTION& LOUNGE	18MM THICK LEATHER FINISH GRANITE FLOORING. MINIMUM WIDTH OF STONE TO BE 750MM, STONE SIZE MIN. 0.6 SQM WHEREVER SPACE PERMITS AS PER APPROVED SHADE, DESIGN, PATTERN AS PER SPECIFICATIONS.	PRE-POLISHED GRANITE STONE SKIRTING WITH 2MM THICK WALL PUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	COMBINATION OF BAMBOO BAFFLE CEILING (90%) 16MM THICK, 65MM HIGH, SPACED 70MM APART WITH ACOUSTIC SPRAY & DARK GREY PLASTIC EMULSION PAINT ON RCC CEILING AND JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING (10%) WITH PLASTIC EMULSION PAINT OVER PUTTY IN THE PERIPHERY AS PER SPECIFICATIONS.
2	OPERATION THEATER	2 MM THICK FULL BODY, MEDICAL GRADE ANTI BACTERIAL AND ANTI FUNGAL STATIC CONDUCTIVE POLY VINYL SHEET FLOORING LAID ON SMOOTH IPS FLOOR COVE FORMING TO MATCH WALL	SKIRTING IN 1 MM THICK FULL BODY MEDICAL GRADE ANTI BACTERIAL AND ANTI FUNGAL POLY VINYL SHEET FLOORING INSTALLED ON SMOOTH PLASTER FINISH ON WALL, 2MM THICK WALL PUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
3	SENIOR VETERINARY DOCTOR /JUNIOR VETERINARY DOCTOR/ANIMAL NUTRITIONIST/MICROBIOLOGIST /IMMUNOLOGIST/RESEARCH ASSOCIATES, INSTRUMENTS ROOM, TREATMENT AREA, STORE, WILDLIFE BIOLOGIST, EXTRA, CHEMIST, LABORATORIES, HOD WILDLIFE DISEASE	MATT/GLOSS VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED SHADE & DESIGN. (MINIMUM SIZE OF TILE TO BE 1200MM X 600MM)	VITRIFIED TILE SKIRTING WITH 2 MM THICK WALLPUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/D ADO	CEILING
	INVESTIGATION AND SURVEILLANCE, BIOINFOMATIC EXPERT, BIOTECHNOLOGIST, TOXICOLOGIST, PATHOLOGIST, EPIDEMIOLOGIST, BIostatisticians			
4	MEETING ROOM	LAMINATE WOODEN (GRADE AC4) FLOORING AAS PER SPECIFICATION AND AS PER APPROVED DESIGN.	12MM THICK PREMIXED GYPSUM PLASTER. WALLS TO HAVE WOODEN SLATS CLADDING UP TO 1200 MM HEIGHT AND 6 MM THICK HIGH-PRESSURE LAMINATES (HPL) OVER THE BASE OF PLYWOOD UP TO FALSE CEILING.	ALUMINUM U-BAFFLE CEILING WITH LINEAR LIGHT FIXTURES. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
7	CORRIDOR	18MM THICK PRE-POLISHED GRANITE FLOORING. MINIMUM WIDTH OF STONE TO BE 750MM, STONE SIZE MIN. 0.6 SQM WHEREVER SPACE PERMITS AS PER APPROVED SHADE, DESIGN, PATTERN AS PER SPECIFICATIONS.	PRE-POLISHED GRANITE STONE SKIRTING WITH 2MM THICK WALL PUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
7	TOILETS	MATT VITRIFIED TILES AS PER APPROVED DESIGN AND SHADE (MINIMUM SIZE 600MM X 600MM).	GLAZED VITRIFIED TILES OF MINIMUM SIZE 1200MM x 600MM UPTO FALSE CEILING HEIGHT AS PER APPROVED DESIGN AND SHADES.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
8	MAIN STAIRCASE	18MM THICK PRE-POLISHED GRANITE STONE (SINGLE LENGTH JOINT FREE X TREAD WIDTH) WITH HALF ROUND NOSING AND 4 NOS. STAINLESS STEEL INSERTS	WALL DADO WITH GRANITE STONE WITH TOP AND NOSE DULY ROUNDED TILL 1200 MM. ABOVE 1200MM: 12MM THICK PREMIXED GYPSUM PLASTER AND	PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
			PLASTIC EMULSION PAINT ABOVE DADO.	
9	PASSENGER ELEVATOR CAR	18 MM THICK GRANITE IN 3 PIECES	STAINLESS STEEL SCRATCH RESISTANT.	LED PANEL
10	INSIDE SHAFTS	25MM THICK PRE-POLISHED KOTA	12MM THICK (1 CEMENT :4 COARSE SAND) CEMENT PLASTER WITH ACRYLIC DISTEMPER PAINT.	NA
10	ELEVATOR WALL FACIA	NA	ENTIRE WALL CLADDING GRANITE STONE WITH TOP AND NOSE DULY ROUNDED TILL 3000 MM INCLUDING ALL JAMBS AND UNDERSIDE OF LINTEL. TO BE DESIGNED WITH SS ELECTROPLATED COPPER/BRASS STRIPS 12MM X12MM AS PER DESIGN. ABOVE 3000MM: 12MM THICK PREMIXED GYPSUM PLASTER AND PLASTIC EMULSION PAINT	NA

OTHER IMPORTANT NOTES ON FINISHES:

1. SS 316 TACTILE STUDS AND STRIPS SHALL BE PROVIDED ON TOP OF FLOORING ALL AS PER UNIVERSAL ACCESS GUIDELINES.
2. ALL JOINTS IN GRANITE/TILES/STONE/MARBLE ETC. SHALL BE FILLED WITH EPOXY GROUT OF THE MATCHING SHADE AS APPROVED BY ENGINEER-IN-CHARGE
3. THICKNESS OF POP OR PUTTY, WHEREVER MENTIONED, SHALL BE 2MM.
4. SKIRTING SHALL BE FLUSHED WITH DADO.
5. UNLESS OTHERWISE SPECIFIED, HEIGHT OF SKIRTING SHALL BE 150 MM AND HEIGHT OF DADO SHALL BE 1200 MM INCLUDING SKIRTING.
6. UNLESS OTHERWISE SPECIFIED, SKIRTING SHALL BE MADE IN THE SAME MATERIAL AS THE FLOORING.
7. CALCIUM SILICATE BORDER OR GYPSUM BORDER WITH TILE SHALL BE PROVIDED AS PER DESIGN APPROVED BY ENGINEER-IN-CHARGE IN FORM OF SHOP DRAWING. THE BORDER SHALL BE PAINTED WITH PLASTIC EMULSION PAINT.
8. ALL EXPOSED STRUCTURAL STEEL MEMBERS SHALL BE COVERED WITH ADEQUATE VERMICULITE CEMENTITIOUS CLADDING TO ENSURE **FIRE RESISTANCE/RATING OF REQUIRED/APPROPRIATE DURATION AS PER NBC 2016.**

9. ACOUSTICAL CLADDING AS/ SPECS TO ACHIEVE DESIRED NOISE LEVEL OUTSIDE AHU, SHALL BE PROVIDED ON WALLS OF ALL AHU.
10. ALL PUBLIC AREAS ARE REQUIRED TO BE UNIVERSALLY ACCESSIBLE AND WHEREEVER REQUIRED AS PER ACCESSIBLE GUIDELINES, SS 316 TACTILE STUDS AND STRIPS SHALL BE PROVIDED IN FLOORING.
11. ALL AHU DOORS AND OPENINGS SHALL BE ACOUSTICALLY AND FIRE TREATED.
12. COUNTER IN TOILETS SHALL BE POLISHED, BEVELLED AND EDGE MOULDED 19 MM THICK GRANITE OF APPROVED SHADE.
13. ALL SILL, LINTEL AND JAMBS SHALL BE IN 18MM THICK GRANITE WITH HALF/FULL ROUND EDGE MOULDING AS PER APPROVED DESIGN.
14. ALL SHARED PARTITIONS TO BE OF 100MM THICK JOINTLESS CALCIUM SILICATE BOARD WITH INSULATION AND WITH PLASTIC EMULSION PAINT OVER PUTTY.
15. GLAZED PANELS WITHIN THE PARTITIONS AS INDICATED IN THE ARCHITECTURAL DRAWINGS OR AS REQUIRED BY THE DETAILED ENGINEERING TO BE PROVIDED
16. ALL ELECTRICAL DISTRIBUTION BOARDS SHALL BE WALL RECESSED IN A NICHE AND COVERED WITH AN AESTHETIC ENCLOSURE.

SCHEDULE '1C'**SCHEDULE OF FINISHING
INFORMATIC AND ANALYTICS & NETWORK & OUTREACH UNIT BUILDING**

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
1	H.O.D. ROOM, RESEARCH ASSOCIATES/ STATISTICIAN/GIS EXPERT/IT EXPERT/M&E EXPERT AND OTHER ROOMS, BUSINESS CENTRE COORDINATION UNIT AND WORK SPACE & DISCUSSION AREA, SOD NETWORK AND OUTREACH, POLICY, MEDIA, EXTRA CHAMBER	MATT/GLOSS VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED SHADE AND DESIGN. (MINIMUM SIZE OF TILE TO BE 1200MM X 600MM)	VITRIFIED TILE SKIRTING OF SAME FLOORING TILE / 2MM THICK WALL PUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
2	MEETING ROOMS, SCREEN AND SERVER	LAMINATE WOODEN (GRADE AC4) FLOORING AAS PER SPECIFICATION AND AS PER APPROVED DESIGN.	12MM THICK PREMIXED GYPSUM PLASTER. WALLS TO HAVE WOODEN SLATS CLADDING UP TO 1200 MM HEIGHT AND 6 MM THICK HIGH-PRESSURE LAMINATES (HPL) OVER THE BASE OF PLYWOOD UP TO FALSE CEILING.	ALUMINUM U-BAFFLE CEILING WITH LINEAR LIGHT FIXTURES. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
3	INVENTORY AND SCRAP ROOM	25MM THICK, 600X600 MM PRE-POLISHED KOTA STONE FLOORING	KOTA STONE SKIRTING AND 2 MM THICK WALL PUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING	PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS ON CEILING SLAB.
4	CORRIDOR	18MM THICK PRE-POLISHED GRANITE FLOORING. MINIMUM WIDTH OF STONE TO BE 750MM, STONE SIZE MIN. 0.6 SQM WHEREVER SPACE PERMITS AS PER	PRE-POLISHED GRANITE STONE SKIRTING / 2 MM THICK WALL PUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
		APPROVED SHADE, DESIGN, PATTERN AS PER SPECIFICATIONS.		SPECIFICATIONS.
5	TOILETS	MATT VITRIFIED TILES AS PER APPROVED DESIGN AND SHADE (MINIMUM SIZE 600MM X 600MM).	GLAZED VITRIFIED TILES OF MINIMUM SIZE 600MM x 1200MM UPTO FALSE CEILING HEIGHT AS PER APPROVED DESIGN AND SHADES.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
6	PANTRY/CANTEEN	MATT VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED SHADE AND DESIGN (SIZE MINIMUM 600MM X 600MM)	GLAZED VITRIFIED TILES OF MINIMUM SIZE 600MM x 1200MM UPTO FALSE CEILING HEIGHT AS PER APPROVED DESIGN AND SHADES.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
7	RECEPTION & LOUNGE	18MM THICK GRANITE FLOORING. MINIMUM WIDTH OF STONE TO BE 750MM, STONE SIZE MIN. 0.6 SQM WHEREVER SPACE PERMITS AS PER APPROVED SHADE, DESIGN, PATTERN AS PER SPECIFICATIONS.	PRE-POLISHED GRANITE STONE SKIRTING / 2MM THICK WALL PUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	COMBINATION OF BAMBOO BAFFLE CEILING (90%) 16MM THICK, 65MM HIGH, SPACED 70MM APART WITH ACOUSTIC SPRAY & DARK GREY PLASTIC EMULSION PAINT ON RCC CEILING AND JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING (10%) WITH PLASTIC EMULSION PAINT OVER PUTTY IN THE PERIPHERY AS PER SPECIFICATIONS.
8	MAIN STAIRCASE	18MM THICK LEATHER FINISHED GRANITE STONE (SINGLE LENGTH JOINT FREE X TREAD WIDTH)	WALL DADO WITH GRANITE STONE WITH TOP AND NOSE DULY ROUNDED TILL 1200 MM. ABOVE 1200MM 12MM THICK PREMIXED GYPSUM PLASTER AND	PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
		WITH HALF ROUND NOSING AND 4 NOS. STAINLESS STEEL INSERTS	PLASTIC EMULSION PAINT ABOVE DADA.	
9	PASSENGER ELEVATOR CAR	18 MM THICK GRANITE IN 3 PIECES	STAINLESS STEEL SCRATCH RESISTANT.	LED PANEL
10	INSIDE SHAFTS	25MM THICK PRE-POLISHED KOTA	12MM THICK (1 CEMENT :4 COARSE SAND) CEMENT PLASTER WITH ACRYLIC DISTEMPER PAINT.	NA
11	LIFT WELL	NA	ENTIRE WALL (UPTO CEILING HEIGHT) CLADDING GRANITE STONE INCLUDING ALL JAMBS AND UNDERSIDE OF LINTEL.	NA
12	ELEVATOR WALL FACIA	NA	ENTIRE WALL CLADDING GRANITE STONE WITH TOP AND NOSE DULY ROUNDED TILL 3000 MM INCLUDING ALL JAMBS AND UNDERSIDE OF LINTEL. TO BE DESIGNED WITH SS ELECTROPLATED COPPER/BRASS STRIPS 12MM X12MM AS PER DESIGN. ABOVE 3000MM: 12MM THICK PREMIXED GYPSUM PLASTER AND PLASTIC EMULSION PAINT	ELEVATOR WALL FACIA

OTHER IMPORTANT NOTES ON FINISHES:

1. SS 316 TACTILE STUDS AND STRIPS SHALL BE PROVIDED ON TOP OF FLOORING ALL AS PER UNIVERSAL ACCESS GUIDELINES.
2. ALL JOINTS IN GRANITE/TILES/STONE/MARBLE ETC. SHALL BE FILLED WITH EPOXY GROUT OF THE MATCHING SHADE AS APPROVED BY ENGINEER-IN-CHARGE
3. THICKNESS OF POP OR PUTTY, WHEREVER MENTIONED, SHALL BE 2MM.
4. SKIRTING SHALL BE FLUSHED WITH DADO.
5. UNLESS OTHERWISE SPECIFIED, HEIGHT OF SKIRTING SHALL BE 150 MM AND HEIGHT OF DADO SHALL BE 1200 MM INCLUDING SKIRTING.
6. UNLESS OTHERWISE SPECIFIED, SKIRTING SHALL BE MADE IN THE SAME MATERIAL AS THE FLOORING.
7. CALCIUM SILICATE BORDER OR GYPSUM BORDER WITH TILE SHALL BE PROVIDED AS PER DESIGN APPROVED BY ENGINEER-IN-CHARGE IN FORM OF SHOP DRAWING. THE BORDER SHALL BE PAINTED WITH PLASTIC EMULSION PAINT.
8. ALL EXPOSED STRUCTURAL STEEL MEMBERS SHALL BE COVERED WITH ADEQUATE VERMICULITE CEMENTITIOUS CLADDING TO ENSURE **FIRE RESISTANCE/RATING OF REQUIRED/APPROPRIATE DURATION AS PER NBC 2016.**
9. ACOUSTICAL CLADDING AS/ SPECS TO ACHIEVE DESIRED NOISE LEVEL OUTSIDE AHU, SHALL BE PROVIDED ON WALLS OF ALL AHU.
10. ALL PUBLIC AREAS ARE REQUIRED TO BE UNIVERSALLY ACCESSIBLE AND WHEREEVER REQUIRED AS PER ACCESSIBLE GUIDELINES, SS 316 TACTILE STUDS AND STRIPS SHALL BE PROVIDED IN FLOORING.
11. ALL AHU DOORS AND OPENINGS SHALL BE ACOUSTICALLY AND FIRE TREATED.
12. COUNTER IN TOILETS SHALL BE POLISHED, BEVELLED AND EDGE MOULDED 18 MM THICK GRANITE OF APPROVED SHADE.
13. ALL SILL, LINTEL AND JAMBS SHALL BE IN 18MM THICK GRANITE WITH HALF/FULL ROUND EDGE MOULDING AS PER APPROVED DESIGN.
14. ALL SHARED PARTITIONS TO BE OF 100MM THICK JOINTLESS CALCIUM SILICATE BOARD WITH INSULATION AND WITH PLASTIC EMULSION PAINT OVER PUTTY.
15. GLAZED PANELS WITHIN THE PARTITIONS AS INDICATED IN THE ARCHITECTURAL DRAWINGS OR AS REQUIRED BY THE DETAILED ENGINEERING TO BE PROVIDED
16. ALL ELECTRICAL DISTRIBUTION BOARDS SHALL BE WALL RECESSED IN A NICHE AND COVERED WITH AN AESTHETIC ENCLOSURE.

SCHEDULE OF FINISHING

TRAINING and CAPACITY

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
1	H.O.D. ROOM, SMART CLASSROOM/INCUBATION CENTER/PEDAGOGY EXPERT/WILDLIFE SME/TRAINER/WORKSTATION, CABINS	MATT/GLOSS VITRIFIED TILES AS PER APPROVED SHADE AND DESIGN. (MINIMUM SIZE OF TILE TO BE 1200MM X 600MM)	VITRIFIED TILE SKIRTING WITH 2MM THICK WALL PUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
2	MEETING ROOMS	LAMINATE WOODEN (GRADE AC4) FLOORING AAS PER SPECIFICATION AND AS PER APPROVED DESIGN.	12MM THICK PREMIXED GYPSUM PLASTER. WALLS TO HAVE WOODEN SLATS CLADDING UP TO 1200 MM HEIGHT AND 6 MM THICK HIGH-PRESSURE LAMINATES (HPL) OVER THE BASE OF PLYWOOD UP TO FALSE CEILING.	ALUMINUM U-BAFFLE CEILING WITH LINEAR LIGHT FIXTURES. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
3	LIBRARY	18MM THICK PRE-POLISHED GRANITE FLOORING MINIMUM WIDTH OF STONE TO BE 750MM, STONE SIZE MIN. 0.6 SQM	PRE-POLISHED GRANITE STONE SKIRTING WITH 2MM THICK CEMENT PUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING	CALCIUM SILICATE CEILING TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY.
4	CORRIDOR	18MM THICK PRE-POLISHED GRANITE FLOORING. MINIMUM WIDTH OF	PRE-POLISHED GRANITE STONE SKIRTING WITH 2 MM THICK WALL PUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
		STONE TO BE 750MM, STONE SIZE MIN. 0.6 SQM WHEREVER SPACE PERMITS AS PER APPROVED SHADE, DESIGN, PATTERN AS PER SPECIFICATIONS.		AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
5	TOILETS	MATT VITRIFIED TILES AS PER APPROVED DESIGN AND SHADE (MINIMUM SIZE 600MM X 600MM).	GLAZED VITRIFIED TILES OF MINIMUM SIZE 600MM x 1200MM UPTO FALSE CEILING HEIGHT AS PER APPROVED DESIGN AND SHADES.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
6	RECEPTION& LOUNGE	18MM THICK PRE-POLISHED GRANITE FLOORING. MINIMUM WIDTH OF STONE TO BE 750MM, STONE SIZE MIN. 0.6 SQM WHEREVER SPACE PERMITS AS PER APPROVED SHADE, DESIGN, PATTERN AS PER SPECIFICATIONS.	PRE-POLISHED GRANITE STONE SKIRTING WITH 2MM THICK WALL PUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	COMBINATION OF BAMBOO BAFFLE CEILING (90%) 16MM THICK, 65MM HIGH, SPACED 70MM APART WITH ACOUSTIC SPRAY & DARK GREY PLASTIC EMULSION PAINT ON RCC CEILING AND JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING (10%) WITH PLASTIC EMULSION PAINT OVER PUTTY IN THE PERIPHERY AS PER SPECIFICATIONS.
7	MAIN STAIRCASE	18MM THICK LEATHER FINISH GRANITE STONE (SINGLE LENGTH JOINT FREE X TREAD WIDTH) WITH HALF	WALL DADO WITH GRANITE STONE WITH TOP AND NOSE DULY ROUNDED TILL 1200 MM. ABOVE 1200MM: 12MM THICK PREMIXED GYPSUM PLASTER AND	PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
		ROUND NOSING AND 4 NOS. STAINLESS STEEL INSERTS	PLASTIC EMULSION PAINT ABOVE DADA.	
8	PASSENGER ELEVATOR CAR	18 MM THICK GRANITE IN 3 PIECES	STAINLESS STEEL SCRATCH RESISTANT.	LED PANEL
9	INSIDE SHAFTS	25MM THICK PRE-POLISHED KOTA	12MM THICK (1 CEMENT :4 COARSE SAND) CEMENT PLASTER WITH ACRYLIC DISTEMPER PAINT .	NA
10	LIFT FRONT FACE	NA	ENTIRE WALL CLADDING GRANITE STONE WITH TOP AND NOSE DULY ROUNDED TILL 3000 MM INCLUDING ALL JAMBS AND UNDERSIDE OF LINTEL. TO BE DESIGNED WITH SS ELECTROPLATED COPPER/BRASS STRIPS 12MM X12MM AS PER DESIGN. ABOVE 3000MM: 12MM THICK PREMIXED GYPSUM PLASTER AND PLASTIC EMULSION PAINT	NA

OTHER IMPORTANT NOTES ON FINISHES:

1. SS 316 TACTILE STUDS AND STRIPS SHALL BE PROVIDED ON TOP OF FLOORING ALL AS PER UNIVERSAL ACCESS GUIDELINES.
2. ALL JOINTS IN GRANITE/TILES/STONE/MARBLE ETC. SHALL BE FILLED WITH EPOXY GROUT OF THE MATCHING SHADE AS APPROVED BY ENGINEER-IN-CHARGE
3. THICKNESS OF POP OR PUTTY, WHEREVER MENTIONED, SHALL BE 2MM.
4. SKIRTING SHALL BE FLUSHED WITH DADO.
5. UNLESS OTHERWISE SPECIFIED, HEIGHT OF SKIRTING SHALL BE 150 MM AND HEIGHT OF DADO SHALL BE 1200 MM INCLUDING SKIRTING.
6. UNLESS OTHERWISE SPECIFIED, SKIRTING SHALL BE MADE IN THE SAME MATERIAL AS THE FLOORING.
7. CALCIUM SILICATE BORDER OR GYPSUM BORDER WITH TILE SHALL BE PROVIDED AS PER DESIGN APPROVED BY ENGINEER-IN-CHARGE IN FORM OF SHOP DRAWING. THE BORDER SHALL BE PAINTED WITH PLASTIC EMULSION PAINT.
8. ALL EXPOSED STRUCTURAL STEEL MEMBERS SHALL BE COVERED WITH ADEQUATE VERMICULITE CEMENTITIOUS CLADDING TO ENSURE FIRE RESISTANCE/RATING OF REQUIRED/APPROPRIATE DURATION AS PER NBC 2016.
9. ACOUSTICAL CLADDING AS/ SPECS TO ACHIEVE DESIRED NOISE LEVEL OUTSIDE AHU, SHALL BE PROVIDED ON WALLS OF ALL AHU.
10. ALL PUBLIC AREAS ARE REQUIRED TO BE UNIVERSALLY ACCESSIBLE AND WHEREEVER REQUIRED AS PER ACCESSIBLE GUIDELINES, SS 316 TACTILE STUDS AND STRIPS SHALL BE PROVIDED IN FLOORING.
11. ALL AHU DOORS AND OPENINGS SHALL BE ACOUSTICALLY AND FIRE TREATED.
12. COUNTER IN TOILETS SHALL BE POLISHED, BEVELLED AND EDGE MOULDED 18 MM THICK GRANITE OF APPROVED SHADE.
13. ALL SILL, LINTEL AND JAMBS SHALL BE IN 18MM THICK GRANITE WITH HALF/FULL ROUND EDGE MOULDING AS PER APPROVED DESIGN.
14. ALL SHARED PARTITIONS TO BE OF 100MM THICK JOINTLESS CALCIUM SILICATE BOARD WITH INSULATION AND WITH PLASTIC EMULSION PAINT OVER PUTTY.
15. GLAZED PANELS WITHIN THE PARTITIONS AS INDICATED IN THE ARCHITECTURAL DRAWINGS OR AS REQUIRED BY THE DETAILED ENGINEERING TO BE PROVIDED
16. ALL ELECTRICAL DISTRIBUTION BOARDS SHALL BE WALL RECESSED IN A NICHE AND COVERED WITH AN AESTHETIC ENCLOSURE.

**SCHEDULE OF FINISHING
UTILITY, SUB-STATION & SECURITY BUILDINGS**

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
1	ROOMS	10MM THICK MATT/GLOSS VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED DESIGN. (SIZE OF TILE TO BE 1200MM X 600MM MINIMUM)	VITRIFIED TILE SKIRTING WITH 12MM THICK PREMIXED GYPSUM PLASTER AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	CALCIUM SILICATE CEILING TILES 600MM X 600MM WITH SUSPENDED LINEAR LIGHT FIXTURES. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
2	SUBSTATION, ELECTRICAL ROOM, SERVER ROOM, UTILITY ROOMS	25MM THICK, 600X600 MM PRE-POLISHED KOTA STONE FLOORING	KOTA STONE SKIRTING AND 2MM THICK WALLPUTTY AND PLASTIC EMULSION PAINT ABOVE SKIRTING	PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS ON CEILING
3	TOILET	MATT VITRIFIED TILES AS PER APPROVED DESIGN AND SHADE (MINIMUM SIZE 600MM X 600MM).	GLAZED VITRIFIED TILES OF MINIMUM SIZE 600MM x 1200MM UPTO FALSE CEILING HEIGHT AS PER APPROVED DESIGN AND SHADES.	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
4	CONTROL ROOM	10MM THICK MATT/GLOSS VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED DESIGN. (SIZE OF TILE TO BE 1200MM X 600MM MINIMUM)	VITRIFIED TILE SKIRTING WITH 12MM THICK PREMIXED GYPSUM PLASTER AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	CALCIUM SILICATE CEILING TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY.

OTHER IMPORTANT NOTES ON FINISHES:

1. SS 316 TACTILE STUDS AND STRIPS SHALL BE PROVIDED ON TOP OF FLOORING ALL AS PER UNIVERSAL ACCESS GUIDELINES.
2. ALL JOINTS IN GRANITE/TILES/STONE/MARBLE ETC. SHALL BE FILLED WITH EPOXY GROUT OF THE MATCHING SHADE AS APPROVED BY ENGINEER-IN-CHARGE
3. THICKNESS OF POP OR PUTTY, WHEREVER MENTIONED, SHALL BE 2MM.
4. SKIRTING SHALL BE FLUSHED WITH DADO.
5. UNLESS OTHERWISE SPECIFIED, HEIGHT OF SKIRTING SHALL BE 150 MM AND HEIGHT OF DADO SHALL BE 1200 MM INCLUDING SKIRTING.
6. UNLESS OTHERWISE SPECIFIED, SKIRTING SHALL BE MADE IN THE SAME MATERIAL AS THE FLOORING.

7. CALCIUM SILICATE BORDER OR GYPSUM BORDER WITH TILE SHALL BE PROVIDED AS PER DESIGN APPROVED BY ENGINEER-IN-CHARGE IN FORM OF SHOP DRAWING. THE BORDER SHALL BE PAINTED WITH PLASTIC EMULSION PAINT.
8. ALL EXPOSED STRUCTURAL STEEL MEMBERS SHALL BE COVERED WITH ADEQUATE VERMICULITE CEMENTITIOUS CLADDING TO ENSURE FIRE RESISTANCE/RATING OF REQUIRED/APPROPRIATE DURATION AS PER NBC 2016.
9. ACOUSTICAL CLADDING AS/ SPECS TO ACHIEVE DESIRED NOISE LEVEL OUTSIDE AHU, SHALL BE PROVIDED ON WALLS OF ALL AHU.
10. ALL PUBLIC AREAS ARE REQUIRED TO BE UNIVERSALLY ACCESSIBLE AND WHEREEVER REQUIRED AS PER ACCESSIBLE GUIDELINES, SS 316 TACTILE STUDS AND STRIPS SHALL BE PROVIDED IN FLOORING.
11. ALL AHU DOORS AND OPENINGS SHALL BE ACOUSTICALLY AND FIRE TREATED.
12. COUNTER IN TOILETS SHALL BE POLISHED, BEVELLED AND EDGE MOULDED 18 MM THICK GRANITE OF APPROVED SHADE.
13. ALL SILL, LINTEL AND JAMBS SHALL BE IN 18MM THICK GRANITE WITH HALF/FULL ROUND EDGE MOULDING AS PER APPROVED DESIGN.
14. ALL SHARED PARTITIONS TO BE OF 100MM THICK JOINTLESS CALCIUM SILICATE BOARD WITH INSULATION AND WITH PLASTIC EMULSION PAINT OVER PUTTY.
15. GLAZED PANELS WITHIN THE PARTITIONS AS INDICATED IN THE ARCHITECTURAL DRAWINGS OR AS REQUIRED BY THE DETAILED ENGINEERING TO BE PROVIDED
16. ALL ELECTRICAL DISTRIBUTION BOARDS SHALL BE WALL RECESSED IN A NICHE AND COVERED WITH AN AESTHETIC ENCLOSURE.

SCHEDULE '2'**EXTERNAL FINISHING SCHEDULE FOR ALL BUILDINGS**

S.N.	LOCATION	DESCRIPTION OF ITEM/ BRIEF SPECIFICATION
1.	ADMINISTRATION DEPARTMENT BUILDING	(i) <u>FACADE</u> : STRUCTURAL GLAZING SYSTEM AND CURTAIN GLAZING SYSTEM AS SHOWN IN THE RENDERED IMAGE WITH INSULATED DOUBLE GLAZED VISION UNITS (MINIMUM 6+12+6MM) OR AS REQUIRED BY THE DETAILED ENGINEERING).
2.	WILDLIFE HEALTH MANAGEMENT AND DISEASES INVESTIGATION AND SURVEILLANCE BUILDING	(ii) <u>EXTERNAL/EXPOSED WALLS & FASCIA</u> : COMBINATION OF BRICK/STONE/GRC CLADDING WITH 15 MM THICK 1:4 CEMENT PLASTER WITH TEXTURE PAINT AS SHOWN IN THE RENDERED IMAGE (iii) <u>ROOF</u> : OVERDECK INSULATION CUM WATERPROOFING AS PER SPECIFICATIONS (iv) <u>STEPS</u> : 18MM THICK PRE-POLISHED GRANITE TREADS AND RISERS WITH 4 NOS. STAINLESS STEEL INSERTS
3.	INFORMATIC AND ANALYTICS & NETWORK & OUTREACH UNIT BUILDING	(v) <u>RAMPS</u> : FULL WIDTH 18MM THICK SHOTBLAST FINISH GRANITE. (vi) <u>ROOF AND RAMP PARAPET</u> – 1.2M HIGH, FINISHING AS PER EXTERNAL FINISHING SCHEDULE AND DRAWINGS
4	TRAINING AND CAPACITY	(vii) <u>STAIRCASE RAILING</u> : STAINLESS STEEL RAILING WITH SS 316 GRADE STAINLESS STEEL OF 50 MM DIA. OF 18 GAUGE HANDRAIL 1300 MM HEIGHT WITH ADEQUATE 20 GAUGE RODS PARALLEL TO HANDRAIL, BALUSTERS, FLANGES, END CAPS, NEWEL POSTS WITH CAPS ETC. COMPLETE AS PER APPROVED DESIGN BY ENGINEER IN CHARGE.
5.	UTILITY, SUB-STATION & SECURITY BUILDINGS	

OTHER IMPORTANT NOTES ON FINISHES:

1. ALL OUTDOOR SERVICES SHALL BE COVERED/CAMOUFLAGED WITH A GRC JAALI FENCING WITH ALL NECESSARY PROVISIONS FOR CLIMBING OF CREEPERS.
2. ALL EXTERNAL FEEDER PILLARS SHALL BE ENCLOSED IN A STONE CLADDED MASONRY ENCLOSURE WITH OPENABLE ALUMINIUM LOUVERED SHUTTERS POWDERCOATED TO MATCH THE STONE SHADE.



FIGURE '1': REPRESENTATIVE IMAGE OF FAÇADE FOR ADMINISTRATION DEPARTMENT BUILDING



FIGURE '2': REPRESENTATIVE IMAGE OF WILDLIFE HEALTH AND DISEASE INVESTIGATION AND SURVEILLANCE



FIGURE '3' : REPRESENTATIVE IMAGE OF INFORMATICS AND ANALYTICS & NETWORK & OUTREACH UNIT BUILDING

SCHEDULE '3A'**DOOR & WINDOW SCHEDULE****(ADMINISTRATION DEPARTMENT BUILDING)**

TAG	LOCATION	WIDTH (R.O)	SILL (R.O)	LINTEL (R.O)	REMARKS
GLAZED AUTOMATIC SLIDING DOOR					
D1	ENTRY/ EXIT	2400	0	2150	AUTOMATIC FRAMED GLAZED DOOR WITH AIR CURTAIN
GLAZED DOOR					
D2	BOARD ROOM, MEETING ROOM, CANTEEN	1250	0	2150	FULLY GLAZED DOOR ASSEMBLY WITH ALLOY ALUMINIUM DOOR SHUTTER/FRAMES
METAL DOOR					
D3	TECHNICAL ASSISTANT ROOM, PANTRY, KITCHEN, PROCUREMENT OFFICERS, AUDIT OFFICER, EXTERNAL AUDITOR, LEGAL EXPERT, ADMINOFFICER, ESTABLISHMENT OFFICER	1050	0	2150	LAMINATED FLUSH DOOR
D4	WAITING ROOM, VICE CHAIRMAN ROOM, WAITING LOUNGE, CHAIRMAN'S ROOM, DEPUTY DIRECTOR'S ROOM, DIRECTOR'S ROOM, MULTIPURPOSE SPACE, ADMIN WORK STATIONS, FINANCE HOD, ADMIN HOD	1250	0	2150	LAMINATED FLUSH DOOR
D5	INVENTORY STORE, ELECTRICAL ROOM	1050	0	2150	LAMINATED FLUSH DOOR
D6	TOILETS, GENTS TOILET, LADIES TOILET	1050	0	2150	LAMINATED FLUSH DOOR WITH 50MM UNDERCUT
WOODEN DOOR					
D7	TOILETS (WC>1)	750	200	2000	CUBICLES
WINDOWS					
1	IN ALL ROOMS/CABINS ON THE EXTERNAL/EXPOSED WALL	1200-2400	900	2150	ALLOY ALUMINUM GLAZED (HERMATICALLY SEALED DOUBLE GLAZED UNIT) WINDOW AS PER SPECIFICATION

NOTE: ANY ADDITIONAL DOORS (INCLUDING FIRE RATED DOORS IN LIEU OF NON-FIRE RATED DOORS) AND WINDOWS AS REQUIRED AS A RESULT OF THE DETAILED ENGINEERING SHALL BE PROVIDED IN LINE WITH THE GUIDELINES LAID IN THIS DOCUMENT

HARDWARE SCHEDULE FOR DOOR & WINDOWS – ADMINISTRATION DEPARTMENT BUILDING

HARDWARE	D02	D03	D04	D05	D06
VISION PANEL	Y	Y	N	N	N
BUTT HINGES	Y*	Y	Y	Y	Y
DOOR CLOSER	Y*	Y	Y	Y	Y
GRAVITY COORDINATOR	Y*	N	N	N	N
DOOR LOCK	Y	Y	Y	Y	Y
DOOR HANDLE (PAIR)	Y	Y	Y	Y	Y
FLUSH BOLT	Y*	N	N	N	N
FLOOR SOCKET	Y*	N	N	N	N
DOOR STOPPER	Y	Y	Y	Y	Y
DOOR BOTTOM SEAL	N	N	N	N	N
DELTA SEAL	N	N	N	N	N
PA BRACKET	Y*	Y	Y	Y	Y
PUSH PLATE	Y	N	N	N	N
ARMOUR PLATE	N	N	N	N	N
SIGN PLATE	Y	Y	Y	Y	Y
MOP PLATE	N	N	N	N	Y
KICK PLATE	N	N	N	N	Y

*IN CASE OF BOTH SIDE SWING DOORS, OTHER SET OF HARDWARE (E.G. PATCH FITTING, PIVOT, FLOOR SPRING ETC.) REQUIRED FOR THESE DOORS SHALL BE USED IN ADDITION OF HARDWARE MENTIONED HEREIN.

NOTE:

1. THE HARDWARE OF FIRE CHECK/RATED DOORS AND WINDOWS SHALL ALSO BE FIRE RATED. THEY SHALL BE EITHER UL OR CE CERTIFIED.
2. HARDWARE SHOWN WITH ANNOTATION/MARKING ‘Y’ AGAINST PARTICULAR DOOR TYPE IN HARDWARE SCHEDULE SHALL BE PROVIDED. HARDWARE SHOWN WITH ANNOTATION/MARKING ‘N’ AGAINST PARTICULAR DOOR TYPE IN HARDWARE SCHEDULE SHALL NOT BE PROVIDED. HOWEVER, IF REQUIRED (AS PER NBC OR OTHER STANDARDS OR FOR FUNCTIONALITY), CONTRACTOR SHALL PROVIDE THE HARDWARE SHOWN WITH ANNOTATION/MARKING ‘N’ AGAINST PARTICULAR DOOR TYPE. APART FROM ABOVE HARDWARE, ACCESSORIES AND OTHER HARDWARE AS SPECIFIED IN PARTICULAR SPECIFICATION SHALL BE PROVIDED AS PER REQUIREMENT AND DIRECTIONS OF ENGINEER-IN-CHARGE. HARDWARE, FOR DOOR TYPE NOT MENTIONED ABOVE, SHALL BE DECIDED BY ENGINEER-IN-CHARGE. HARDWARE FOR THE WINDOWS, VENTILATORS, SPECIALIZED DOORS SHALL BE AS PER DRAWINGS, FUNCTIONAL REQUIREMENT AS DECIDED BY ENGINEER-IN-CHARGE.

SCHEDULE '3B'**DOOR & WINDOW SCHEDULE****(WILDLIFE HEALTH MANAGEMENT AND DISEASES INVESTIGATION AND SURVEILLANCE BUILDING)**

TAG	LOCATION	WIDTH (R.O)	SILL (R.O)	LINTEL (R.O)	REMARKS
GLAZED AUTOMATIC SLIDING DOOR					
D1	ENTRY/ EXIT	2400	0	2150	AUTOMATIC FRAMED GLAZED DOOR WITH AIR CURTAIN
GLAZED DOOR					
D2	BOARD ROOM, MEETING ROOM, CANTEEN	1250	0	2150	FULLY GLAZED DOOR ASSEMBLY WITH ALUMINIUM ALLOY DOOR SHUTTER/FRAMES
METAL DOOR					
D3	CABINS, PANTRY, WILDLIFE BIOLOGIST, RESEARCH ASSOCIATES, IMMUNOLOGIST, MICROBIOLOGIST, ANIMAL NUTRITIONIST, CHEMIST, JUNIOR AND SENIOR VETENINARY DOCTOR, BIostatistician, TOXICOLOGIST, PATHOLOGIST, EPIDEMIOLOGIST, BIOINFORMATIC EXPERT, BIOTECHNOLOGIST, VACCINOLOGIST, MOLUCULAR BIOLOGIST, SAMPLE COLLECTION	1050	0	2150	LAMINATED FLUSH DOOR WITH VISION PANEL
D4	WAITING ROOM, HOD WILDLIFE DISEASE INVESTIGATION, WAITING LOUNGE, LABORATORIES,	1250	0	2150	LAMINATED FLUSH DOOR
D4A	TREATMENT WARD, TREATMENT AREA, INSTRUMENT ROOM, OPERATION THEATRE,	2100	0	2150	DOUBLE LEAF LAMINATED FLUSH DOOR
D5	STORE, ELECTRICAL ROOM	1050	0	2150	LAMINATED FLUSH DOOR
D6	TOILETS, GENTS TOILET, LADIES TOILET	1050	0	2150	LAMINATED FLUSH DOOR WITH 50MM UNDERCUT
WOODEN DOOR					
D7	TOILETS (WC>1)	750	200	2000	CUBICLES
WINDOWS					
1	IN ALL ROOMS/CABINS ON THE EXTERNAL/EXPOSED WALL	1200-2400	900	2150	ALLOY ALUMINUM GLAZED (HERMATICALLY SEALED DOUBLE GLAZED UNIT) WINDOW AS PER SPECIFICATION

NOTE: ANY ADDITIONAL DOORS (INCLUDING FIRE RATED DOORS IN LIEU OF NON-FIRE RATED DOORS) AND WINDOWS AS REQUIRED AS A RESULT OF THE DETAILED ENGINEERING SHALL BE PROVIDED IN LINE WITH THE GUIDELINES LAID IN THIS DOCUMENT

HARDWARE SCHEDULE FOR DOOR & WINDOWS – WILDLIFE HEALTH MANAGEMENT AND DISEASES INVESTIGATION AND SURVEILLANCE BUILDING

HARDWARE	D02	D03	D04	D05	D06
VISION PANEL	Y	Y	N	N	N
BUTT HINGES	Y*	Y	Y	Y	Y
DOOR CLOSER	Y*	Y	Y	Y	Y
GRAVITY COORDINATOR	Y*	N	N	N	N
DOOR LOCK	Y	Y	Y	Y	Y
DOOR HANDLE (PAIR)	Y	Y	Y	Y	Y
FLUSH BOLT	Y*	N	N	N	N
FLOOR SOCKET	Y*	N	N	N	N
DOOR STOPPER	Y	Y	Y	Y	Y
DOOR BOTTOM SEAL	N	N	N	N	N
DELTA SEAL	N	N	N	N	N
PA BRACKET	Y*	Y	Y	Y	Y
PUSH PLATE	Y	N	N	N	N
ARMOUR PLATE	N	N	N	N	N
SIGN PLATE	Y	Y	Y	Y	Y
MOP PLATE	N	N	N	N	Y
KICK PLATE	N	N	N	N	Y

*IN CASE OF BOTH SIDE SWING DOORS, OTHER SET OF HARDWARE (E.G. PATCH FITTING, PIVOT, FLOOR SPRING ETC.) REQUIRED FOR THESE DOORS SHALL BE USED IN ADDITION OF HARDWARE MENTIONED HEREIN.

NOTE:

1. THE HARDWARE OF FIRE CHECK/RATED DOORS AND WINDOWS SHALL ALSO BE FIRE RATED. THEY SHALL BE EITHER UL OR CE CERTIFIED.
2. HARDWARE SHOWN WITH ANNOTATION/MARKING ‘Y’ AGAINST PARTICULAR DOOR TYPE IN HARDWARE SCHEDULE SHALL BE PROVIDED. HARDWARE SHOWN WITH ANNOTATION/MARKING ‘N’ AGAINST PARTICULAR DOOR TYPE IN HARDWARE SCHEDULE SHALL NOT BE PROVIDED. HOWEVER, IF REQUIRED (AS PER NBC OR OTHER STANDARDS OR FOR FUNCTIONALITY), CONTRACTOR SHALL PROVIDE THE HARDWARE SHOWN WITH ANNOTATION/MARKING ‘N’ AGAINST PARTICULAR DOOR TYPE. APART FROM ABOVE HARDWARE, ACCESSORIES AND OTHER HARDWARE AS SPECIFIED IN PARTICULAR SPECIFICATION SHALL BE PROVIDED AS PER REQUIREMENT AND DIRECTIONS OF ENGINEER-IN-CHARGE. HARDWARE, FOR DOOR TYPE NOT MENTIONED ABOVE, SHALL BE DECIDED BY ENGINEER-IN-CHARGE. HARDWARE FOR THE WINDOWS, VENTILATORS, SPECIALIZED DOORS SHALL BE AS PER DRAWINGS, FUNCTIONAL REQUIREMENT AS DECIDED BY ENGINEER-IN-CHARGE.

SCHEDULE '3C'**DOOR & WINDOW SCHEDULE****(INFORMATIC AND ANALYTICS & NETWORK & OUTREACH UNIT BUILDING)**

TAG	LOCATION	WIDTH (R.O)	SILL (R.O)	LINTEL (R.O)	REMARKS
GLAZED AUTOMATIC SLIDING DOOR					
D1	ENTRY/ EXIT	2400	0	2150	AUTOMATIC FRAMED GLAZED DOOR WITH AIR CURTAIN
GLAZED DOOR					
D2	MEETING ROOM, CANTEEN	1250	0	2150	FULLY GLAZED DOOR ASSEMBLY WITH ALLOY ALUMINIUM DOOR SHUTTER/FRAMES
METAL DOOR					
D3	M&E EXPERT, IT EXPERT, STATITICIAN, GIS EXPERT, SCREEN & SERVER, RRT, MEDIA, POLICY	1050	0	2150	LAMINATED FLUSH DOOR WITH VISION PANEL
D4	WAITING ROOM, HOD INFOMATICS AND ANALYTICS, RESEARCH ASSOCIATES AND DATA ANALYST, BUSINESS CENTRE COORDINATION UNIT, HOD NETWORK AND OUTREACH, RECEPTION	1250	0	2150	LAMINATED FLUSH DOOR
D5	INVENTORY STORE, ELECTRICAL ROOM	1050	0	2150	LAMINATED FLUSH DOOR
D6	TOILETS, GENTS TOILET, LADIES TOILET	1050	0	2150	LAMINATED FLUSH DOOR WITH 50MM UNDERCUT
WOODEN DOOR					
D7	TOILETS (WC>1)	750	200	2000	CUBICLES
WINDOWS					
1	IN ALL ROOMS/CABINS ON THE EXTERNAL/EXPOSED WALL	1200-2400	900	2150	ALLOY ALUMINUM GLAZED (HERMATICALLY SEALED DOUBLE GLAZED UNIT) WINDOW AS PER SPECIFICATION

NOTE: ANY ADDITIONAL DOORS (INCLUDING FIRE RATED DOORS IN LIEU OF NON-FIRE RATED DOORS) AND WINDOWS AS REQUIRED AS A RESULT OF THE DETAILED ENGINEERING SHALL BE PROVIDED IN LINE WITH THE GUIDELINES LAID IN THIS DOCUMENT

HARDWARE SCHEDULE FOR DOOR & WINDOWS – INFORMATIC AND ANALYTICS & NETWORK & OUTREACH UNIT BUILDING

HARDWARE	D02	D03	D04	D05	D06
VISION PANEL	Y	Y	N	N	N
BUTT HINGES	Y*	Y	Y	Y	Y
DOOR CLOSER	Y*	Y	Y	Y	Y
GRAVITY COORDINATOR	Y*	N	N	N	N
DOOR LOCK	Y	Y	Y	Y	Y
DOOR HANDLE (PAIR)	Y	Y	Y	Y	Y
FLUSH BOLT	Y*	N	N	N	N
FLOOR SOCKET	Y*	N	N	N	N
DOOR STOPPER	Y	Y	Y	Y	Y
DOOR BOTTOM SEAL	N	N	N	N	N
DELTA SEAL	N	N	N	N	N
PA BRACKET	Y*	Y	Y	Y	Y
PUSH PLATE	Y	N	N	N	N
ARMOUR PLATE	N	N	N	N	N
SIGN PLATE	Y	Y	Y	Y	Y
MOP PLATE	N	N	N	N	Y
KICK PLATE	N	N	N	N	Y

*IN CASE OF BOTH SIDE SWING DOORS, OTHER SET OF HARDWARE (E.G. PATCH FITTING, PIVOT, FLOOR SPRING ETC.) REQUIRED FOR THESE DOORS SHALL BE USED IN ADDITION OF HARDWARE MENTIONED HEREIN.

NOTE:

1. THE HARDWARE OF FIRE CHECK/RATED DOORS AND WINDOWS SHALL ALSO BE FIRE RATED. THEY SHALL BE EITHER UL OR CE CERTIFIED.
2. HARDWARE SHOWN WITH ANNOTATION/MARKING ‘Y’ AGAINST PARTICULAR DOOR TYPE IN HARDWARE SCHEDULE SHALL BE PROVIDED. HARDWARE SHOWN WITH ANNOTATION/MARKING ‘N’ AGAINST PARTICULAR DOOR TYPE IN HARDWARE SCHEDULE SHALL NOT BE PROVIDED. HOWEVER, IF REQUIRED (AS PER NBC OR OTHER STANDARDS OR FOR FUNCTIONALITY), CONTRACTOR SHALL PROVIDE THE HARDWARE SHOWN WITH ANNOTATION/MARKING ‘N’ AGAINST PARTICULAR DOOR TYPE. APART FROM ABOVE HARDWARE, ACCESSORIES AND OTHER HARDWARE AS SPECIFIED IN PARTICULAR SPECIFICATION SHALL BE PROVIDED AS PER REQUIREMENT AND DIRECTIONS OF ENGINEER-IN-CHARGE. HARDWARE, FOR DOOR TYPE NOT MENTIONED ABOVE, SHALL BE DECIDED BY ENGINEER-IN-CHARGE. HARDWARE FOR THE WINDOWS, VENTILATORS, SPECIALIZED DOORS SHALL BE AS PER DRAWINGS, FUNCTIONAL REQUIREMENT AS DECIDED BY ENGINEER-IN-CHARGE.

SCHEDULE '3D'**DOOR & WINDOW SCHEDULE
(TRAINING AND CAPACITY BUILDING)**

UTILITY, SUB-STATION & SECURITY BUILDINGS, GUARD CABIN

TAG	LOCATION	WIDTH (R.O)	SILL (R.O)	LINTEL (R.O)	REMARKS
GLAZED AUTOMATIC SLIDING DOOR					
D1	ENTRY/ EXIT	2400	0	2150	AUTOMATIC FRAMED GLAZED DOOR WITH AIR CURTAIN
GLAZED DOOR					
D2	MEETING ROOM, CANTEEN	1250	0	2150	FULLY GLAZED DOOR ASSEMBLY WITH ALLOY ALUMINIUM DOOR SHUTTER/FRAMES
METAL DOOR					
D3	TECHNICAL ASSISTANT ROOM, PANTRY, KITCHEN, PROCUREMENT OFFICERS, AUDIT OFFICER, EXTERNAL AUDITOR, LEGAL EXPERT, ADMIN OFFICER, ESTABLISHMENT OFFICER, PEDAGOGY EXPERT, WILDLIFE SME, TRAINER	1050	0	2150	LAMINATED FLUSH DOOR WITH VISION PANEL
D4	HOD TRAINING AND CAPACITY, WAITING AREA, RECEPTION, SMART CLASS ROOM, WORK STATION,	1250	0	2150	LAMINATED FLUSH DOOR
D4A	LIBRARY, INCUBATION CENTRE,	2100	0	2150	DOUBLE LEAF LAMINATED FLUSH DOOR
D5	INVENTORY STORE, ELECTRICAL ROOM	1050	0	2150	LAMINATED FLUSH DOOR
D6	TOILETS, GENTS TOILET, LADIES TOILET	1050	0	2150	LAMINATED FLUSH DOOR WITH 50MM UNDERCUT
WOODEN DOOR					
D7	TOILETS (WC>1)	750	200	2000	CUBICLES
WINDOWS					
1	IN ALL ROOMS/CABINS ON THE EXTERNAL/EXPOSED WALL	1200-2400	900	2150	ALLOY ALUMINUM GLAZED (HERMATICALLY SEALED DOUBLE GLAZED UNIT) WINDOW AS PER SPECIFICATION

NOTE: ANY ADDITIONAL DOORS (INCLUDING FIRE RATED DOORS IN LIEU OF NON-FIRE RATED DOORS) AND WINDOWS AS REQUIRED AS A RESULT OF THE DETAILED ENGINEERING SHALL BE PROVIDED IN LINE WITH THE GUIDELINES LAID IN THIS DOCUMENT

HARDWARE SCHEDULE FOR DOOR & WINDOWS – TRAINING AND CAPACITY BUILDING

HARDWARE	D02	D03	D04	D05	D06
VISION PANEL	Y	Y	N	N	N
BUTT HINGES	Y*	Y	Y	Y	Y
DOOR CLOSER	Y*	Y	Y	Y	Y
GRAVITY COORDINATOR	Y*	N	N	N	N
DOOR LOCK	Y	Y	Y	Y	Y
DOOR HANDLE (PAIR)	Y	Y	Y	Y	Y
FLUSH BOLT	Y*	N	N	N	N
FLOOR SOCKET	Y*	N	N	N	N
DOOR STOPPER	Y	Y	Y	Y	Y
DOOR BOTTOM SEAL	N	N	N	N	N
DELTA SEAL	N	N	N	N	N
PA BRACKET	Y*	Y	Y	Y	Y
PUSH PLATE	Y	N	N	N	N
ARMOUR PLATE	N	N	N	N	N
SIGN PLATE	Y	Y	Y	Y	Y
MOP PLATE	N	N	N	N	Y
KICK PLATE	N	N	N	N	Y

*IN CASE OF BOTH SIDE SWING DOORS, OTHER SET OF HARDWARE (E.G. PATCH FITTING, PIVOT, FLOOR SPRING ETC.) REQUIRED FOR THESE DOORS SHALL BE USED IN ADDITION OF HARDWARE MENTIONED HEREIN.

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SCHEDULE '3E'

DOOR & WINDOW SCHEDULE

(UTILITY, SUB-STATION & SECURITY BUILDINGS, GUARD CABIN ETC.)

TAG	LOCATION	WIDTH (R.O)	SILL (R.O)	LINTEL (R.O)	REMARKS
METAL DOOR					
D3	ROOMS, CABINS	1050	0	2150	METAL DOOR WITH VISION PANEL
D5	INVENTORY STORE, ELECTRICAL ROOM	1050	0	2150	METAL DOOR
D6	TOILETS, GENTS TOILET, LADIES TOILET	1050	0	2150	METAL DOOR WITH 50MM UNDERCUT
WOODEN DOOR					
D7	TOILETS (WC>1)	750	200	2000	CUBICLES
WINDOWS					
1	IN ALL ROOMS/CABINS ON THE EXTERNAL/EXPOSED WALL	1200-2400	900	2150	ALLOY ALUMINUM GLAZED (HERMATICALLY SEALED DOUBLE GLAZED UNIT) WINDOW AS PER SPECIFICATION

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HARDWARE SCHEDULE FOR DOOR & WINDOWS – UTILITY, SUB-STATION & SECURITY BUILDINGS, GUARD CABIN ETC.

HARDWARE	D02	D03	D04	D05	D06
VISION PANEL	Y	Y	N	N	N
BUTT HINGES	Y*	Y	Y	Y	Y
DOOR CLOSER	Y*	Y	Y	Y	Y
GRAVITY COORDINATOR	Y*	N	N	N	N
DOOR LOCK	Y	Y	Y	Y	Y
DOOR HANDLE (PAIR)	Y	Y	Y	Y	Y
FLUSH BOLT	Y*	N	N	N	N
FLOOR SOCKET	Y*	N	N	N	N
DOOR STOPPER	Y	Y	Y	Y	Y
DOOR BOTTOM SEAL	N	N	N	N	N
DELTA SEAL	N	N	N	N	N
PA BRACKET	Y*	Y	Y	Y	Y
PUSH PLATE	Y	N	N	N	N
ARMOUR PLATE	N	N	N	N	N
SIGN PLATE	Y	Y	Y	Y	Y
MOP PLATE	N	N	N	N	Y
KICK PLATE	N	N	N	N	Y

*IN CASE OF BOTH SIDE SWING DOORS, OTHER SET OF HARDWARE (E.G. PATCH FITTING, PIVOT, FLOOR SPRING ETC.) REQUIRED FOR THESE DOORS SHALL BE USED IN ADDITION OF HARDWARE MENTIONED HEREIN.

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SCHEDULE '4'

SCHEDULE OF WATERPROOFING IN ALL BUILDINGS

S. N.	BUILDING / BLOCK / AREA	LOCATION	DESCRIPTION OF ITEM / BRIEF SPECIFICATIONS
1	* ADMINISTRATION DEPARTMENT BUILDING	FOUNDATION	PRE-APPLIED HDPE MEMBRANE AS PER SPECIFICATION MENTIONED IN CONTRACT DOCUMENT + POST-APPLIED SBS MEMBRANE AS PER SPECIFICATION MENTIONED IN CONTRACT DOCUMENT
	* WILDLIFE HEALTH MANAGEMENT AND DISEASES INVESTIGATION AND SURVEILLANCE BUILDING		
	* INFORMATIC AND ANALYTICS & NETWORK & OUTREACH UNIT BUILDING	PLINTH/GRADE SLAB	PRE-APPLIED HDPE MEMBRANE AS PER SPECIFICATION MENTIONED IN CONTRACT DOCUMENT
	* TRAINING AND CAPACITY	TOILET/PANTRY/JANITOR ROOM	CEMENTITIOUS COATING SYSTEM AS PER SPECIFICATION MENTIONED IN CONTRACT DOCUMENT
	* UTILITY, SUB-STATION & SECURITY BUILDINGS		
	* GUARD CABIN	TERRACE	PU WATERPROOFING MEMBRANE WITH PU FOAM INSULATION AS PER SPECIFICATION MENTIONED IN CONTRACT DOCUMENT
2	UGT/WTP	OUTSIDE	PRE-APPLIED HDPE MEMBRANE AS PER SPECIFICATION MENTIONED IN CONTRACT DOCUMENT + POST-APPLIED SBS MEMBRANE AS PER SPECIFICATION MENTIONED IN CONTRACT DOCUMENT
		INSIDE	AS PER SPECIFICATION MENTIONED IN CONTRACT DOCUMENT
3	STP	OUTSIDE	PRE-APPLIED HDPE MEMBRANE AS PER SPECIFICATION MENTIONED IN CONTRACT DOCUMENT + POST-APPLIED SBS MEMBRANE AS PER SPECIFICATION MENTIONED IN CONTRACT DOCUMENT
		INSIDE	AS PER SPECIFICATION MENTIONED IN CONTRACT DOCUMENT
4	WATER BODIES	-	GEOTEXTILE WITH MIN. 1.8MM THICK PVC WATERPROOFING MEMBRANE AS PER SPECIFICATION MENTIONED IN CONTRACT DOCUMENT

NOTE:

1. ALL THE WATERPROOFING SHALL BE DONE AS PER THE SPECIFICATIONS MENTIONED IN CONTRACT DOCUMENTS.
2. IF DETAILS FOR ANY AREAS ARE NOT MENTIONED HEREINABOVE, THE DETAILS OF THE AREA HAVING FUNCTIONAL SIMILARITY SHALL BE FOLLOWED.
3. ALL RCC WORKS SHALL BE ADMIXED WITH CEMENTITIOUS INTEGRAL CRYSTALLINE ADMIXTURE AS MENTIONED IN CONTRACT DOCUMENT.
4. THE CONTRACTOR SHALL PROVIDE THE WARRANTY FOR 10 YEARS FOR THE EXECUTED WATERPROOFING WORKS.

SCHEDULE '5'**SCHEDULE OF PLUMBING FIXTURES & FITTINGS IN ALL BUILDINGS BLOCK**

S. N.	ITEM	DESCRIPTION	FINISH	OPTION-1	OPTION-2	OPTION-3
I	WASHROOMS / TOILETS					
A	BASIN AREA					
1	BASIN FAUCET	PRESSMATIC WALL MOUNTED BASIN TAP (AUTO CLOSING) WITH WALL FLANGE (SQUARE)	CHROME	JAQUAR (PRS-O61)	ROCA (RT5A7877 C00)	KOHLER (K-23486IN-4ND-AF)
2	BOTTLE TRAP	BOTTLE TRAP (WITH INTERNAL PARTITION) 32MM SIZE WITH 300MM & 190MM LONG WALL CONNECTION PIPES & WALL FLANGE	CHROME	JAQUAR (ALD 769 L 300 X 190)	ROCA (RF9066A1)	KOHLER (K-75823IN-CP)
4	CLICK WASTE	CLICK CLACK WASTE 32MM SIZE HALF THREAD WITH 80MM/ 130MM HEIGHT	CHROME	JAQUAR (ALD 729L130)	ROCA (RF5054019 A1)	KOHLER (K-1065000-CP)
5	BRAIDED HOSE	600MM LONG BRAIDED HOSE WITH M10X1 NIPPLE, 15MM NUT, O-RING & RUBBER WASHER	CHROME	JAQUAR (ALD 801 B)	ROCA (RF5B2115 C00 (SHOWER HOSE))	KOHLER (K-12067T-RGD)
6	ANGULAR STOP COCK	ANGULAR STOP COCK WITH WALL FLANGE	CHROME	JAQUAR (OPP 15053 PM)	ROCA (RT5A8090 CA1)	KOHLER (K-80156IN-4-CP)
7	BASIN	TABLE TOP BASIN, SIZE: 700 X 435 X 135MM	WHITE	JAQUAR (ARS-WHT-39903)	ROCA (RS3275L0 00C)	KOHLER (K-2661IN-47)
8	AUTOMATIC SOAP DISPENSER	SOAP DISPENSER	SS	EURONICS (ES80A)	ROCA (RA816391 001)	KOHLER (K-5487K-CP)
9	HAND DRIER PANEL	(HAND DRYER + TISSUE DISPENSER + WASTE RECEPTACLE)	SS	EURONICS (KINOX KMR33A)	DOLPHY (DWCB000 1)	TOTO (TYC602P)
B	URINAL					
1	URINAL	URINAL WITH FIXING ACCESSORIES, SIZE: 370X315X620MM	WHITE	JAQUAR (URS WHT 13253N)	ROCA (RS35945M 000)	KOHLER (K-18645IN-SS-0)
2	ANGULAR STOP COCK	ANGULAR STOP COCK WITH WALL FLANGE	CHROME	JAQUAR (OPP 15053 PM)	ROCA (RT5A8090 CA1)	KOHLER (K-80156IN-4-CP)
3	SENSOR	AQUISENSE SENSOR CONCEALED TYPE FLUSHING VALVE FOR URINAL COMPLETE SET WITH INSTALLATION BOX WITH CONTROL COCK	CHROME	JAQUAR (SNR-STL-51083)	ROCA (RS35945M 000 (INCLUDE D IN URINAL))	KOHLER (K-24199IN-C03-CP)

C	WC AREA					
1	HEALTH FAUCET	HAND SHOWER (HEALTH FAUCET) WITH 1 METER LONG EASY FLEX TUBE IN CHROME FINISH & WALL HOOK	CHROME	JAQUAR (ALD 565)	ROCA (RF9060A1)	KOHLER (K-97258IN-CP)
2	TOILET ROLL HOLDER WITH FLAP	TOILET ROLL HOLDER WITH STAINLESS STEEL FLAP	CHROME	JAQUAR (AKP-35753PS)	ROCA (RA816662001)	KOHLER (K-97503T-CP)
3	ANGULAR STOP COCK	ANGULAR STOP COCK WITH WALL FLANGE	CHROME	JAQUAR (OPP 15053 PM)	ROCA (RT5A8090 CA1)	KOHLER (K-80156IN-4-CP)
4	CONCEALED CISTERN WITH FRAME	SINGLE PIECE SLIM CONCEALED CISTERN WITH FLOOR MOUNTING FRAME, INSTALLATION KIT AND "P-TYPE" DRAIN PIPE CONNECTION SET FOR WALL HUNG WC (WITHOUT FLUSH CONTROL PLATE)	NA	JAQUAR (JCS-WHT-2400FS)	ROCA (RE890010020)	KOHLER (K-77028IN-M-NA)
5	FLUSH PLATE	CONTROL PLATE KUBIX	CHROME	JAQUAR (JCP-CHR-352415)	ROCA (RE890196001)	KOHLER (K-8857IN-M-MS1)
6	WC	RIMLESS, BLIND INSTALLATION WALL HUNG WC WITH UF SOFT CLOSE SEAT COVER, HINGES, ACCESSORIES SET, SIZE : 345X490X360 MM	WHITE	JAQUAR (ARS-WHT-39953BIUFSM)	ROCA (RS34647L000)	KOHLER (K-99994IN-0)
7	ROBE HOOK	DOUBLE COAT HOOK	CHROME	JAQUAR (ACN 1161 N)	ROCA (RA815491001)	KOHLER (K-72572T-CP)
II	DIFFERENTIALLY ABLED TOILET					
A	BASIN AREA					
1	BASIN FAUCET	SENSOTRONIC SENSOR FAUCET FOR WASH BASIN	CHROME	JAQUAR (SNR-51021)	ROCA (RT5A7877C00)	KOHLER (K-20747IN-8-CP)
2	BOTTLE TRAP	BOTTLE TRAP (WITH INTERNAL PARTITION) 32MM SIZE WITH 300MM & 190MM LONG WALL CONNECTION PIPES & WALL FLANGE	CHROME	JAQUAR (ALD 769 L 300 X 190)	ROCA (RF9066A1)	KOHLER (K-75823IN-CP)
4	CLICK WASTE	CLICK CLACK WASTE 32MM SIZE HALF THREAD WITH 80MM/ 130MM HEIGHT	CHROME	JAQUAR (ALD 729L130)	ROCA (RF5054019A1)	KOHLER (K-1065000-CP)
5	BRAIDED HOSE	600MM LONG BRAIDED HOSE WITH M10X1 NIPPLE, 15MM NUT, O-RING & RUBBER WASHER	CHROME	JAQUAR (ALD 801 B)	ROCA (RF5B2115C00)	KOHLER (K-12067T-RGD)

6	ANGULAR STOP COCK	ANGULAR STOP COCK WITH WALL FLANGE	CHROME	JAQUAR (OPP 15053 PM)	ROCA (RT5A8090 CA1)	KOHLER (K-80156IN-4-CP)
7	BASIN	WALL HUNG INTEGRATED BASIN, WITH FIXING ACCESSORIES SIZE : 490X450X375 MM	WHITE	JAQUAR (ONS-WHT-10801)	ROCA (RS3275L0 00C)	KOHLER (K-2661IN-47)
B	URINAL					
1	URINAL	URINAL WITH FIXING ACCESSORIES, SIZE: 370X315X620MM	WHITE	JAQUAR (URS WHT 13253N)	ROCA (RS35945M 000)	KOHLER (K-18645IN-SS-0)
2	SENSOR	AQUISENSE SENSOR CONCEALED TYPE FLUSHING VALVE FOR URINAL COMPLETE SET WITH INSTALLATION BOX WITH CONTROL COCK	CHROME	JAQUAR (SNR-STL-51083)	ROCA (RS35945M 000 (INCLUDE D IN URINAL))	KOHLER (K-24199IN-C03-CP)
C	WC AREA					
1	HEALTH FAUCET	HAND SHOWER (HEALTH FAUCET) WITH 1 METER LONG EASY FLEX TUBE IN CHROME FINISH & WALL HOOK	CHROME	JAQUAR (ALD 565)	ROCA (RF9060A1)	KOHLER (K-97258IN-CP)
2	TOILET ROLL HOLDER WITH FLAP	TOILET ROLL HOLDER WITH STAINLESS STEEL FLAP	CHROME	JAQUAR (AKP-35753PS)	ROCA (RA816662 001)	KOHLER (K-97503T-CP)
3	ANGULAR STOP COCK	ANGULAR STOP COCK WITH WALL FLANGE	CHROME	JAQUAR (OPP 15053 PM)	ROCA (RT5A8090 CA1)	KOHLER (K-80156IN-4-CP)
4	CONCEALED CISTERN WITH FRAME	SINGLE PIECE SLIM CONCEALED CISTERN WITH FLOOR MOUNTING FRAME, INSTALLATION KIT AND "P-TYPE" DRAIN PIPE CONNECTION SET FOR WALL HUNG WC (WITHOUT FLUSH CONTROL PLATE)	NA	JAQUAR (JCS-WHT-2400FS)	ROCA (RE8900100 20)	KOHLER (K-77028IN-M-NA)
5	FLUSH PLATE	CONTROL PLATE KUBIX	CHROME	JAQUAR (JCP-CHR-352415)	ROCA (RE8901960 01)	KOHLER (K-8857IN-M-MS1)
6	WC	RIMLESS, BLIND INSTALLATION WALL HUNG WC WITH UF SOFT CLOSE SLIM SEAT COVER, HINGES, ACCESSORIES SET, SIZE : 370X490X365 MM	WHITE	JAQUAR (ONS-WHT-10953BIUFS M)	ROCA (RS34647L 000)	KOHLER (K-99994IN-0)
D	MISCELLANEOUS					
1	TISSUE DISPENSER PANEL	(TISSUE DISPENSER + WASTE RECEPTACLE	SS	EURONICS (KINOX KPD RN)	DOLPHY (DWCB000 3)	-

2	AUTOMATIC SOAP DISPENSER	SOAP DISPENSER	SS	EURONICS (ES80A)	ROCA (RA816391001)	KOHLER (K-5487K-CP)
3	SPECIALLY ABLED TOILET FITTINGS SUCH AS GRAB BARS FOR WASH BASIN , WC AND WHEEL CHAIR HANDRAIL.					
III PANTRY/UTILITY						
A BASIN AREA						
1	SINK FAUCET	EXPOSED PART KIT OF SINGLE LEVER BASIN MIXER WALL MOUNTED CONSISTING OF OPERATING LEVER, WALL FLANGE, NIPPLE & SPOUT	CHROME	JAQUAR (COP-179BPM)	ROCA (RT5A8497CA1)	KOHLER (K-13963T-C4-VS)
2	DOUBLE BOWL WITH SINGLE DRAIN BOARD SINK WITH PLUMBING CONNECTORS	SS SINK OF SIZE 1690 X 510 MM. ANTI SCRATCH FINISH	WHITE	JAYNA (DBSD 02)	NEELKANTH (ALEXENDER 5418 DBSD)	HINDWAR E (ENRICO)



IV INTERNAL WATER SUPPLY LINE						
A DOMESTIC WATER						
A.1	INTERNAL TOILETS FOR COLD AND HOT WATER SUPPLY		STAINLESS STEEL GRADE AISI 316 PIPES CONFIRMING TO REQUIREMENTS OF JIS G 3448 AND THE PRESS FITTINGS SHALL CONFIRM TO JWWA G 116 FOR PRESS CONNECTION SYSTEM WITH LEAK BEFORE PRESSED FUNCTION (LBP) SHOWING PENETRATION OF WATER AT THE UNPRESSED CONNECTION WHILE FILLING THE INSTALLATION. THE SYSTEM SHOULD WITHSTAND WORKING PRESSURE OF 15 KG/CM2 AND TEST PRESSURE 25 KG/CM2 AT 30 MINUTES			
A.2	PIPE UNDER VERTICAL IN SHAFT AND TERRACE FOR COLD AND HOT WATER SUPPLY					
B	FLUSHING WATER SUPPLY		CPVC PIPE & FITTINGS			
C	DRAINAGE – SOIL, WASTE & VENT PIPE		UPVC SWR TYPE ‘B’			
D	VENT PIPE & RAIN WATER DOWN TAKE PIPE		UPVC SWR TYPE ‘A’			
V EXTERNAL WATER SUPPLY LINE						



A	DOMESTIC WATER		
A.1	PLANT ROOM	UPVC SCH-40 PIPE & FITTINGS	
A.2	EXTERNAL/TRUNK PIPING	HDPE (PE 80 GRADE) PIPE & FITTINGS	
B	FLUSHING WATER		
B.1	STP PLANT ROOM PIPING	UPVC SCH-40 PIPE & FITTINGS	
B.2	EXTERNAL/TRUNK PIPING	HDPE (PE 80 GRADE) PIPE & FITTINGS	
C	SEWERAGE SYSTEM	HDPE DWC PIPE SN 8 GRADE	
D	STORM WATER SYSTEM	RCC NP3 CLASS PIPE	
E	MANHOLE COVER & FRAME	SFRC MANHOLE COVER & FRAME	

NOTE -




1. CONTRACTOR SHALL FURNISH WITHOUT COST ALL SUCH ACCESSORIES AND FIXING DEVICES THAT ARE NECESSARY AND REQUIRED BUT NOT SUPPLIED ALONG WITH THE PLUMBING FIXTURES & CP FITTINGS BY THE MANUFACTURERS AS A PART OF THE ORIGINAL AND STANDARD SUPPLY. ALL FITTINGS AND FIXTURES SHALL BE FIXED IN A NEAT WORKMANLIKE MANNER TRUE TO LEVEL AND HEIGHTS SHOWN ON THE DRAWINGS AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. CARE SHALL BE TAKEN TO FIX ALL INLET AND OUTLET PIPES AT CORRECT POSITIONS. FIXING SCREWS SHALL BE HALF ROUND HEAD CHROMIUM PLATED BRASS SCREWS WITH C.P. WASHERS WHERE NECESSARY. CONTRACTOR SHALL SEAL ALL FIXTURES FIXED NEAR WALL, MARBLE AND EDGES. WITH AN APPROVED TYPE OF POLY-SULPHIDE SEALANT APPROPRIATE FOR ITS APPLICATION.
2. THE CONTRACTOR SHALL REDEVELOP THE EXISTING THE TUBEWELLS THAT WILL BE INCLUDING THE INCREASE IN DIA, DEPTH ETC. INCLUDING PROVIDING ALL REQUIRED EQUIPMENT AND ACCESSORIES AS REQUIRED FOR FULLY FUNCTIONAL AND TO MEET THE 1 DAY WATER REQUIREMENT IN CASE OF EMERGENCY.
3. THE FIXTURES AS MENTIONED ABOVE ARE THE MINIMUM BASIC REQUIREMENTS. THE CONTRACTOR SHALL PROPOSE THE FIXTURES IN LINE OF THE SAME FOR APPROVAL OF THE ENGINEER-IN-CHARGE.


SCHEDULE OF SIGNAGES
EXTERNAL SIGNAGES



S. N.	AREAS	QUANTITY (TENTATIVE)	TYPE	SIZE	REFERENCE	VISIBILITY
DIRECTIONAL/ WAY FINDING SIGNAGE						
1	PYLONS IN EXTERNAL AREAS	AS PER STANDARDS AND TO MEET VISIBILITY CRITERIA	STAINLESS STEEL FRAMING WITH ACP LASER CUT PANELS INCLUDING FOUNDATION AND 3D VINYL CUT LETTERS BACKLIT WITH LED. THE COMPLETE PYLON ASSEMBLY TO BE IP 65. BOTH SIDES TO HAVE DIRECTIONAL SIGNS AS PER CUSTOMISED DESIGN APPROVED BY ENGINEER IN CHARGE. NUMBER OF DIRECTIONS TO BE 6 ON EITHER SIDE OF THE PYLON.	3000 MM X 1200MM X 300 MM		50 METERS
2	CAMPUS MAP	AS PER STANDARDS AND TO MEET VISIBILITY CRITERIA	GALVANISED STEEL POWDER COATED IN TEXTURED FINISH WITH 6 MM THICK ALUMINIUM SHEET MOULDED WITH CUSTOMISED GRAPHIC FINISH MEANT FOR EXTERIOR APPLICATIONS ON EITHER SIDE.	2400MM X 1200MM X 100MM		5 METERS


S. N.	AREAS	QUANTITY (TENTATIVE)	TYPE	SIZE	REFERENCE	VISIBILITY
BUILDING/ AREA SIGNAGE						
1	BUILDING SIGNAGE FOR BUILDINGS/BLOCKS	COMBINATION OF: BLOCK NAME & LOGO ALL OTHER LETTERS DESCRIBING BLOCK (APPROX. 40 LETTERS PER BLOCK)	WALL MOUNTED. BACKLIT AND CUSTOM DESIGNED FOR EACH BLOCK IN BRUSHED STAINLESS STEEL LASER CUT LETTES AS PER IMAGE.	BLOCK X - 750 MM HEIGHT LOGO - 1200 MM HIGH ALL OTHER LETTERS DESCRIBING BLOCK (APPROX. 40 LETTERS PER BLOCK) - 450 MM HEIGHT		150 METERS
2	AREA SIGNAGES	AS PER STANDARDS AND TO MEET VISIBILITY CRITERIA	GALVANISED STEEL POWDER COATED IN TEXTURED FINISH WITH 6 MM THICK ALUMINIUM SHEET MOULDED WITH CUSTOMISED GRAPHIC FINISH MEANT FOR EXTERIOR APPLICATIONS ON ONE BOTH SIDES.	POLE HEIGHT - 1200-2100 MM SIGNAGE DIMENSION - 1200MM X 450 MM		10 METRES
EQUIPMENT MARKERS / UTILITY MARKERS/UTILITY PIPE MARKERS - OUTDOOR APPLICATION						
1	EQUIPMENT MARKERS	AS PER THE EQUIPMENT PIECES.	10 MM THICK POLYCARBONATE WITH VINYL AND MOUNTED WITH SS STUDS	16 SQ CENTIMETER	NA	NA
2	UTILITY LINE MARKERS	AS PER REQUIREMENTS DEFINED IN ANSI STANDARDS.	AS PER COLOURS DEFINED IN ANSI STANDARD A13.1	AS PER SIZES DEFINED IN ANSI STANDARD A13.1	NA	NA

INTERNAL SIGNAGES

S. N.	AREAS	QUANTITY (TENTATIVE)	TYPE	SIZE	AREA	VISIBILITY
DIRECTIONAL/ WAY FINDING SIGNAGE						
1	ONLY FOR MARKING UTILITIES AND DEPARTMENTS. SEPARATE FROM STATUARY SIGNAGES.	AS PER STANDARDS AND TO MEET VISIBILITY CRITERIA	ALL STAINLESS STEEL SUSPENSION SYSTEM IN CORRIDORS WITH LACQUERED GLASS/ HPL/ POLYCARBONATE MARKERS AND GRAPHIC PRINTING/ VINYL CUTTING.	MARKER AREA TO BE MINIMUM 2 SQFT PER MARKER. OVERALL SIZE MINIMUM 1800MM X 450MM. (SUSPENSION EXCLUDED.)		8-10 METERS
DIRECTORY SIGNS/ ENTRANCE LOBBY SIGNAGE						
1	BUILDING DIRECTORY WITH ALL DEPARTMENTS IN ENTRANCE LOBBY.	1 PER BLOCK (FOR ALL BLOCKS).	WALL MOUNTED. BACKLIT AND CUSTOM DESIGNED FOR EACH BLOCK IN STAINLESS STEEL FRAME/BACK WITH POLYCARBONATE/ GLASS INFILL AND VINYL CUTOUTS AND GRAPHIC PRINTING.	2400 X 2400 MM		6 METERS
2	FLOOR DIRECTORY WITH FLOOR PLAN IN ALL FLOOR LIFT LOBBIES.	1 PER FLOOR (FOR ALL BLOCKS).		2400MM X 1200MM	3 METERS	
3	LIFT DIRECTORY - PER FLOOR	1 PER FLOOR (FOR ALL BLOCKS).		300MM X 1200MM WITH FLAP OF 300MM X 300MM		3 METERS

AREA/ROOM SIGNAGE						
1	LIFT LOBBY FLOOR MARKER		ALL SIGNAGES TO BE WALL MOUNT WITH STAINLESS STEEL FRAME AND PLATE WITH VINYL AND GRAPHICS PRINT. SIGNAGES TO HAVE INFORMATION ON BOTH SIDES OF THE SIGNAGE.	OF AREA AVERAGE 500 SQUARE CENTIMETER PER SIGNAGE.		6 METERS
2	TOILETS INCLUDING SPECIALLY ABLED TOILETS					
3	AHU ROOM					
4	ALL UTILITY AREAS					
5	CONTROL ROOMS					
6	ENTRANCE LOBBY DOORS					
7	OFFICE / WORK / STORAGE AREAS	ONE PER ENTRY/ EXIT FOR ALL ROOMS/AREA.	IN AREAS WHICH HAVE NO WALL AVAILABLE, DOOR SIGNAGES ONLY ON WOODEN DOORS MAY BE ALLOWED, HOWEVER THE DESIGN WOULD REMAIN THE SAME WITH CENTRAL ALIGNMENT. MEETING AND CONFERENCE ROOMS TO HAVE ADDITIONAL DOOR SIGNAGE FOR OCCUPANCY IN STAINLESS STEEL.	OF AREA AVERAGE 300 SQUARE CENTIMETER PER SIGNAGE		3 METERS

EQUIPMENT MARKERS / UTILITY MARKERS/UTILITY PIPE MARKERS						
1	EQUIPMENT MARKERS	AS PER THE EQUIPMENT PIECES.	10 MM THICK POLYCARBONATE WITH VINYL AND MOUNTED WITH SS STUDS	16 SQ CENTIMETER	-	
2	UTILITY LINE MARKERS	AS PER REQUIREMENTS DEFINED IN ANSI STANDARDS.	AS PER COLOURS DEFINED IN ANSI STANDARD A13.1	AS PER SIZES DEFINED IN ANSI STANDARD A13.1	-	
REGULATORY AND SAFETY SIGNAGE						
1	FIRE EXIT/ FIRE TOWER/ FIRE EQUIPMENT/ ESCAPE SIGNAGES, HAZARDOUS EQUIPMENT SIGNAGES, CAUTION SIGNAGES, SAFETY SIGNAGES	AS PER STATUTORY REQUIREMENTS OF FIRE AUTHORITIES, AND STANDARD ENGINEERING PRACTISE.	3MM PVC SINGLE SIDED WITH PHOTO-LUMINOUS / GLOW IN DARK VINYL (6-8 HOURS GLOW) FIXED WITH SUITABLE ARRANGEMENT.	AS PER STATUTORY REQUIREMENTS OF FIRE AUTHORITIES, AND IS: 9457 & IS: 12349		10 METERS
2	ILLUMINATED FIRE WAYFINDING SIGNS FIRE EVACUATION LED DISPLAY WITH BATTERY BACKUP. BOTH SIDES TO HAVE SIGNAGE.	AS PER STATUTORY REQUIREMENTS OF FIRE AUTHORITIES, AND STANDARD ENGINEERING PRACTISE.	SUPPLY & FIXING OF 8MM ACRYLIC DOUBLE SIDED WITH LED LIGHT WITH BATTERY BACKUP OF 2 HOURS SUSPENDED WITH GALVANISED ROD COVERED WITH SS SLEEVES WITH DOOM NUT.	AS PER STATUTORY REQUIREMENTS OF FIRE AUTHORITIES, AND IS: 9457 & IS: 12349		20 METERS

5	FIRE EVACUATION MAPS WITH 3D MODEL GRAPHIC	AS PER STATUTORY REQUIREMENTS OF FIRE AUTHORITIES, AND STANDARD ENGINEERING PRACTISE.	6 MM ACRYLIC TWO LAYERS SANDWICHED WITH PHOTO-LUMINOUS AND CLEAR SHEET WITH MAP PRINTED AS PER DESIGN APPROVED BY OWNER FIXED WITH FOUR SS STUDS.	AS PER STATUTORY REQUIREMENTS OF FIRE AUTHORITIES, AND IS: 9457 & IS: 12349		3 METERS
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NOTE- ALL THE SIGNAGES SHALL BE INSTALLED AS PER THE RESPECTIVE STANDARDS AND AS PER THE INTENT AS DEFINED IN THE TENDER DOCUMENTS.

**AUTOMATIC ORGANIC WASTE COMPOSTER TO BE PROVIDED AS PER BELOW
SPECIFICATION AND REQUIREMENTS**

- (i) TREATMENT CAPACITY: MIN. 200 KG OF ORGANIC WASTE /DAY.
- (ii) MINIMUM NUMBERS TO BE PROVIDED – 1 NOS.
- (iii) OPERATION: BATCH WISE OPERATION TO CONVERT 15KG-20KG (MINIMUM) ORGANIC WASTE TO MANURE/ECO-FRIENDLY PRODUCT.
- (iv) MOBILITY ARRANGEMENT - SUITABLE MOBILITY ARRANGEMENT FOR THE EQUIPMENT FOR MOVEMENT ON THE PLAIN FLOORING.
- (v) CURING SYSTEM - CURING SYSTEM OF CAPACITY 100 KG OF ORGANIC/WASTE PER DAY WITH ALL THE REQUIRED FACILITY / ACCESSORIES FOR WASTE HANDLING & CURING.
- (vi) SHREDDER - SHREDDER TO TAKE CARE OF GARDEN/CAMPUS WASTE & KITCHEN WASTE
- (vii) THE CONTRACTOR SHALL PROVIDE THE SHED ALONG FOR HOUSING OF THE COMPOSTER ALONG WITH THE STORAGE FACILITIES FOR EFFICIENT MANAGEMENT AND WORKING.

STAGE PAYMENT SCHEDULE

S.N.	DESCRIPTION	PERCENTAGE OF TENDERED AMOUNT	
A	CIVIL WORKS		
1	Administrative Department Building	75.50	15.50
2	Wildlife Health Management and Disease Investigation and Surveillance Building		17.50
3	Informatics and Analytics & Network & Outreach Unit Building		6.00
4	Training & Capacity Building		8.00
5	Utility Block, Sub-stations and Security Building		3.00
6	SITE DEVELOPMENT WORK		25.50
B	MEP WORKS		
1	Fire Alarm System	20.50	0.40
2	Internal Electric installations		5.70
	Power wiring and plugs		1.80
3	Lighting conductors		0.10
4	Telephone conduits		0.10
5	Lift		0.40
6	Specialized E&M work		12.00
C	DESIGN AND ENGINEERING	1.00	
D	MISCELLANEOUS WORKS **	3.00	

* This shall correspond to those works that may be required for the completion of the work as per the terms and conditions of the contract whose stage payment is not defined in the above-mentioned stage payment schedule. The part payment (subject to the maximum amount of 1% of tendered value) against this subhead may be released only after completion of works corresponding to 50% of the tendered amount. However, the balance payment of this subhead shall only be released only after completion of work in all respect.

** **Stage Payment for electrical and mechanical works: The stage payment of electrical and mechanical works is further sub divided as per table given below:**

Sl. No.	Stage of Work	Payment in terms of %age.
1	On initial inspection of materials and delivery at site in good condition	50%
2	On completion of installation work of equipment	25%
3	On completion of testing and commissioning of equipment	15%
4	On Handing Over	10%
	Total	100%

Notes - The part payment for each substage on pro-rata basis of total quantity of substage (in cum, sqm, no. etc.) may be made by engineer-in-charge.

**SCHEDULE OF STAGE PAYMENT
(For Planning, Design works)**

S. No	Description of Item	% of total estimated cost of the building
1.	Preparation of the masterplan and building plans, submission and obtaining approval of these plans from all local bodies and statutory authorities including Environmental clearance (if required).	30 %
2.	Preparation of detailed good for construction drawings (architectural, structural, landscape, services etc.), checking/vetting by proof consultant or by engineer in charge and subsequent approval of the same.	40 %
3.	On submission and approval of as – built completion drawings and obtaining completion/occupancy certificate from local body.	30 %
	Total =	100%

Note: The part payment for each substage on pro-rata basis of total quantity of substage may be made by engineer-in-charge.

**SCHEDULE OF STAGE PAYMENT
(For Administrative Department Building)**

S. No	Description of Item	% of total estimated cost of the building
1.	Completion of all work in foundation upto plinth level	
A	Earthwork (in excavation/filling) & PCC Work	3%
B	RCC Works	7 %
2.	Completion of super structure work (RCC/Composite structural work) of the building	25%
3.	AAC/Brick work partition walls of whole building	7%
4.	Flooring, skirting, dado, wall lining work	9%
5.	Doors& Windows, wall guard/ hand rail, corner guard i/c all hardware and accessories at all floors	7%
6.	Internal False Ceiling Work	6%
7.	Finishing Work	6%
9.	Waterproofing work i/c/ Overdeck Insulation if any	6%
10.	Façade work (Exterior Cladding, Curtain Wall, Structural glazing, louvers etc.)	7%
11.	Other Works, viz. Stainless-steel work, Signages etc.	1%
12.	Water Supply, Sewerage, Drainage System	
A	Water Supply System & Sanitary Installations	2%
B	Internal SW & Sewerage System	1%
C	Fitting & Fixtures	2%
D	Drainage	1%
13.	Completion and Handing Over	
	i. Testing & Commissioning	5%
	ii. Handing over	5%
	Total =	100%

Note: The part payment for each substage on pro-rata basis of total quantity of substage (in cum, sqm, no. etc.) may be made by engineer-in-charge.

**SCHEDULE OF STAGE PAYMENT
(WILDLIFE HEALTH MANAGEMENT AND DISEASES INVESTIGATION AND
SURVEILLANCE BUILDING)**

S. No	Description of Item	% of total estimated cost of the building
1.	Completion of all work in foundation upto plinth level	
A	Earthwork (in excavation/filling) & PCC Work	3%
B	RCC Works	7 %
2.	Completion of super structure work (RCC/Composite structural work) of the building	25%
3.	AAC/Brick work partition walls of whole building	7%
4.	Flooring, skirting, dado, wall lining work	9%
5.	Doors& Windows, wall guard/ hand rail, corner guard i/c all hardware and accessories at all floors	7%
6.	Internal False Ceiling Work	6%
7.	Finishing Work	6%
9.	Waterproofing work i/c/ Overdeck Insulation if any	6%
10.	Façade work (Exterior Cladding, Curtain Wall, Structural glazing, louvers etc.)	7%
11.	Other Works, viz. Stainless-steel work, Signages etc.	1%
12.	Water Supply, Sewerage, Drainage System	
A	Water Supply System & Sanitary Installations	2%
B	Internal SW & Sewerage System	1%
C	Fitting & Fixtures	2%
D	Drainage	1%
13.	Completion and Handing Over	
	i. Testing & Commissioning	5%
	ii. Handing over	5%
	Total =	100%

Note: The part payment for each substage on pro-rata basis of total quantity of substage (in cum, sqm, no. etc.) may be made by engineer-in-charge.

**SCHEDULE OF STAGE PAYMENT
(INFORMATIC AND ANALYTICS & NETWORK & OUTREACH UNIT BUILDING)**

S. No	Description of Item	% of total estimated cost of the building
1.	Completion of all work in foundation upto plinth level	
A	Earthwork (in excavation/filling) & PCC Work	3%
B	RCC Works	7 %
2.	Completion of super structure work (RCC/Composite structural work) of the building	25%
3.	AAC/Brick work partition walls of whole building	7%
4.	Flooring, skirting, dado, wall lining work	9%
5.	Doors& Windows, wall guard/ hand rail, corner guard i/c all hardware and accessories at all floors	7%
6.	Internal False Ceiling Work	6%
7.	Finishing Work	6%
9.	Waterproofing work i/c/ Overdeck Insulation if any	6%
10.	Façade work (Exterior Cladding, Curtain Wall, Structural glazing, louvers etc.)	7%
11.	Other Works, viz. Stainless-steel work, Signages etc.	1%
12.	Water Supply, Sewerage, Drainage System	
A	Water Supply System & Sanitary Installations	2%
B	Internal SW & Sewerage System	1%
C	Fitting & Fixtures	2%
D	Drainage	1%
13.	Completion and Handing Over	
	i. Testing & Commissioning	5%
	ii. Handing over	5%
	Total =	100%

Note: The part payment for each substage on pro-rata basis of total quantity of substage (in cum, sqm, no. etc.) may be made by engineer-in-charge.

**SCHEDULE OF STAGE PAYMENT
(TRAINING & CAPACITY BUILDINGS)**

S. No	Description of Item	% of total estimated cost of the building
1.	Completion of all work in foundation upto plinth level	
A	Earthwork (in excavation/filling) & PCC Work	3%
B	RCC Works	7 %
2.	Completion of super structure work (RCC/Composite structural work) of the building	25%
3.	AAC/Brick work partition walls of whole building	7%
4.	Flooring, skirting, dado, wall lining work	9%
5.	Doors& Windows, wall guard/ hand rail, corner guard i/c all hardware and accessories at all floors	7%
6.	Internal False Ceiling Work	6%
7.	Finishing Work	6%
9.	Waterproofing work i/c/ Overdeck Insulation if any	6%
10.	Façade work (Exterior Cladding, Curtain Wall, Structural glazing, louvers etc.)	7%
11.	Other Works, viz. Stainless-steel work, Signages etc.	1%
12.	Water Supply, Sewerage, Drainage System	
A	Water Supply System & Sanitary Installations	2%
B	Internal SW & Sewerage System	1%
C	Fitting & Fixtures	2%
D	Drainage	1%
13.	Completion and Handing Over	
	i. Testing & Commissioning	5%
	ii. Handing over	5%
	Total =	100%

Note: The part payment for each substage on pro-rata basis of total quantity of substage (in cum, sqm, no. etc.) may be made by engineer-in-charge.

**SCHEDULE OF STAGE PAYMENT
(UTILITY BLOCK, SUB-STATION & SECURITY BUILDING)**

S. No	Description of Item	% of total estimated cost of the building
1.	Completion of all work in foundation upto plinth level	
A	Earthwork (in excavation/filling) & PCC Work	3%
B	RCC Works	7 %
2.	Completion of super structure work (RCC/Composite structural work) of the building	25%
3.	AAC/Brick work partition walls of whole building	7%
4.	Flooring, skirting, dado, wall lining work	9%
5.	Doors& Windows, wall guard/ hand rail, corner guard i/c all hardware and accessories at all floors	7%
6.	Internal False Ceiling Work	6%
7.	Finishing Work	6%
9.	Waterproofing work i/c/ Overdeck Insulation if any	6%
10.	Façade work (Exterior Cladding, Curtain Wall, Structural glazing, louvers etc.)	7%
11.	Other Works, viz. Stainless-steel work, Signages etc.	1%
12.	Water Supply, Sewerage, Drainage System	
A	Water Supply System & Sanitary Installations	2%
B	Internal SW & Sewerage System	1%
C	Fitting & Fixtures	2%
D	Drainage	1%
13.	Completion and Handing Over	
	i. Testing & Commissioning	5%
	ii. Handing over	5%
	Total =	100%

Note: The part payment for each substage on pro-rata basis of total quantity of substage (in cum, sqm, no. etc.) may be made by engineer-in-charge.

**SCHEDULE OF STAGE PAYMENT
(For Development Works)**

S. N	Description of Item	Percentage of total estimated cost of the subhead (as per break up of estimated cost of civil component)
1.	Infrastructure Development	
	Levelling, Roads, footpaths, Horticulture, Signage, etc. on pro-rata basis.	
A	Levelling (excavation/filling) works	5 %
B	Internal Road with WBM and bituminous with Kerb stones, pavers on footpath, grass pavers, painting, marking etc.	25%
C	Granite / stonework over the Path ways	5%
D	Open/ Surface Parking	2%
E	Signages	3%
F	Miscellaneous Works	10%
2.	External/bulk Services	
A	Water-Supply System	5%
B	Sewerage System	2%
C	Drainage System	7%
3.	Trenches for services	4%
4.	Rain Water Harvesting Works	2%
5.	Water Bodies	10%
6.	Miscellaneous	10%*
7.	Completion and Handing Over	
A	Testing & Commissioning	5%
B	Handing over	5%
	Total =	100%

Note: The part payment for each substage on pro-rata basis of total quantity of substage (in cum, sqm, no. etc.) may be made by engineer-in-charge.

- * This shall correspond to those works that may be required for the completion of the work as per the terms and conditions of the contract whose stage payment is not defined in the above-mentioned stage payment schedule. However, the balance payment of this subhead shall only be released only after completion of work in all respect

LIST OF PREFERRED MAKE / MANUFACTURERS FOR DIFFERENT MATERIALS TO BE USED IN THIS WORK / PROJECT FOR CIVIL WORKS

S. NO.	DETAILS OF MATERIALS	MANUFACTURERS NAME
1	ANTI TERMITE PESTICIDES	BAYER, FMC INDIA, HINDUSTAN INSECTICIDES
2	STEEL (TMT FE-500D)	TATA., RINL, JINDAL STEEL & POWER LTD, JSW STEEL LTD., SAIL
3	STRUCTURAL STEEL SECTIONS	TATA, JINDAL, SAIL, RINL
4	CEMENT [OPC/PPC]	ACC, AMBUJA, ULTRATECH, WONDER
5	READY MIXED CEMENT CONCRETE	ACC, ULTRA TECH, AFCON
6	WHITE CEMENT	BIRLA, J.K., ULTRATECH
7	VITRIFIED TILES (DOUBLE CHARGED / FULL BODY/ULTRA SLIM /ANTISKID / ACID-ALKALI RESISTANT)- (ALL TILES SHALL BE PROCURED FROM FULLY OWNED FACTORY OF THE MANUFACTURER AND NOT FROM JV / OUTSOURCED)	SOMANY, KAJARIA, NITCO
8	CERAMIC GLAZED TILES	SOMANY, KAJARIA, NITCO
9	WATER-PROOF CEMENT PAINT, SYNTHETIC ENAMEL PAINT, PLASTIC EMULSION PAINT, DISTEMPER/ACRYLIC EMULSION PAINT, TEXTURED PAINT, STEEL PRIMER, WOOD PRIMER, EXTERIOR WATERPROOFING PAINT, WOOD FINISH (MELAMINE & PU POLISH)	ASIAN PAINT, NEROLAC, ICI, BERGER
10	PLY BOARD, PLYWOOD (PINE BOARD), LAMINATE, FLUSH DOOR (ALL FLUSH DOORS SHALL BE PROCURED FROM FULLY OWNED FACTORY OF THE MANUFACTURER AND NOT FROM JV / OUTSOURCED), PRELAMINATED PARTICLE BOARD	GREEN, MERINO, CENTURY
11	SELF LEVELLING COMPOUND	MAPAI, ARDEX ENDURA, BIZZAR
12	EPDM GASKET	HANU, ANAND, VICTOR
13	WOOD ADHESIVE	FEVICOL, 3M, ARALEDITE, SIKA
14	FIRE SEALANT	HILTI, 3M, MCCOY
15	TILE ADHESIVE, STONE ADHESIVE, EPOXY GROUTING COMPOUND	PIDILITE, ARDEX ENDURA, WEBER
16	DASH, ANCHORING FASTENERS	HILTI, FISCHER, CANON
17	ALUMINIUM COMPOSITE PANEL	ALUCOBOND, REYNOBOND, ALPOLIC
18	READY MIX GYPSUM PLASTER	SAINT GOBAIN, USG BORAL, ULTRATECH
19	READY MIX CEMENT PLASTER	WEBER, ULTRATECH, BIRLA
20	SILICON SEALANT	GE, DOW CORNING, PIDILITE
21	GYPSUM BOARD	USG BORAL, LAFAGE, SAINT GOBAIN, KNAUF DANOLINE

S. NO.	DETAILS OF MATERIALS	MANUFACTURERS NAME
22	REFLECTIVE GLASS, TINTED GLASS, HIGH PERFORMANCE GLASS, LACQUERED GLASS, HIGH PERFORMANCE GLASS, FIRE RESISTANT GLASS	SAINT GOBAIN, PILKINGTON, ASAHI
23	FLOAT GLASS, LOOKING GLASS / MIRROR	MODI GLASS, ATUL, ASAHI
24	MECHANICAL COUPERS	USHA MARTIN, DEXTRA, HALFEN
25	CRYSTALLIANE CEMENTITIOUS WATERPROOFING COMPOUND	XYPEX CONSTRUCTION CHEMICAL, KRYTONE
26	BITUMEN MEMBRANE FOR WATERPROOFING, HDPE MEMBRANE FOR WATERPROOFING, POLYUREA MEMBRANE FOR WATERPROOFING	SIKA, SAINT GOBAIN, SOPREMA
27	HOLLOW METAL PRESSED DOORS (METAL DOORS)	NAVAIR, TATA PRAVESH, SHAKTI HORMANN
28	ROLLER BLIND	VISTA, MAC, HUNTER DOUGLUS
29	HYDRAULIC DOOR CLOSER, FLOOR SPRING, DOOR AUTOMATION, HARDWARES FOR FIRE RATED DOORS, STAINLESS STEEL FITTINGS/HARDWARE FOR WOODEN/METAL/GLAZED/STEEL DOOR & WINDOWS, FRICTION STAY HINGES, HARDWARE FITTINGS FOR ALUMINIUM WINDOWS & DOORS	DORMA, GEZE, EBCO, HAFELE, HORMANN
30	ADHESIVE TAPE	3M, NORTON, BOPD, TESA
31	HIGH PERFORMANCE EPOXY BASED RESIN ANCHOR SYSTEM	FOSROC, CICO, SIKA
32	EPOXY MORTAR	FOSROC, SIKA, MYK LATICRETE, CICO
33	ALUMINIUM SECTIONS FOR DOORS & WINDOWS ETC.	JINDAL, HINDALCO, BHORUKA
34	FABRICATOR FOR ALUMINUM WORK AND STRUCTURAL GLAZING WORK	SAPA, KALCO, TECHNAL
35	MS SECTIONS (PIPES, BOXES CHANNELS)	JINDAL HISAR, TATA
36	S.S. MATERIAL/HADRAILS/RAILINGS	JINDAL STAINLESS STEEL LTD., TATA STEEL, SAIL
37	WALL PUTTY	JK, BIRLA, ASAIN PAINT
38	FLOOR HARDENER, POLYSULPHIDE SEALANT, WATERPROOFING COMPOUND, ADMIXTURES/CURING COUMPOUND	SIKA, SAINT GOBAIN, SOPREMA
39	EXPANSION JOINT	MIGUA, CS, CAMEO
40	METAL/ALUMINUM FALSE CEILING	SAINT GOBAIN, HUNTER DOUGLUS, ARMSTRONG
41	AAC BLOCK	AEROCON, JINDAL BLOCK, MODCRETE, FINECRETE
42	AAC BLOCK ADHESIVE_	ARDEX ENDURA, PIDILITE, WEBER
43	UPVC WINDOWS	FENESTA, ALUPLAST, KOENMERLING

S. NO.	DETAILS OF MATERIALS	MANUFACTURERS NAME
44	VINYL / CONDUCTIVE FLOORING, DADO SKIRTING	FORBO, TARAKETT, ARMSTRONG, GERFLOOR
45	CALCIUM SILICATE TILES FALSE CEILING	AEROLITE, RAMCO, HILUX
46	FIRE CHECK DOORS (METAL/ROLLING/GLAZED)	NAVAIR, TATA PRAVESH, SHAKTI HORMANN, 4C FIRE PROTECTION PVT LTD
47	ACOUSTIC SEAL / DOOR SEAL	LORIENT, RAVEN, DORMA, 3M, HAFELE
48	INTUMESCENT FIRE / SMOKESEAL	ASTRO FLAME, RAVEN, SEALZ, LORIENT
49	CALCIUM SILICATE BOARD FOR FIRE DOOR	PROMOTECH, PROMINA, RAMCO
50	POLYCARBONATE SHEET	DANPALON, SOLALITE, DPI SYSTEM, EVERLITE, CPI
51	GI PIPES	JINDAL HISAR, TATA
52	GI FITTINGS	UNIK, TATA
53	CPVC PIPES	ASTRAL, PRINCE, SFMC
54	HDPE PIPES	SUPREME, FINOLEX, ASTRAL, RELIANCE,
55	SOIL, WASTE, VENT PIPES & FITTINGS	ASTRAL, PRINCE, SFMC
56	C.P. BRASS FITTING AND ACESSORIES	JAQUAR, ROCA, KOHLER, KEROVIT
57	SS SINK	NILKANTH, NIRALI, JAYNA
58	SANITARY WARE (URINAL, WASH BASIN, WC ETC.)	JAQUAR, GROHE, KOHLER, KEROVIT
59	GLASS MOSAIC TILE	ITALIA, CORAL, KAJARIA
60	FAÇADE AND WINDOW SYSTEM	SCHUCO, ALUK, REYNAERS, GUTMANN
61	FIRE STOP IN CURTAIN WALL SYSTEM	HILTI, 3M, FISCHER, LORIENT
62	POP OUT VENT FOR FAÇADE AND SYSTEM WINDOW HARDWARE	COTSWOLD, SCHUCO, ALUK, REYNAERS
63	ALUMINIUM OPERABLE LOUVER	TECHNAL, DOMAL, YOGI GLAZE, SCHUCO
64	AIR TRANSFER GRILL	RUSKIN, SYSTEM AIR, TROX, TREMCO
65	ENGINEERED WOODEN FLOORING AND SKIRTING	MIKASA (GREENLAM), TARKETT, HAVWOODS, PARADOR (HIL), PERGO, KAHRS
66	ENGINEERED MARBLE	HR JOHNSON, KALINGA STONE, NITCO, ASIAN
67	SS TACTILE	EMINENT, FERROTECH, SUNDARAM, JINDAL
68	BAMBOO DECKING, ROOFING & CLADDING	ECO GREEN FLOORING, EPITOME BAMBOOWOOD, LAMIWOOD
69	OUTDOOR SIGNAGES	3M, AVERY DENNISON, VEDAAANSHI SIGNS
70	ACOUSTIC PANELS	ARMSTRONG, USG BORAL, ANUTONE

S. NO.	DETAILS OF MATERIALS	MANUFACTURERS NAME
71	WEATHER/STRUCTURE SILICON SEALANT	WACKER, MCCOY, DOW CORNING
72	BACKER ROD	SUPREME, SYSTRANS
73	POLYSTRENE BOARD	SUPREME, DOW CORNING, TEXAS, PIDILITE
74	DUCTILE IRON PIPES	ELECTROSTEEL, KESORAM, TISCO
75	STAINLESS STEEL PIPES AND FITTINGS	JINDAL STAINLESS STEEL, J-PRESS ALFA PRESS
76	SLUICE VALVES, GATE / BALL VALVES	ZOLOTO, KIRLOSKAR, LEADER
77	FURNITURE (CHAIRS/WORKSTATIONS, STORAGE UNITS ETC.)	HERMAN-MILLER, HAYWORTH, STEEL CASE, ROCKWORTH, GODREJ

Note: -

1. **The articles / materials which are not mentioned in the above said list shall be approved by the Engineer-in-Charge before execution of work with the approval of NIT approving authority.**
2. **Only BIS Mark materials in the list shall be used in the work, non-BIS Mark materials may be provided by the Engineer-in-charge when BIS Mark materials are not manufactured.**

GUARANTEE BOND TO BE EXECUTED BY THE CONTRACTOR FOR REMOVAL OF DEFECTS AFTER COMPLETION OF SPECILAISED WORKS

The agreement made this..... day of (Two Thousand----- only) betweenS/o(hereinafter called the GUARANTOR of the one part) and the PRESIDENT OF INDIA (hereinafter called the Government of the other part)

WHEREAS THIS agreement is supplementary to a contract (Hereinafter called the Contract) dated and made between the GUARANTOR OF THE ONE PART AND the Government of the other part whereby the contractor inter alia undertook to remove all the defects in(name of specialized work) in said contract completely.

AND WHEREAS THE GUARANTOR agreed to give a guarantee to the affect that the said work will remain intact without any defect for (No. of years) from the date of completion of the work.

NOW THE GUARANTOR hereby guarantee that the works executed by him will remain intact and full functional without any defects of any kind for(No. of years) to be reckoned from the date of completion of work under the contract.

The decision of the Engineer-in-Charge with regard to nature and cause of defects shall be final.

During this period of guarantee, the guarantor shall make good all defects and in case of any defect being found in the(name of specialized works) to the satisfaction of the Engineer-in-Charge at his cost and shall commence the work for such rectification within seven days from the date of issue of the notice from Engineer-in-Charge calling upon him to rectify the defects failing which the work shall be got done by the Department by some other contractor at the Guarantor's risk and cost. The decision of the Engineer -in-charge as to the cost payable by the Guarantor shall be final and binding.

That if the guarantor fails to make good all defects or commits breach there under, then the Guarantor will indemnify Engineer-in-Charge and his successor against all loss, damage, cost expense or otherwise which may be incurred by him by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and/or damage and / or cost incurred by the Government, the decision of the Engineer-in-charge will be final and binding on both the parties.

IN WITNESS WHEREOF these presents have been executed by the obligator and by for and on behalf of the PRESIDENT OF INDIA on the day, month and year first above written.

SIGNED, sealed and delivered by OBLIGATOR in the presence of :-

1. 2.

SIGNED FOR AND BEHALF OF THE PRESIDENT OF INDIA BY in the presence of

1. 2.

DRAWINGS LIST

S.N.	Description	Remarks
1	Indicative Master Plan	
2	Ground Floor Plan of Administrative Department Building	
3	First Floor Plan of Administrative Department Building	
4	Ground Floor Plan of Wildlife Health Management, Disease Investigation and Surveillance Building	
5	First Floor Plan of Wildlife Health Management, Disease Investigation and Surveillance Building	
6	Ground Floor Plan of Informatics, Analytics, Network and Outreach Unit Building	
7	First Floor Plan of Informatics, Analytics, Network and Outreach Unit Building	
8	Ground Floor Plan of Training and Capacity Building	
9	First Floor Plan of Training and Capacity Building	

PART-C

SCOPE, SPECIAL CONDITIONS, PARTICULAR SPECIFICATION OF ELECTRICAL AND MECHANICAL WORK

ELIGIBILITY CRITERIA FOR ASSOCIATION OF SPECIALIZED FIRMS FOR E&M WORKS

1.1 Definition of Similar Works of various Electrical and Mechanical Works are as under:

D1: Internal Electrical Installations and External Lighting

Similar works: Not Applicable.

D2: Electrical Sub-station:

Similar works shall mean “Providing, Installation, testing & commissioning of Sub-Station with minimum 80% capacity of individual transformer proposed in NIT.”

D3: Diesel Generating Set

Similar works shall mean “Providing, Installation, testing & commissioning of DG set/s with minimum 80% capacity of individual DG set proposed in NIT.”

D4: Fire Fighting (Down Comer System)

Similar works shall mean “Providing, Installation, testing & commissioning of Fire Fighting and Down Comer System.”

D5: Manual Fire Alarm and Public Address System

Similar works shall mean “Providing, Installation, testing & commissioning of **Manual** Fire Alarm and Public Address System.”

D6: EPABX

Similar works shall mean “Providing, Installation, testing & commissioning of “IP based EPABX system”.

D7: CCTV Surveillance System:

Similar works shall mean “Providing, Installation, testing & commissioning of **IP Based** CCTV system.”

D8: Data Networking System:

Similar works shall mean “Providing, Installation, testing & commissioning of “Data Networking System / LAN system”.

D9: Lifts:

Similar works: Not Applicable.

D10: Sewage Treatment Plant & ETP Plant, Pumps for Water Supply and Drainage:

Similar works shall mean “Providing, Installation, testing & commissioning of STP plant & ETP Plant”.

D11: Roof Top Solar PV Power Plant:

Similar works shall mean “Providing, Installation, testing & commissioning of Solar PV Plant Work”.

D13: Smart Class Room:

Similar works shall mean “SITC of Audio-Video Work”.

1.2 For specialized E&M works mentioned detailed hereinabove in para ‘1.1’, the contractor shall have to engage/associate with specialized agency, who fulfills the following requirements (Joint ventures for associate agencies are not accepted):

- a. Should have satisfactorily completed the works as mentioned below during last 7 years ending previous day of of the month previous to the one in which tenders are invited:

(i) Three similar works each of value not less than 40% of the cost of corresponding specialized work.

Or

(ii) Two similar works each of value not less than 60% of the cost of corresponding specialized work.

Or

(iii) One similar work of value not less than 80% of the cost of corresponding specialized work.

All amounts rounded off to a nearest convenient figure.

Note: Cost of corresponding specialized work shall be the same as mentioned in stage payment schedule for electrical and mechanical works.

The value of executed works shall be brought to the current costing level by enhancing the actual value of work at simple rate of 7% per annum; calculated from the date of completion to previous day of last date of submission of bid.

The contractor is also eligible to carry out himself/herself the any or all of these specialized works without associating with any specialized agency provided that: -

(a) He fulfils the prescribed eligibility criteria respectively for these work(s).

Or

(b) He directly procures the equipment of approved make from manufacturer and gets it installed from authorized agency/service provider of the manufacturer or specialized agency as per criteria mentioned in NIT.

Note: The main contractor/agency has to submit details of such agency to be associated to the Engineer-in-charge within the prescribed time. The associated agency shall be approved by Engineer-in-charge. In case the main contractor intends to change associated agency/agencies during the operation of the contract, he shall obtain prior approval of Engineer-in-charge. The new agency/agencies shall also have to satisfy the laid down eligibility criteria mentioned above. In case Engineer-in-charge is not satisfied with the performance of any agency, he can direct the main contractor to change the agency executing such items of work and this shall be binding on the contractor.

1.3 Approval of the specialized agencies for each specialized work shall be obtained from the Engineer-in-charge within the prescribed time. Even if, such specialized items of work shall be executed by the specialized agencies at later date the work shall be deemed to be executed by the tenderer for all purposes and the responsibility of the quality of items of works executed etc. shall continue to be that of the tenderer only.

1.4 The associate agency shall submit the willingness to get associated with the main contractor for execution of the E&M component of works in wholesome manner and as per the conditions set out in the MOU to be entered into, between the one who is awarded the work and the associated eligible electrical contractor. (Format of willingness and MOU is attached)

1.5 The eligibility documents of the proposed associated electrical contractor i.e. copy of their registration documents, Electrical Contractor's License, GST documents, eligibility documents etc. duly attested by Main contractor shall be submitted to the Engineer-in-charge. Such associate electrical contractor will certify that they are not debarred as on the day of application for sale of tender.

- 1.6** If, the concerned E&M agency does not perform satisfactorily or associate agency / sub-contractor fails to complete the specialized E&M work, the main contractor on the written direction of the department, shall remove the Associate agency / sub-contractor deployed on the work and shall submit name of new associate agency who fulfills the eligibility conditions mentioned in NIT to execute the leftover work without any loss of time or variation in cost to the department in this regard. Such associates agency shall also enter into Agreement with the main tenderer and shall meet all the guarantee for the equipment already supplied for which payment has been released by the department in part. If any equipment supplied for the work, during the currency of the earlier Associate agency / sub-contractor and paid partly by the department becomes redundant /not in a position to be installed or/and commissioned or/and put to beneficial use due to change in associate agency for execution of specialized E&M work, the main contractor shall be liable for replacement of the equipment(s) at no additional cost to Department. Change of associate agency will not be allowed without prior approval of the Engineer-in-charge.
- 1.7** The main contractor shall be responsible and liable for proper and complete execution of the E&M works and ensure coordination and completion of both civil and electrical work.
- 1.8** The associate agency shall attend the inspection of the work by the Engineer-in-charge as and when required.
- 1.9** The agencies executing the electrical work should have valid license for LT/HT as applicable.

MEMORANDUM OF UNDERSTANDING [M.O.U] BETWEEN

- 1] M/S [Name of the firm with full address] Enlistment Status
Valid upto:

[Henceforth called the main contractor] And

- 2] M/S [Name of the firm with full address]

Enlistment Status Valid upto:

[Henceforth, called Associated Contractor]

Name of Work: Specify the E&M Services

We state that M.O.U. between us will be treated as an agreement and has legality as per Indian Contract Act (amended up to date) and the department (CCU, MoEF&CC) can enforce all the terms and conditions of the agreement for execution of the above work. Both of us shall be responsible for the execution of work as per the agreement to the extent this MOU allows. Both the parties shall be paid consequent to the execution as per agreement to the extent this MOU permits.

We have agreed as under:

1. The associated contractor shall be liable for disciplinary action if he failed to discharge the action(s) and other legal action as per agreement besides forfeiture of the security deposit.
2. All the material, machinery and equipments, tools and tackles required for execution of the electrical works as per agreement shall be the responsibility of the associated contractor.
3. The site staff required for the electrical work shall be arranged by the associated contractor as per terms and conditions of the agreement.

Signature of main contractor

Date:

Place:

Signature of associate contractor

Date:

Place:

Countersigned by the Executive Engineer

WILLINGNESS CERTIFICATE

Name of Work:

I hereby give my willingness to work as associated contractor for the above-mentioned work. I will execute the work as per specifications and conditions for the agreement and as per direction of the Engineer-in-charge. Also, I will employ full time technically qualified supervisor for the works. I will attend inspection of officers of the department as and when required.

Date:

Signature of Contractor

GENERAL CONDITIONS (ELECTRICAL & MECHANICAL WORKS)

1. Scope of Electrical & Mechanical Works

The work is to be executed on ENGINEERING, PROCUREMENT AND CONSTRUCTION (EPC) (Turn Key) basis. The cost of labour, materials, tools and plants and machinery required for execution of the whole project as per Layout plan, detailed design and drawings/specifications (developed by contractor in accordance with contract) is within the scope of this work. The buildings are to be planned, executed and registered/compliant to minimum 5-star GRIHA Rating, net zero energy and shall be in compliant to SUPER ECSBC building requirements of ECSBC 2024 as amended up to last date of submission of tender including extension if any.

Various E&M services to be provided under this EPC contract have been divided into following Sub Heads. The broad scope design concept and specifications of various E&M services to be provided under this EPC contract is given in respective sub-heads of Scope, Additional Conditions and Technical Specifications. Irrespective of whatever is specified, it will be the responsibility of contractor to Design, supply, install, execute, test, commission all the items /any item required to make the service useful / compliant to various provisions.

Code No	Sub Head
D-1	Internal Electrical Installations and External Lighting
D-2	Electrical Sub-station
D-3	Diesel Generating Set
D-4	Down Comer System
D-5	Manual Fire Alarm and Public Address System
D-6	EPABX System.
D-7	CCTV Surveillance System
D-8	Data Networking System
D-9	Lifts
D-10	Sewage Treatment Plant & ETP Plant, Pumps for Water Supply and Drainage;
D-11	Roof Top Solar PV Power Plant
D-12	Split / Cassette AC
D-13	Smart Class Room (108 Seat)

The scope of works includes the preparation of layout plans, drawings for E & M schemes and approval of the same from the respective local bodies / authorities / Gujarat Fire Services/ Lift Inspector/ local electric supply agency etc. before the commencement of work. During execution at any stage or after completion, if the modifications/alterations required by local bodies / statutory authorities for issuance of NOCs, the same shall be executed by the contractor without payment of extra cost. Obtaining approvals / NOCs / clearances from local bodies or/and statutory authorities, for handing over after completion, shall be the responsibility of contractor.

2. Scope of Maintenance of Electrical & Mechanical works

This section covers operation and maintenance of all E&M services/assets installed under the contract for a period of 05 years. The scope includes:

- a. Operation and Routine Maintenance i/c repair/replacement as required, supply of spare parts, providing of required materials and consumables (except HSD oil for DG Set) etc. along with providing minimum staff as per schedule mentioned in NIT, for all E&M services executed in this contract.
- b. Preventive/Comprehensive maintenance as per OEM schedule/Check-List and as approved by the

Engineer-in-charge and Breakdown maintenance at any time during 24 hours x 365 days inclusive of all Sundays & Holidays. This covers repair/replacement as required, supply of spare parts, providing of required materials and consumables (except HSD oil for DG Set) etc. along with man power.

- c. **The defect liability period of all E&M installation of this section shall be 5 years from the date of completion or handover, whichever is later. The main contractor shall enter in MoU with OEM or his authorized service provider for carrying out AMC of following services for 5 years.**
- i. **Sub-Station**
 - ii. **DG Set**
 - iii. **EPABX system**
 - iv. **STP/ ETP, pumps for water supply and drainage**
 - v. **Lift**
 - vi. **CCTV system**
 - vii. **Down Comer system**
 - viii. **Manual Fire Alarm system & PA system**
 - ix. **Solar (Roof top solar PV power plant)**
 - x. **Audio- Video system for Smart class room**
 - xi. **Split and cassette AC**
 - xii. **Data networking system**

NOTE: It shall be the responsibility of the contractor to depute additional staff/ supervisors/engineers as required for proper operation, maintenance and upkeep of installations.

Contractor shall maintain a help desk for managing complaints similar to the system being followed at CPWD Enquiry offices. Complaints shall be attended in a satisfactory manner.

3. The agency must study various CPWD specifications; get themselves acquainted with site and site conditions, provision for firefighting system for various building in local byelaws, CPCB norms and additional conditions carefully. The work shall be executed in close co-ordination with the progress of building work.
4. The works shall be executed as per CPWD's General specification for Electrical Works, Part-I (Internal-2023); Part-II (External)-2023; Part-III (Lifts and Escalators)-2003, Part-IV (Substation)-2013, Part-V (Wet Riser and Sprinkler System for Fire Fighting Installation)-2020, Part-VI (Fire Detection and Alarm System)-2018, Part-VII (DG Set)-2013, HVAC works-2024 (all as amended up to date), IE Rules, Indian Standards amended up to date and as per direction of Engineer-in-charge. The additional conditions & specification given along with the NIT are to be read with above and in case of any discrepancy, the following order of preference shall be observed: -
- (i) Additional conditions & Specifications.
 - (ii) General conditions.
 - (iii) Local bye laws, as amended up to date.
 - (iv) CEA regulations on measures relating to safety and electric supply 2010, as amended up to date.
 - (v) National Building code 2016, as amended up to date.
 - (vi) **ECSBC 2024**, as amended up to date.
 - (vii) CPWD general specifications for electrical works amended up to date.
 - (viii) National electrical code 2023, as amended up to date.
 - (ix) Relevant BIS standards, as amended up to date.

(Note: The higher specifications / stringent conditions among the above shall be followed.)

5. All Electrical & Mechanical Installations shall meet the requirements of **minimum 5 star GRIHA**

Rating and Super ECSBC of ECSBC 2024 as amended up to date. Equipment capacity/selection and design shall also be made as per good engineering practices, CPWD Specifications, NBC -2016, Local body & Gujarat Fire service rules.

6. All the equipment shall be delivered with (i) Manufacturer's test certificate, (ii) Manufacturer's technical catalogues and Installation / Instruction (O&M) manuals.

7. Inspection Before Dispatch:

- (a) All major equipment such as Transformer, DG set, APFC panel, AMF panel, HT Panel, LT Panel with incomer as ACB or MCCB more than 200amp., Rising Mains / Bus Duct, Poles (if quantities is more than 100 nos.), Lift etc. shall be tested at manufacturers premises.
- (b) All Routine Tests shall be conducted before dispatch of equipment. No equipment shall be dispatched out from the manufactures premises before such tests are conducted and test result are recorded. These test certificates shall be given along the supply of equipment.
- (c) The Engineer-in-charge shall, if he so desires, may inspect and witness the pre-delivery tests. For this purpose, the contractor shall give 15-days advance notice. Contractor shall arrange for inspection of the department. Department shall bear expenses of its officials for inspection as far as traveling, boarding and / lodging is concerned. Routine Test & Type Test Certificates shall have to be submitted for equipment.
- (d) Prior to dispatch, all equipment shall be adequately protected & insured for the whole period of transit, storage and erection against corrosion and incidental damages etc. from the effect of vermin, sunlight, rain, heat and humid climate.

8. Procedure For Approval of Materials, Shop Floor Drawings and Commencement of Work:

The contractor shall submit following documents for approval by Engineer in charge.

- (i) List of makes & Model numbers of all equipment and accessories under each Sub-Head of work.
- (ii) Sample of materials.
- (iii) Catalogues of the equipment to be supplied.
- (iv) Shop floor drawings of each packages/ Sub work separately for approval.

It is the responsibility of the contractor to get the makes, models and shop floor drawings approved by the Engineer -In-charge before placing of procurement order. All technical data sheets shall be submitted in advance so that there is ample time to check & comment accordingly & the progress of work is not affected adversely.

9. Insurance:

The agency shall include storage cum erection insurance including third party insurance right from the storage to commissioning and handing over of various equipment. In insurance, the beneficiary shall be Engineer -In-charge at the cost of the contractor. All insurance which the agency is required to enter into under the contract shall be obtained from any authorized general insurance company and the contractor shall produce the policies of insurance. In case of any delay in Installation, Testing, Commissioning & handing over, the insurance cover shall be suitably extended by the contractor at his own cost.

10. Remedy of Failure to Insure:

If the contractor fails to effect and keep in force the insurance referred to in the preceding sub-clause the department may affect and keep in force any such insurance and pay such premium as may be

necessary for that purpose and from time to time. In such case, the department may deduct the amount so paid, from any sum of money due or which may become due to contractor.

11. Quality of Material and Workmanship:

All parts of the equipment shall be of such design, size and material so as to function satisfactorily under all rated conditions of operation. All components of the equipment shall have adequate factor of safety. The work of fabrication and assembly shall conform to sound engineering practice and on the basis of “Fail Safe Design”. The mechanical parts subject to wear and tear shall be easily replaceable type. The construction of the equipment shall be such as to facilitate easy operation, inspection, maintenance and repairs. All connections and contacts shall be designed to minimize risk of accidental short circuits caused by animals, birds and vermin etc. All identical items and their component parts should be completely, interchangeable including spare parts.

12. Inspection and Testing at Site:

- (i) The installation shall be subject to necessary inspection during every stage of erection, by the Engineer-in-charge or his authorized representative. The contractor shall provide all facilities and assistance for the purpose.
- (ii) The completed installation shall be inspected and tested by the Engineer-in-charge.
- (iii) All instruments and facilities necessary for the tests shall be provided by the contractor.

13. Completeness of Work:

- (i) The installations shall be completed in all respects and put in to operation even where certain details have not been mentioned / left out in these specifications.
- (ii) All electrical & mechanical fittings / fixture / appliances, which are to be provided for the work shall have either 5-star rating (where BEE certification is available) or Super ECSBC (of **ECSBC 2024**) Compliant. Since, the proposed construction is for minimum 5-star GRIHA Rating, all fittings and fixtures shall be provided to ensure minimum 5-star GRIHA Rating.
- (iii) SLD of all installations shall be prepared in color print, got laminated in suitable size and displayed suitably at respective plant room etc.

The CPWD specifications are available at CPWD website “cpwd.gov.in”. The department shall not be responsible for the lack of knowledge and also the consequences thereof to the Contractor. The information and data mentioned in the tender document have been furnished in good faith and for general information and guidance only. If the data or information furnished in tender document is different from data / drawing after Preparation of architectural drawings, design approved for construction, the Engineer-in-charge in no case shall be held responsible for any accuracy thereof and / or interpretations or conclusions drawn therefrom by the Contractor.

All consequences in this regard shall be borne by the Contractor and no claim from the Contractor, whatsoever, shall be entertained by the department. It is presumed that the Contractor has satisfied himself for all possible contingencies, situations, bottlenecks and acts of coordination, which may be required between different agencies.

14. Incidental Charges:

All incidental charges of any kind including cartage, storage, wastage and safe custody of material etc. shall be borne by the Contractor.

15. Quality Assurance:

The Contractor shall make available, on request from the Department, for record, copies of invoices, challans, cash memos, receipts, GST bills, E-way bills etc. and other certificates, if any, vouchers towards the quantity and quality of various materials procured and the same shall be kept in record.

These shall also provide information on the name of the manufacturer, manufacturer's product identification, manufacturer's instructions, warning, date of manufacturing and test certificates from manufacturers for the product for each consignment delivered at site, shelf life, if any, for the department to ensure that the material have been procured from the approved source and of the approved quality, as directed by the Engineer-in-charge. Day to day account of receipt of such material shall be maintained at site of work and shall be regulated by the department. Nothing extra shall be payable on this account.

16. Storage Of Materials:

Storage and safe custody of all materials shall be the sole responsibility of the Contractor. Nothing extra shall be payable on this account.

17. Quality Control and Testing of Materials:

- (i) Only articles classified as first quality by the manufacturers shall be used unless otherwise specified. The Engineer in charge may relax the condition regarding testing if the quantity of the materials required for the work is small. In all cases proof of procurement of materials from authentic manufacturers shall be provided by the contractor to the entire satisfaction of Engineer-in-charge.
- (ii) If the department desires to send any samples of materials for testing in an accredited laboratory, the Contractor at his own expense shall supply all materials, labour for preparing and testing samples as required by the Engineer-in-charge. The testing shall be carried out in the presence of the representative of the Engineer- in- Charge. The transportation and testing charges shall also be borne by the contractor.
- (iii) The testing plan for quality control for material/equipment shall be as per CPWD Quality Assurance Policy and checklist for E&M Services-2016.

18. No foreign exchange shall be made available by the department for importing (purchase) of equipment, plants, machinery, materials of any kind. No delay and no claim of any kind shall be entertained from the Contractor on account of variation in the foreign exchange rate and/or any Custom duties / charges or any other levies.

19. The contractor shall take into account the element of wastage(s) those are likely to be there in all elements of the work and quote his price, taking that into account. The contractor shall study all the items from the point of view of wastage(s), which are likely to take place.

20. Power supply and water supply.

Power supply required for construction; testing & commissioning shall have to be arranged by the bidder. Water required for testing of equipment is also in the scope of agency.

21. Extent Of Work

The work shall comprise of entire labour including supervision and all materials necessary to make a complete installation and such tests and adjustments and commissioning, as may be required by the department. The term complete installation shall not only mean major items of the plant and equipment covered by specifications but all incidental sundry components necessary for complete execution and satisfactory performance of installation with all layout charts whether or not those have been specifically mentioned in the tender document. The decision of the engineer-in- charge in the matter shall be final and binding upon the contractor.

The description of E&M service & specification is given in general but they are not exhaustive i.e. does not mention all the incidental works required to be carried out for complete execution of the item

of work. The work shall be carried out, all in accordance with true intent and meaning of the specifications and the drawings taken together, regardless of whether the same may or may not be particularly shown on the drawings and/ or described in the specifications, provided that the same can be reasonably inferred therefrom.

There may be several incidental works, which are not mentioned in the contract document/specifications but will be necessary to complete the item in all respects. All these incidental works/ costs which are not mentioned, but are necessary to complete the work shall be deemed to have been included in the overall amount quoted by the contractor for various components of work.

Being EPC Contract, no adjustment of rates shall be made for any variation in quantum of incidental works due to variation/change in actual working drawings. Also, no adjustment of rates shall be made due to any change in incidental works or any other deviation in such element of work (which is incidental to the items of work and are necessary to complete such items in all respects) on account of the directions of Engineer-in- charge. Nothing extra shall be payable on this account.

22. Cooperation With Other Agencies

The successful contractor shall ensure proper coordination between various associate agencies executing the work of different E&M services in the construction of buildings, if any, and exchange freely all technical information so as to make the execution of this work/contract smooth. No remuneration should be claimed from the department for such technical cooperation. If any unreasonable hindrance is caused to other agencies and any completed portion of the work has to be dismantled and re-done for want of cooperation and coordination by the contractor during the course of execution of such works, expenditure so incurred will be recovered from the contractor if the restoration work to the original condition or specification of the dismantled portion of the work was not undertaken by the contractor himself.

23. Painting

This shall include cost of painting of the entire installation. The major equipment shall be factory final finish painted. The contractor shall be required to do only touching to the damages caused to the painting during transportation, handling & installation at site, if there is no major damage to the painting. However, hangers, supports etc. of bus trunking shall be painted in required shade with spray painting with two coats of anticorrosive primer paint at site.

24. Guarantee

All equipment shall be guaranteed as per time period given in the respective sub-head and general conditions, from the date of taking over the installation by the department, against unsatisfactory performance and/or break down due to defective design, workmanship or material. The equipment or components, or any part thereof, so found defective during guarantee period shall be forthwith repaired or replaced free of cost, to the satisfaction of the Engineer-in- Charge. In case it is felt by the department that undue delay is being caused by the contractor in doing this, the same will be got done by the department at the risk and cost of the contractor. The decision of the Engineer-in-charge in this regard shall be final & binding on the contractor.

25. Guarantee regarding generated Solar output / Solar PV panel

The 25 years guarantee shall be furnished on non-judicial stamp paper of value Rs.100/- or more, in prescribed proforma for generated solar output / solar PV panel. The guarantees shall be submitted before final payment and shall not in any way limit any other rights which the Engineer-in-charge may have under the Contract.

In addition to above, 10% (Ten percent) of the cost of Roof top solar PV power plant shall be

withheld from the bills towards guarantee. This amount to be withheld towards guarantee shall be in addition to the other amounts to be withheld as mentioned elsewhere in the contract agreement. However, one-fifth (1/5) of this withheld amount would be released after every five years from the date of completion of the work, if the performance, as required, is satisfactory. If any defects are noticed during the guarantee period, it shall be rectified by the Contractor within seven days of issue of notice to the Contractor, temporarily, to the satisfaction of the Engineer-in-charge and within a period of one month the permanent rectification of the defects/replacement of defective materials should be carried out by the Contractor. If not attended to, the same shall be got done through other Contractor at the risk and cost of the Contractor and the cost, which shall be final and binding on the Contractor, shall be recovered from the amount withheld towards the guarantee as mentioned above or any other amount due to the Contractor. However, the amount withheld as guarantee can be released in full, if irrevocable bank guarantee, from a Schedule/Nationalized Banks, of the same amount, for the guarantee period is submitted by the Contractor in favour of Engineer-in-charge. The defects, if any, shall be rectified, retaining the same aesthetics and other functional parameters of the original work.

26. Guarantee regarding LED light fixtures, CCTV cameras, PoE Network switches, DDC, WIFI, EPABX, NVR:

The 5 years guarantee shall be furnished on non-judicial stamp paper of value Rs.100/- or more, in prescribed performa for LED light fixtures, CCTV cameras, PoE Network switches, DDC, WIFI, EPABX, NVR. The guarantees shall be submitted before final payment and shall not in any way limit any other rights which the Engineer-in-charge may have under the Contract.

In addition to above, 10% (Ten percent) of the cost of total LED light fixtures, CCTV cameras, PoE Network switches, DDC, WIFI, EPABX, NVR shall be withheld from the bills towards guarantee. This amount to be withheld towards guarantee shall be in addition to the other amounts to be withheld as mentioned elsewhere in the contract agreement. If any defects are noticed during the guarantee period, it shall be rectified by the Contractor within seven days of issue of notice to the Contractor to the satisfaction of the Engineer-in-charge. If not attended to, the same shall be got done through other Contractor at the risk and cost of the Contractor and the cost, which shall be final and binding on the Contractor, shall be recovered from the amount withheld towards the guarantee as mentioned above or any other amount due to the Contractor. However, the amount withheld as guarantee can be released in full, if irrevocable bank guarantee, from a Schedule/Nationalized Banks, of the same amount, for the guarantee period is submitted by the Contractor in favour of Engineer-in-charge. The defects, if any, shall be rectified, retaining the same aesthetics and other functional parameters of the original work.

27. Undertaking from OEM for specialized E&M works:

The contractor shall submit following undertaking from the OEM, from the officer not below the rank of General Manager.

- (a) That OEM will unconditionally support technically throughout the execution of contract as well as during Maintenance/ Comprehensive Maintenance Contract for the useful life of the system, and
- (b) The OEM will provide all the spares required for healthy functioning of the equipment having minimum 10 years.

28. Cable Laying:

The M30 grade precast RCC utility duct for HT cable from metering point of local electric supply company, main cables and supplies cables to the buildings, feeder pillar etc. shall be provided in the entire development zone. For further distribution the DWC pipe/ HDPE pipe/ RCC Hume pipe shall be used for cable laying in green areas and wherever required.

29. Approval from local authorities

- (a) The contractor / consultant shall submit all details and carryout liaison / coordination work with local / statutory authorities for obtaining NOC / approval for 11 KV electric sub-station / approval of electrical load / release of load / load sanction for premises / net metering for grid connected roof top solar PV power plant from local electricity supply agency. Similarly, the contractor shall obtain NOC / approval from pollution control board or any other authority, if required.
- (b) The contractor / consultant shall coordinate with service provider such as MTNL/ BSNL for providing telephones / broad bands and IGL for providing PNG connection.
- (c) All payments required for these approvals from local authorities such as local electrical supply agency/ CEA/ MTNL/ BSNL etc. shall be made by the Engineer-in-charge. However, if paid by the agency for saving of time, amount shall be reimbursed by the department on production of relevant documents. Department's role shall be limited only to sign the application / drawings / documents on behalf of owner for submission to these authorities for their approval.

30. Training

The scope of works includes the on job technical training of two persons of department at site. Nothing extra shall be payable on this account.

31. Erection Tools

No tools and tackles either for unloading or for shifting the equipment for erection purposes would be made available by the department. The contractor shall make his own arrangement for all these facilities.

32. Care of the Building

Care shall be taken by the contractor while handling and installing the various equipment and components of the work to avoid any damage. He shall be responsible for repairing all damages and restoring the same to their original finish at his cost. He shall also remove at his cost all unwanted and waste materials arising out of the installation from the site of work.

- 33.** Foundation of all equipment as per recommendations of OEM, Anti vibration isolators etc. as required shall be provided.
- 34.** Minor building works necessary for installation of equipment, foundation, trench for fuel line & cable, making of opening / core cutting in walls or in floors and restoring them to their original condition/finish and necessary grouting etc. as required shall be done by the contractor.
- 35.** All support for exhaust & water pipes, chimney, bus trunking, cables, anti-vibration pads etc. as required, shall be provided.
- 36.** All electrical work and neutral earthing, body earthing, control and instrument wiring, required for any E&M equipment as per codal requirements, shall be provided.
- 37.** Scaffoldings & any other T & P required for execution, testing and commissioning of work shall be arranged by the contractor and is included in the cost of work tendered by the contractor.

SCOPE, ADDITIONAL CONDITIONS AND TECHNICAL SPECIFICATIONS

D-1 INTERNAL ELECTRICAL INSTALLATIONS and EXTERNAL STREET LIGHTING

D1.1 SCOPE OF WORK

Scope of this sub head covers planning, designing, supply, installation, testing and commissioning of complete Internal and External Electrical Works which includes not only the items exclusively defined hereunder but also any other item required to commission and complete the work as per site requirement in this sub head or as per good Engineering practice or as required under the codes or by local/statutory authorities.

INTERNAL ELECTRICAL INSTALLATIONS FOR THE AREA DETAILED BELOW: -

1. All SPN/TPN DB used for final circuits anywhere shall be double door type, shall have 30mA sensitivity RCCB + DPMCB/ Four pole MCB as incomer and SPMCB's as outgoing etc. as required. Minimum 20% spare circuit with MCB shall also be available.
2. FRLS Copper wiring in Heavy duty PVC/ Medium class steel conduit i/c light/fan/call bell/exhaust fan points of all categories, power points, circuit wiring and sub main wiring with modular switches & sockets i/c modular plates and suitable GI boxes in all areas as required. Heavy duty PVC conduit shall be used for recessed conduiting in slab/ wall, whereas medium class steel conduit shall be used on surface, including surface above false ceiling.
 - a. In all buildings, total no. of power outlets shall be provided as per detailed engineering/layout. However, the **power outlets** shall be calculated on the basis of following proposed minimum requirement.
 - (i) In corridor/common area for each 50 sq mtr area 1 no. 15/16 amp power outlet shall be provided. In offices area, for each 20 sq mtrs area in general 1 no. 15/16 amp power plug shall be provided.
 - (ii) In addition to above for each computer work stations/ executive table/ reception/ entrance of each building, 1 no. 15/16 amps Switch with 3 nos. 3 pin 5/6A socket outlet power outlets, 1 no. USB Charger socket, and 1 no telephone & 1 no data socket shall be provided in separate box. Rooms below the size of 100 sq.ft shall also be treated as work station.
 - (iii) In addition to above for each gadget like high wall mounted type indoor unit of air conditioner, server, networking switches etc., 5A/15A amp power plug with controlling switch shall be provided.
 - (iv) Wherever it is not possible to lay the conduit/ in floor the electrical wiring shall be provided through GI raceways duly compartmentalized with necessary junction box, Popup box, etc. for electrical and ELV services.
 - b. The connection between incoming switch / isolator and bus bar shall be made suitable size of thimble and cable.
 - c. Cable TV outlet comprises 2 nos. 6 amp. switches, 3 nos. 3 pin 6A socket and one RG-6 socket in GI Boxes. These shall be provided at entrance area of each building.
 - d. LED mirror light above/side of each wash basin
 - e. 1 no. 15A power point in all electrical LT panel, feeder pillar, MDB to be provided.
 - f. 1 no. 15A power point and 2 nos. LAN points to be provided at each printer.
 - g. 1 no. 15A power point to be provided for each wi-fi access point.
 - h. Electrical point to be provided for Urinal sensors in all toilets.

3. Fittings in Electrical installation in Pump room/ STP/ Sub-Stations/ Utility Block area etc.:
 - a. General lighting by suspended /surface/recess 4 feet IP 65 LED fittings.
 - b. 15/5 Amp power plug socket as required but minimum two nos. for every room or for every 20 sqmtr.
 - c. One number computer outlet (1 no. 15/16 amps Switch with 4 nos. 3 pin 5/6A socket outlet power outlets, 1 no. 3.1A USB Charger) and 1 no. telephone & 1 no. data socket shall be provided in separate box.
4. Electrical installation in Parking Area - General lighting by suspended /surface/ fixed 4 feet IP 65 LED fittings.
5. Drawings of all areas prepared by successful bidder shall be approved by the department.
6. Toilet shall be specially abled friendly as per “Accessible India Guidelines” of Govt. of India.
7. All stair case shall be provided with 2 way light control with emergency supply.
8. All LED light fixtures such as LED chandelier, LED cove lighting, LED bulkhead lighting, LED Surface / recess down lighter, LED mirror light, LED 4 feet batten, LED surface / recess panel, chandelier with 5 head LED lamps, decorative wall bracket single head / double head LED lamp, LED step light etc. for the area as detailed below: -

Sr. No.	Room/Space /Location	Type of LED Light	Average Lux level required	Fittings Parameters
				Glare/CRI/THD/Efficacy (Lum/watt), PF, Colour temp. or any other parameter as required)
(1)	(2)	(3)	(4)	(5)
a. Training & Capacity				
i. Ground floor				
1	Library	LED Downlighter	500	As per Illumination Schedule (Internal)
2	HOD Training & Capacity	LED Downlighter	500	
3	Meeting Room	LED Downlighter	500	
4	Smart Class room	LED Downlighter	500	
5	Pantry	LED Downlighter	500	
6	Gents toilet	LED Downlighter	150	
7	Ladies toilet	LED Downlighter	150	
8	H. Toilet	LED Downlighter	150	
9	Corridor	LED Downlighter	150	
10	Entrance area	LED Uniform light plane & Downlighter	300	
11	Stair	LED Downlighter	150	
ii. First floor				
1	Incubation Center	LED Downlighter	500	
2	Cabin	LED Downlighter	500	
3	Pedagogy Expert	LED Downlighter	500	

Sr. No.	Room/Space /Location	Type of LED Light	Average Lux level required	Fittings Parameters
				Glare/CRI/THD/Efficacy (Lum/watt), PF, Colour temp. or any other parameter as required)
(1)	(2)	(3)	(4)	(5)
4	Wildlife SME	LED Downlighter	500	
5	Work station	LED Downlighter	500	
6	Trainer	LED Downlighter	500	
7	Corridor	LED Downlighter	500	
8	Gents toilet	LED Downlighter	150	
9	Ladies toilet	LED Downlighter	150	
10	Stair	LED Downlighter	150	
b.	Informatics and Analytics & Network and Outreach Unit			
i.	Ground floor			
1	Statistician	LED Downlighter	500	
2	GIS Expert	LED Downlighter	500	
3	Screen & Server	LED Downlighter	500	
4	H.O.D. Informatics and analytics	LED Downlighter	500	
5	Reception & Lounge	LED Downlighter	500	
6	Research Associates and Data Analysts	LED Downlighter	500	
7	Meeting Room	LED Downlighter	500	
8	Inventory & Scrap room	LED Downlighter	500	
9	M&E Expert	LED Downlighter	500	
10	IT Expert	LED Downlighter	500	
11	Gents toilet	LED Downlighter	150	
12	Ladies toilet	LED Downlighter	150	
13	H. Toilet	LED Downlighter	150	
14	Corridor	LED Downlighter	150	
15	Entrance area	LED Uniform light plane & Downlighter	300	
16	Stair	LED Downlighter	150	
ii.	First floor			
1	RRT	LED Downlighter	500	
2	Regional Center Coordination unit and workspace & Discussion area	LED Downlighter	500	
3	HOD Network and outreach	LED Downlighter	500	
4	Work Station	LED Downlighter	500	
5	Chamber	LED Downlighter	500	

Sr. No.	Room/Space /Location	Type of LED Light	Average Lux level required	Fittings Parameters
				Glare/CRI/THD/Efficacy (Lum/watt), PF, Colour temp. or any other parameter as required)
(1)	(2)	(3)	(4)	(5)
6	Meeting Room	LED Downlighter	500	
7	Media	LED Downlighter	500	
8	Policy	LED Downlighter	500	
9	Pantry	LED Downlighter	500	
11	Gents toilet	LED Downlighter	150	
12	Ladies toilet	LED Downlighter	150	
13	H. Toilet	LED Downlighter	150	
14	Corridor	LED Downlighter	150	
15	Stair	LED Downlighter	150	
c.	Wildlife Health Management And Disease Investigation and Surveillance			
i.	Ground floor			
1	Research Associates	LED Downlighter	500	
2	Extra	LED Downlighter	500	
3	Wildlife Biologist	LED Downlighter	500	
4	Immunologist	LED Downlighter	500	
5	Micro Biologist	LED Downlighter	500	
6	Animal Nutritionist	LED Downlighter	500	
7	HOD Wildlife Disease Investigation and Surveillance	LED Downlighter	500	
8	Meeting Room	LED Downlighter	500	
9	Chemist	LED Downlighter	500	
10	Jr. Veterinary Doctor	LED Downlighter	500	
11	Sr. Veterinary Doctor	LED Downlighter	500	
12	Reception & Lounge	LED Downlighter	500	
13	Animal Treatment Ward	LED Downlighter	500	
14	Operation Theatre	LED Downlighter	500	
15	Treatment Area	LED Downlighter	500	
16	Instruments Room	LED Downlighter	500	
17	Store	LED Downlighter	500	
18	Gents toilet	LED Downlighter	150	
19	Ladies toilet	LED Downlighter	150	
20	H. Toilet	LED Downlighter	150	
21	Corridor	LED Downlighter	150	
22	Entrance area	LED Uniform light plane & Downlighter	300	
23	Stair	LED Downlighter	150	

Sr. No.	Room/Space /Location	Type of LED Light	Average Lux level required	Fittings Parameters
				Glare/CRI/THD/Efficacy (Lum/watt), PF, Colour temp. or any other parameter as required)
(1)	(2)	(3)	(4)	(5)
ii.	First floor			
1	Histopathology Lab	LED Downlighter	500	
2	Pathology Lab	LED Downlighter	500	
3	Cabin	LED Downlighter	500	
4	Bio Informatics Lab	LED Downlighter	500	
5	Biotechnology Lab	LED Downlighter	500	
6	Bio Statisticians	LED Downlighter	500	
7	Epidemiologist	LED Downlighter	500	
8	Pathologist	LED Downlighter	500	
9	Toxicologist	LED Downlighter	500	
10	Bioinformatics Expert	LED Downlighter	500	
11	Biotechnologist	LED Downlighter	500	
12	Vaccinologist	LED Downlighter	500	
13	Molecular Biologist	LED Downlighter	500	
14	Microbiology Lab	LED Downlighter	500	
15	Toxicology Lab	LED Downlighter	500	
16	Virology Lab	LED Downlighter	500	
17	Sample Collection	LED Downlighter	500	
18	BSI Lab-1	LED Downlighter	500	
19	BSI Lab-2	LED Downlighter	500	
20	Cabin	LED Downlighter	500	
21	Stair	LED Downlighter	150	
22	Pantry	LED Downlighter	500	
23	Gents toilet	LED Downlighter	150	
24	Ladies toilet	LED Downlighter	150	
25	H. Toilet	LED Downlighter	150	
26	Corridor	LED Downlighter	150	
d.	Administrative Department			
i.	Ground floor			
1	Electrical Room	LED Downlighter	500	
2	Deputy Director room	LED Downlighter	500	
3	Technical Assistant	LED Downlighter	500	
4	Director Room	LED Downlighter	500	
5	Vice Chairman Room	LED Downlighter	500	
6	Waiting Area	LED Downlighter	500	
7	Reception & Lounge	LED Downlighter	500	

Sr. No.	Room/Space /Location	Type of LED Light	Average Lux level required	Fittings Parameters
				Glare/CRI/THD/Efficacy (Lum/watt), PF, Colour temp. or any other parameter as required)
(1)	(2)	(3)	(4)	(5)
8	Waiting Lounge	LED Downlighter	500	
9	Board Room	LED Downlighter	500	
10	Inventory Store	LED Downlighter	500	
11	Canteen	LED Downlighter	500	
12	Kitchen	LED Downlighter	500	
13	Store	LED Downlighter	500	
18	Gents toilet	LED Downlighter	150	
19	Ladies toilet	LED Downlighter	150	
20	H. Toilet	LED Downlighter	150	
21	Corridor	LED Downlighter	150	
22	Entrance area	LED Uniform light plane & Downlighter	300	
23	Stair	LED Downlighter	150	
ii.	First floor			
1	Admin work Station	LED Downlighter	500	
2	Procurement Officer	LED Downlighter	500	
3	Audit Officer	LED Downlighter	500	
4	External Auditor	LED Downlighter	500	
5	Legal Expert	LED Downlighter	500	
6	Waiting Area	LED Downlighter	500	
7	Multipurpose Space for Future expansion	LED Downlighter	500	
8	Establishment officer	LED Downlighter	500	
9	Admin Officer	LED Downlighter	500	
10	Meeting Room	LED Downlighter	500	
11	Stair	LED Downlighter	150	
12	Gents toilet	LED Downlighter	150	
13	Ladies toilet	LED Downlighter	150	
14	H. Toilet	LED Downlighter	150	
15	Corridor	LED Downlighter	150	
e.	Utility Block	Lighting by suspended /surface/recess 4 feet IP 65 LED fittings	150	

9. Ceiling fans will be provided in all functional areas/security room/ etc. All ceiling fans should be 5 star rated BLDC type ceiling fans and with compatible regulator (without remote). Optimum size / number of ceiling fans for room of different sizes shall be as in accordance with NBC 2016/ as per provision laid down in CPWD specifications for internal EI work 2023. In common/lift lobby area at each floor of each building minimum 1 no ceiling fans shall be provided.
10. 5-star rating BLDC type ceiling fans and compatible regulator (without remote), 5-star wall fan, fresh air fan, exhaust fan shall be provided as required for respective areas and as mentioned below:

SCHEDULE OF INTERNAL ELECTRICAL INSTALLATION

a. For Ventilation/Air circulation in room/halls

S. No	Room/ Space/ Location	Whether fans required	Type of fan (Ceiling / Wall/ Exhaust fan)	Fan parameters	Type of control		Control linked with	
				BEE Energy Efficiency/ star rating				
					Single	Group	Regulator based/ Keypad/ remote	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
a.	Training & Capacity							
i.	Ground floor							
1	Library	Y	Ceiling/ Wall	BLDC Fan-5 Star	Y		Y (Regulator)	As per CPWD General Specification for Electrical works Part-I Internal 2023, 3.16.1-Table 3.1 & 3.2
2	HOD Training & Capacity	Y	Ceiling/ Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
3	Meeting Room	Y	Ceiling/ Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
4	Smart Class room	Y	Ceiling/ Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
5	Pantry	Y	Exhaust	Inline-IE4	Y			As per NBC 2016 design
6	Gents toilet	Y	Exhaust	Inline-IE4	Y			-do-

7	Ladies toilet	Y	Exhaust	Inline-IE4	Y			-do-
8	H. Toilet	Y	Exhaust	Inline-IE4	Y			-do-
10	Entrance area	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	As per CPWD General Specification for Electrical works Part-I Internal 2023, 3.16.1- Table 3.1 & 3.2
ii.	First floor							
1	Incubation Center	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	As per CPWD General Specification for Electrical works Part-I Internal 2023, 3.16.1- Table 3.1 & 3.2
2	Cabin	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
3	Pedagogy Expert	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
4	Wildlife SME	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
5	Work station	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
6	Trainer	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
7	Gents toilet	Y	Exhaust	Inline-IE4	Y			As per NBC 2016 design
8	Ladies toilet	Y	Exhaust	Inline-IE4	Y			-do-
b.	Informatics and Analytics & Network and Outreach Unit							
i.	Ground floor							
1	Statistician	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	As per CPWD General Specification for Electrical works Part-I Internal 2023, 3.16.1- Table 3.1 & 3.2
2	GIS Expert	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
3	Screen & Server	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-

4	H.O.D. Informatics and analytics	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
5	Reception & Lounge	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
6	Research Associates and Data Analysts	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
7	Meeting Room	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
8	Inventory & Scrap room	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
9	M&E Expert	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
10	IT Expert	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
11	Gents toilet	Y	Exhaust	Inline-IE4	Y			As per NBC 2016 design
12	Ladies toilet	Y	Exhaust	Inline-IE4	Y			-do-
13	H. Toilet	Y	Exhaust	Inline-IE4	Y			-do-
14	Entrance area							
ii. First floor								
1	RRT	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	As per CPWD General Specification for Electrical works Part-I Internal 2023, 3.16.1-Table 3.1 & 3.2
2	Regional Center Coordination unit and workspace & Discussion area	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
3	HOD Network and outreach	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
4	Work Station	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
5	Chamber	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
6	Meeting Room	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
7	Media	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
8	Policy	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
9	Pantry	Y	Exhaust	Inline-IE4	Y			As per NBC 2016 design
11	Gents toilet	Y	Exhaust	Inline-IE4	Y			-do-

12	Ladies toilet	Y	Exhaust	Inline-IE4	Y			-do-
13	H. Toilet	Y	Exhaust	Inline-IE4	Y			-do-
14	Stair							
c.	Wildlife Health Management And Disease Investigation and Surveillance							
i.	Ground floor							
1	Research Associates	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	As per CPWD General Specification for Electrical works Part-I Internal 2023, 3.16.1-Table 3.1 & 3.2
2	Extra	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
3	Wildlife Biologist	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
4	Immunologist	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
5	Micro Biologist	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
6	Animal Nutritionist	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
7	HOD Wildlife Disease Investigation and Surveillance	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
8	Meeting Room	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
9	Chemist	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
10	Jr. Veterinary Doctor	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
11	Sr. Veterinary Doctor	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
12	Reception & Lounge	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
13	Animal Treatment Ward	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
14	Operation Theatre	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
15	Treatment Area	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-

16	Instruments Room	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
17	Store	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
18	Gents toilet	Y	Exhaust	Inline-IE4	Y			As per NBC 2016 design
19	Ladies toilet	Y	Exhaust	Inline-IE4	Y			-do-
20	H. Toilet	Y	Exhaust	Inline-IE4	Y			-do-
21	Entrance area	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	As per CPWD General Specification for Electrical works Part-I Internal 2023, 3.16.1- Table 3.1 & 3.2
ii. First floor								
1	Histopathology Lab	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
2	Pathology Lab	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
3	Cabin	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
4	Bio Informatics Lab	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
5	Biotechnology Lab	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
6	Bio Statisticians	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
7	Epidemiologist	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
8	Pathologist	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
9	Toxicologist	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
10	Bioinformatics Expert	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
11	Biotechnologist	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
12	Vaccinologist	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
13	Molecular Biologist	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
14	Microbiology Lab	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
15	Toxicology Lab	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
16	Virology Lab	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-

17	Sample Collection	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
18	BSI Lab-1	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
19	BSI Lab-2	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
20	Cabin	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
21	Pantry	Y	Exhaust	Inline-IE4	Y			As per NBC 2016 design
22	Gents toilet	Y	Exhaust	Inline-IE4	Y			-do-
23	Ladies toilet	Y	Exhaust	Inline-IE4	Y			-do-
24	H. Toilet	Y	Exhaust	Inline-IE4	Y			-do-
d.	Administrative Department							
i.	Ground floor							
1	Electrical Room	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	As per CPWD General Specification for Electrical works Part-I Internal 2023, 3.16.1- Table 3.1 & 3.2
2	Deputy Director room	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
3	Technical Assistant	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
4	Director Room	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
5	Vice Chairman Room	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
6	Waiting Area	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
7	Reception & Lounge	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
8	Waiting Lounge	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
9	Board Room	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
10	Inventory Store	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-
11	Canteen	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	-do-

12	Kitchen	Y	Exhaust	Inline-IE4	Y			As per NBC 2016 design
13	Store	Y	Exhaust	Inline-IE4	Y			-do-
18	Gents toilet	Y	Exhaust	Inline-IE4	Y			-do-
19	Ladies toilet	Y	Exhaust	Inline-IE4	Y			-do-
20	H. Toilet	Y	Exhaust	Inline-IE4	Y			-do-
21	Entrance area	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	As per CPWD General Specification for Electrical works Part-I Internal 2023, 3.16.1-Table 3.1 & 3.2
ii. First floor								
1	Admin work Station	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
2	Procurement Officer	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
3	Audit Officer	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
4	External Auditor	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
5	Legal Expert	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
6	Waiting Area	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
7	Multipurpose Space for Future expansion	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
8	Establishment officer	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
9	Admin Officer	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
10	Meeting Room	Y	Ceiling/Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
11	Gents toilet	Y	Exhaust	Inline-IE4	Y			As per NBC 2016 design
12	Ladies toilet	Y	Exhaust	Inline-IE4	Y			-do-
13	H. Toilet	Y	Exhaust	Inline-IE4	Y			-do-

e.	Utility Block	Y	Ceiling/ Wall	BLDC Fan- 5 Star	Y		Y (Regulator)	As per CPWD General Specification for Electrical works Part-I Internal 2023, 3.16.1- Table 3.1 & 3.2
		Y	Exhaust	Inline-IE4	Y			As per NBC 2016 design

Note: Inline fan shall be provided with supply and return duct wherever required. **Lighting automation and daylight sensing shall be provided in all building to achieve GRIHA rating.** Occupancy Sensor shall be designed as per below parameters –

- a. OS-1 (10 Amp, Coverage – 5m dia, PIR Technology)
- b. OS-2 (10 Amp, Coverage - 5m x 20m, Microwave Based Technology)
- c. OS-3 (10 Amp, Coverage - 5m dia, PIR Technology with Photo Sensor)
- d. Each toilet block shall be provided minimum 2 numbers of Exhaust Fan.
(Occupancy sensor for all area as per detailed engineering and as decided by Engineer-in-charge. The design parameters are as above.)



11. RG-6 Cable TV wiring in steel conduit for Dish Antenna at terrace for each block is covered in this scope (the location shall be decided by Engineer in charge).
12. Conduit with GI junction box for Telephone, Data network and CCTV. (Cat-6A cabling / telephone wiring and faces plate etc. as required for EPABX / Data networking / CCTV are covered in respective sub heads).
13. Cabling from UPS-to-UPS distribution Panel and UPS distribution panel to UPS DB's, necessary UPS circuits, switch boards etc. as required, shall be provided.
14. Minimum two nos. call bell (multi tones.) and red green indication lights for the office of Scientist/HOD. in each building/ block. Minimum One call bell point shall be provided in each room in office area except mentioned at serial no. (iv) in each building/ block.
15. Minimum one nos. Hand dryer with 15A power point and associated wiring shall be provided in all toilets.
16. Energy conservation measures as mentioned below shall be provided:
 - (i) Arranging circuit and timer-based auto control to switch off 50% light in common area during lean hours.
17. Earthing system:



GI plate earth pits and complete earthing system as required shall be carried out as per CPWD specification's part I (internal)-2023 & Part IV substation-2013.

In addition , following works shall be executed by the contractor :

- (a) 2 no GI earth strip along-with every cable tray,

- (b) Earth pit along with GI strip/GI wire for Lifts, Data networking, CCTV and EPABX, FAS and any other services as per OEM requirement.
 - (c) 2 Nos. Copper Earth pit along with copper strip for UPS for each block.
 - (d) 2 Nos. Copper Earth pit along with copper strip for roof top solar power plant for each parking roof.
18. Lightning arrester system for complete lightning protection including walls protection for all buildings shall be as per IS/IEC-62305/ NBC 2016 requirement.

II	L-2	POST TOP	<p>SINGLE PIECE WITH A CIRCULAR SHAPE MADE OF EXTRUDED ALUMINUM PROCESS, IP 66, IK-8, DECORATIVE TOP LUMINAIRE WHICH IS MADE OF NONYELLOWING UV STABILIZED TRANSLUCENT POLYCARBONATE DIFFUSER, FIXED ON THE TOP WITH SILICON GASKET. AUXILIARY AND OPTICAL COMPARTMENT CAN BE ACCESSED BY TILTING THE TOP FRAME. INTEGRAL POST TOP OF SYSTEM LUMEN PACK >3000 LUMENS, (TOLERANCE $\pm 10\%$), 360° SYMMETRICAL OPTICS TYPE V OPTICS, CCT 3000K. IT SHOULD HAVE CRI >80. SDCM≤ 5. LIFE CLASS L70B50 > 50,000 HRS, LUX: 15 TO 20. POWER CONSUMPTION <30 W, THE DRIVER SHOULD BE INTEGRATED NON-DIMMABLE WITH PF>0.9 & THD<5%. DRIVER EFFICIENCY > 85% . ELECTRONIC POWER SUPPLY FOR LED MODULE, WHICH OFFERS PROTECTION AGAINST SHORT CIRCUITS, OVER VOLTAGE & OVER-CURRENT, WITH IN-BUILT SURGE PROTECTION > 4KV. FIXTURE SHOULD BE BIS CERTIFIED DRIVER SHOULD BE POTTED</p>		As per detail design
III	L-3	LIGHT POLE	<p>DECORATIVE POLE 4 MTR. HEIGHT MADE OUT 6 MM THICK MS PIPE FACILITATING THE LUMINAIRE MOUNTING AT THE TOP. THE POLE SHALL BE SURFACE MOUNTED ON A CONCRETE FOUNDATION. THE GRADE OF PRESSURE DIECAST MATERIAL SHALL BE ADC12. A GDC EMBELLISHMENT IS PROVIDED AT APPROPRIATE HEIGHT ENHANCING THE DECORATIVE OUTLOOK OF THE POLE. THE GRADE OF GRAVITY DIE CAST MATERIAL SHALL BE LM6. A BASE COMPARTMENT WITH A DIE CAST ALUMINIUM DOOR CONTOURED TO THE POLES'S SHAPE HOUSING THE GEAR TRAY, PREWIRED WITH 2 WAY CONNECTOR. THE SURFACE PREPARATION OF THE POLE & COMPONENTS SHALL BE DONE BY</p>		As per detail design

			SHOT BLASTING WHICH IS ENVIRONMENTALLY SAFE ELIMINATING THE CHEMICAL AND ACID USE AND ENSURING THE THOROUGHREMOVAL OF IMPURITISE LIKE, RUST, OXIDES AND OTHER UNWANTED PARTICLES FROM THE SUFACE FOR HIGH STANDARD COATING. THE SURFACE FINISH OF THE POLE SHALL BE ZINCH RICH PRIMER COAT & PURE POLYESTER POWDER COATING OR EPOXY ZINC PHOSPHATE PRIMER FOLLOWED BY THE ENVIRONMENTALLY STABLE POLYURETHANE BASED PAINT.		
IV	L-4	G.I. OCTAGONAL POLE	8 MTR HIGH G.I. OCTAGONAL POLE HAVING TOP DIA 70 MM, BOTTOM DIA 130 MM, SHEET THICKNESS 3MM WITH BASE PLATE (AS PER OEM STANDARD), WITH PRECAST RCC FOUNDATION OF SUITABLE SIZE, J TYPE 4 NOS STEEL BOLTS & NUTS AS PER MANUFACTURER RECOMMENDATION COMPLETE WITH ALLEN KEYS, NEUTRAL LINK, CONNECTOR, SP MCB, WITH FLUSH WEATHER PROOF DOOR WITH LOCKING FACILITY., COMPLETE WITH ≥ 1.0 METER LONG OVRHANG BRACKET THESE SHALL BE PROVIDED ALONG THE ENTIRE LENGTH OF THE BOUNDARY AT A MAX. SPACING OF 18M AND 1.2M AWAY FROM THE BOUNDARY LINE.		As per detail design
VI	L-5	STREET LIGHT	HIGH QUALITY INTEGRATED LED LUMINAIRE WITH A SYSTEM LUMEN OF 7200 LM AND SYSTEM WATTAGE 60W WITH AN EFFICIENCY 125 LUMEN/WATT. CCT OF 5700K WITH SDCM OF < 5 AND CRI>70. THE HOUSING SHOULD BE TOP OPENABLE & OF HIGH-QUALITY PRESSURE DIE CAST ALUMINUM LM6 ALLOY WITH PF > 0.95 AND THD< 10% INBUILT SURGE PROTECTION OF 4KV AND EXTERNAL SPD OF 10 KV. INPUT VOLTAGE OF 140-270V. LIFETIME OF 50K HOURS @L70.		As per detail design

			<p>THE INGRESS PROTECTION SHOULD BE MINIMUM IP 66 WITH AN IK RATING OF 08. THE LED USED IN THE LUMINAIRE SHALL BE SMD TYPE ONLY. THE LUMINAIRE SHOULD BE COMPLIANT TO CISPR 15 & IES 61547 (EMC, EMI COMPLIANT). THE DRIVER SHOULD BE POTTED/ENCAPSULATED & SHOULD BE A BIS APPROVED DRIVER AND NOT A PRINTED CIRCUIT BOARD WITHOUT CASING, MOUNTED INSIDE THE LUMINAIRE. THE LUMINAIRE SHOULD BE CAPABLE OF WITHSTANDING VOLTAGE STRESS OF 440V FOR 8 HRS, SHOULD HAVE AN AUTO SHUTDOWN @ 325V AND HAVE AN AUTO RECOVERY FEATURE. THE MINIMUM LENGTH OF THE LUMINAIRE SHOULD BE 400 MM AND THE WIDTH OF THE LUMINAIRE SHOULD BE MORE THAN 250MM ENSURING A STABLE OPTICAL AND THERMAL MANAGEMENT. THE NUMBER OF AND NOT MORE THAN 42 IN COUNT ENSURING UNIFORM LIGHT DISTRIBUTION AND THERMAL MANAGEMENT. THE WEIGHT OF THE LUMINAIRE SHOULD NOT BE LESS THAN 4.5 KG. BIS APPROVAL FOR BOTH DRIVER AND THE LUMINAIRE NEEDS TO BE</p>	
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Note: -

1. The connector for all indoor and outdoor fittings shall be as per IP67 rating.
2. LM 79 report of each type of LED luminaire from third party NABL Accredited Lab to be submitted at the time of approval of fittings
3. LM 80 report of LEDs for each type of LED luminaire from LED manufacturer to be submitted.
4. The external lighting comprising of aesthetic lighting, street lighting, landscape lighting, path ways, entrance, of the whole campus shall be design by the professional expert in lighting design and shall be got approved by Engineer-in-charge.
5. All fixtures wire termination must have IP67 connector
6. All luminaires and their respective drivers must be BIS certified.
7. All light fittings shall be complete with all necessary drivers, control gears, mounting arrangement Dimmable drivers (if required), with LMS software are included to be scope of work.
8. Provision of IP66/ IP 67 terminal box with 6A SPMCB control & neutral link for each light is in scope of work.

D1.2 SPECIFICATIONS AND DESIGN CONCEPT

1. Compliance:

Electrical work in general shall be carried out as per General Specifications for Electrical Works.- Part-I Internal-2023 and Part -II- External Work- 2023. as amended up to date. Provisions of NBC 2016, ECSBC 2024 (SUPER ECSBC) relevant IS shall also be complied. Out of them, most stringent shall be complied. In addition, following shall also be complied, observed and implemented.

2. Conduit / switches:

- a. All internal electrical works shall be carried out with steel conduits and accessories. shall be provided. in places where conduiting is not possible suitable size XLPE armoured cable may be laid maintaining the aesthetic of the building
- b. The wiring and conduit route plan/drawings shall be submitted by the contractor and shall be got approved from the Engineer-in-charge.
- c. To facilitate drawing of wires, 18 SWG GI fish wire shall be provided along laying of recessed conduit.
- d. While laying conduits for fire alarm system, telephone, TV, Data networking, CCTV, sufficient junction outlets are to be provided for ease of drawing wires and maintenance as per the direction of the Engineer-in-charge.

3. DBs :

- a. Size of distribution board shall be as per number of light / power circuits. All distribution boards shall be double door type. 30 mA sensitivity DP RCCB and MCB of suitable rating and numbers shall be provided as main incomer in all SP DBs. 20% spares circuits MCB shall be kept in all DB's.
- b. Location of DB's shall be decided considering aesthetics.

4. Wiring and switch sockets:

- a. All switches, sockets, IP Phone socket, Data sockets, stepped type electronic fan regulators, bell push and accessories along with matching mounting boxes shall be of modular type.
- b. T.V outlet wiring shall be terminated in suitable size of G.I. box along with splitter, Dish antenna (master or individual) is not covered in the scope of contractor, the same shall be provided by department.
- c. Telephone outlet point wiring shall be terminated in suitable size of krone junction box wherever required. Conduit for telephone wiring may be provided through branching by providing suitable size of G.I. box along suitable tag block at each floor. The inter connections of all junction boxes fixed at all floors shall be done properly by making proper distribution system.
- d. In parking areas no switch for individual light control is to be provided, all such point shall be executed on looping basis and controlled directly from DB/ feeder pillar panel.
- e. In big halls, corridors, staircase, etc. most of the points may be group controlled (not requiring separate switch) or as decided by Engineer-in-charge.
- f. Minimum size of copper conductor for power wiring shall be 4 Sq mm and that for light and fan points wiring shall be 1.5 sq mm.

5. Wiring in Lift shaft:

- a. In building power supply to DBs meant for Lift shall be provided at lift machine room/ at top floor in case of MRL lifts at suitable location as approved by Engineer- in-charge using suitable size XLPE insulated armored Aluminum cable.
- b. Inside the lift shaft there shall be arrangement of one light point at each floor level and one light point at overhead, one light point in lift pit. All light points shall be in group controlled and wired with 1.5 sq mm FRLS copper conductor cable. LED Bulk head fittings of suitable rating to provide minimum lux of 100 shall be connected with each point of lift shaft.
- c. 6/16 Amp power socket shall be provided at each floor. Wiring of these power plugs shall be done with 4 sq mm FRLS copper wires.

6. Cable:

- a. Cables up to 16 sq.mm conductor size shall be copper conductor XLPE insulated armored or unarmored (as required) PVC sheathed. Cables above 16 sq.mm conductor size shall be Aluminum conductor XLPE insulated armored PVC sheathed.
- b. Wherever Cables are laid on cable trays, the approx. 50% capacity of all such cable trays shall remain unused as future provision.
- c. Aluminum Bus trunking or Fire integrity/Fire survival copper conductor cable or copper conductor ZHLS wire in steel conduit shall be used for fire Alarm system, PA system, Ventilation Panels and Ventilation Fans
- d. **Voltage drop for feeders shall not exceed 2% at design load. Voltage drop for branch circuit shall not exceed 3% at design load.**

7. LED FITTINGS:

- a. **All LED Indoor lighting fixtures should be following parameters:**

Suspended/Recessed/Surface Linear & Luminaire

Sl. No.	Description	Parameters
1.	CRI	>80
2.	THD	≤5%
3.	SDCM	≤3
4.	LM 79 test report from NABL accredited 3 rd party lab	to be provided for each model being Offered from LED manufacturer.
5.	LM 80 test report	From LED manufacturer
6.	Driver	BIS certified
7.	System efficacy	minimum 110 lm/W at temp 0 to +45 deg. C and humidity 10% to 90%
8.	IP rating	20 for Indoor Fittings
9.	System life time (Burning Hour with driver)	50000 hours @ L70 as per LM 70 Report
10.	Driver voltage	220-240V potted driver
11.	power factor	> 0.95
12.	Efficiency	≥ 85 %
13.	Surge protection	4 kV
14.	Color Temperature	3000 to 6500 ⁰ K as per site requirement.
15.	Guarantee Period	Five years from the date of handover
16.	LED Lamp Make	Cree, Nichia, Osram, Lumiled, seoul
17.	Diffuser	Prismatic/ PMMA

- a. Driver shall have over voltage, over current, open load and short circuit protection confirming to EN 61547.
- b. In case Luminaire (except down lighters) is to be recessed with the false ceiling grid / required to be suspended, the same to be suspended to the true ceiling by providing Anchor fasteners of 8 mm diameter and suspended by GI wires so as the load of the luminaire is not transferred to the false ceiling grid.
- c. All suspended light fittings shall use suspension wire and assembly either supplied by Light fitting manufacturer or by their recommended OEM.
- d. Lighting luminaries (LED type) shall be decided as per schedule, functional requirement, design and drawing approved by Engineer in-charge.

TDS for Recessed/Surface/Suspended Down Light & Spot Light

Sl. No.	Description	Parameters
1.	CRI	>80
2.	THD	≤5%
3.	Initial luminaire SDCM	≤3
4.	LM 79 test report from NABL accredited 3 rd party lab	to be provided for each model being Offered from LED manufacturer.
5.	LM 80 test report	From LED manufacturer
6.	Driver	BIS certified
7.	System efficacy	minimum 115 lm/W at temp 0 to +45 deg. C and humidity 10% to 90%
8.	IP rating	20
9.	System life time (Burning Hour with driver)	50000 hours @ L70 as per LM 70 Report
10.	Driver voltage	220-240V
11.	power factor	> 0.95
12.	Efficiency	≥ 85 %
13.	Surge protection	4Kv
	Ripple Factor	<5%
14	Color Temperature	3000 to 6500 ⁰ K as per site requirement.
15	Guarantee Period	Five years from the date of Completion
16.	LED Lamp Make	Cree, Nichia, Osram, lumiled, seoul
17.	Diffuser	Prismatic/ PMMA
18.	LED beam angle	24 to 65 degrees

- e. Luminaires shall comply with IS10322.
- f. The agency shall submit an undertaking from the OEM of LED fixtures that OEM will provide guarantee for five years from the date of completion.
- g. Driver shall have over voltage, over current, open circuit and short circuit protection confirming to EN 61547. The driver should comply to IEC61000-3-2 ED.3.2, 2009 for harmonics, IEC61347 -2 -13, 2006 in conjunction with IEC61347-1 ED.2.0, 2007 for electrical safety, IEC62384 ED.1.1, 2011 for performance and IEC61547 ED.2.0, 2009, CISPR-15 FOR EMI.
- h. Lighting luminaries (LED type) shall be decided as per schedule, functional requirement, design and drawing approved.

TDS for Surface Batten Light

Sl. No.	Description	Parameters
1.	CRI	>80
2.	THD	≤5%
3.	SDCM	≤3
4.	LM 79 test report from NABL accredited 3 rd party lab	to be provided for each model being Offered from LED manufacturer.
5.	LM 80 test report	From LED manufacturer
6.	Driver should be BIS certified	
7.	System efficacy	minimum 110 lm/W at temp 0 to +45 deg. C and humidity 10% to 90%
8.	IP rating	20
9.	System life time (Burning Hour with driver)	50000 hours @ L70 as per LM 70 Report
10.	Driver voltage	220-240V
11.	power factor	> 0.95
12.	Efficiency	≥ 85 %
13.	Surge protection	2.5Kv
	Ripple Factor	<5%
14	Color Temperature	3000 to 6500 ⁰ K as per site requirement.
15	Guarantee Period	Five years from the date of Completion
16	LED Lamp Make	Cree, Nichia, Osram, Lumiled, seoul
17	Diffuser	Prismatic/ PMMA

- i. Luminaires shall be BIS certified.
- j. The agency shall submit an undertaking from the OEM of LED fixtures that OEM will provide guarantee for five years from the date of completion.
- k. Driver shall have over voltage, over current, open circuit and short circuit protection confirming to EN 61547. The driver should comply to IEC61000-3-2 ED.3.2, 2009 for harmonics, IEC61347 -2 -13, 2006 in conjunction with IEC61347-1 ED.2.0, 2007 for electrical safety, IEC62384 ED.1.1, 2011 for performance and IEC61547 ED.2.0, 2009, CISPR-15 for EMI.
Lighting luminaries (LED type) shall be decided as per schedule, functional requirement, design and drawing approved by Engineer in-charge.

TDS for IP-65 SURFACE/ SUSPENDED LIGHT

Sl. No.	Description	Parameters
1.	CRI	>80
2.	THD	≤5%
3.	SDCM	≤3
4.	LM 79 test report from NABL accredited 3 rd party lab	to be provided for each model being Offered from LED manufacturer.
5.	LM 80 test report	From LED manufacturer
6.	Driver	BIS certified
7.	System efficacy	minimum 110 lm/W at temp 0 to +45 deg. C and humidity 10% to 90%
8.	IP rating	65 Fittings
9.	System life time (Burning Hour with driver)	50000 hours @ L70 as per LM 70 Report
10.	Driver voltage	140-270V driver
11.	power factor	> 0.95
12.	Efficiency	≥ 85 %
13.	Surge protection	4 kV
14.	Color Temperature	3000 to 6500 ⁰ K as per site requirement.
15.	Guarantee Period	Five years from the date of handover
16.	LED Lamp Make	Cree, Nichia, Osram, Lumiled, seoul
17.	Diffuser	Polycarbonate for IK 08

- a. Luminaires shall be in compliance with IS10322.
- b. Driver shall have over voltage, over current, open circuit and short circuit protection confirming to EN 61547. The driver should comply to IEC61000-3-2 ED.3.2, 2009 for harmonics, IEC61347 -2 -13, 2006 in conjunction with IEC61347-1 ED.2.0, 2007 for electrical safety, IEC62384 ED.1.1, 2011 for performance and IEC61547 ED.2.0, 2009, CISPR-15 for EMI.
- c. Lighting luminaries (LED type) shall be decided as per schedule, functional requirement, design and drawing approved.

TDS for STRECTCH CEILING FABRIC LIGHT

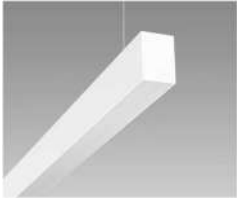


Sl. No.	Description	Parameters
1.	CRI	>80
2.	THD	<10%
3.	SDCM	≤3
4.	LM 79 test report from NABL accredited 3 rd party lab	to be provided for each model being Offered from LED manufacturer.
5.	LM 80 test report	From LED manufacturer
6.	Dalli Driver	BIS certified (Dimming 0 to 100%)
7.	System efficacy	minimum 110 lm/W at temp 0 to +45 deg. C and humidity 10% to 90%
8.	IP rating	40 Fittings
9.	System life time (Burning Hour with driver)	50000 hours @ L70 as per LM 70 Report
10.	Driver voltage	140-270V driver
11.	power factor	> 0.95
12.	Efficiency	≥ 85 %
13.	Surge protection	4 kV
14.	Color Temperature	(3000-6500K) (Tunable).
15.	Guarantee Period	Five years from the date of handover
16.	LED Lamp Make	Cree, Nichia, Osram, Lumiled, seoul
17.	Fabric	Fire resistant fabric

- a. Luminaires should be IS10322.
- b. Driver shall have over voltage, over current, open circuit and short circuit protection confirming to EN 61547. The driver should comply to IEC61000-3-2 ED.3.2, 2009 for harmonics, IEC61347 -2 -13, 2006 in conjunction with IEC61347-1 ED.2.0, 2007 for electrical safety, IEC62384 ED.1.1, 2011 for performance and IEC61547 ED.2.0, 2009, CISPR-15 for EMI.


Lighting luminaries (LED type) shall be decided as per schedule, functional requirement, design and drawing approved.

c. INTERNAL LIGHTING SCHEDULES

SCHEDULE FOR INTERNAL LIGHTING IS GIVEN BELOW FOR GUIDANCE PURPOSES. FINAL LAYOUT DRAWING SHALL BE APPROVED BY ENGINEER IN-CHARGE

S. N.	REFERENCE	DESCRIPTION / REFERENCE		PRODUCT IMAGE
	INETRNAL			
I	I-1		LINEAR CONNECTED	
II	I-2		DOWNLIGHTER	
III	I-3	-	DOWNLIGHTER	

S. N.	REFERENCE	DESCRIPTION / REFERENCE		PRODUCT IMAGE
IV	I-4	-	SUSPENDED DOWNLIGHTER_ AESTHTETICS	
VII	I-7	STRETCH CEILING	UNIFORM LIGHT PLANE	
VIII	I-8	FALSE CEILING AREA		
		UTILITY /ELEC ROOM/ PUMP ROOM/ ETP/ STP/ SUB STATION ROOM		
IX	I-9	TRUE CEILING	SUSPENDED	

S. N.	REFERENCE	DESCRIPTION / REFERENCE		PRODUCT IMAGE
X	I-10	MEDIUM BAY		

8. Lightning Arrester

- Lightning arresters shall be provided for building as per relevant IS/IEC code as amended up to date and CPWD specifications for internal work – 2023.
- Detailed designing to be got done from professional and shall be submitted to Engineer-in-charge for approval.

9. Specification for Cable Tray

- GI Cable trays (perforated or ladder type) to be provided. Planning of cable tray and support system may be prepared using suitable software of the OEM of cable tray. Special attention shall be paid toward hanging / suspension support system. The support system shall also be provided by cable tray manufacture as per recommendation of OEM of cable trays.
- All tray and accessories shall be Hot Dip Galvanized. There shall not be any welded joints .the thickness of Galvanizing shall not be less than 75 Micron thickness, and the same shall be done after fabrication of cable tray and in accordance with IS 2629.
- Proper factory made Tee, Bend, cross, joints and other accessories shall be used
- Planning of cable tray and support system may be prepared using suitable software of the OEM of cable tray.
- Special attention shall be paid toward hanging / suspension support system. The support system shall also be provided by cable tray manufacture as per recommendation of OEM of cable trays.

10. Modular Type DLP Trunking:

- Shall be made from very high quality of heavy duty PVC with very good strength.
- Shall be used to distribute power as well as LAN cables.
- Shall be installed in combination with the Internal Angles, External Angles, and Flat Angles etc. in order to suit the application area where we are installing it on.
- The different components involved are : DLP Trunking Base, Flexible Cover, Separation Partition, Clip On Partition (For creating separate compartments in 150*50 & 195*50 Size Trunking), End Caps, Internal Angle, External Angle, Flat Angle (for any 90 Degree Angle), Flat Junction (T Point), Mosaic Frames (For mounting Switches & sockets etc.)
- The trunking Base is fixed on to the wall by using the correct fasteners on the pre drilled location. Then the cable is carried into the DLP and wherever require

At the Staircase/ Lift/ Corridor/ electrical room any other location approved by E-I-C	Supplying and fixing of 1.0 mm rigid PVC sheet photo luminescent Non- toxic, Non-radioactive maintenance free self-glowing Signage glows in the dark with UV stabilized coated sheet and mounting arrangement for wall / ceiling i/c computerized design and printing etc complete as required.
For evacuation plan any other location approved by E-I-C	Supplying and fixing of 1.0 mm rigid PVC sheet photo luminescent Non- toxic, Non-radioactive maintenance free self-glowing Signages glows in the dark with UV stabilized coated sheet and mounting arrangement for wall / ceiling i/c computerized design and printing etc complete as required.
Corridor/Rooms/Stair steps any other location approved by E-I-C	Supplying and fixing of 0.2 mm thick(80mm width) flexyle sheet photo luminescent Non- toxic, Non radioactive maintenance free self glowing tape with arrow marked indication with UV stabilized coating and mounting arrangement for wall / ceiling i/c computerized design and printing etc complete as required.
<ul style="list-style-type: none"> • At each exit door intended to be used in an emergency • Near stairs, each step of stair receives direct light • Mandatory emergency exits & safety signs • At each change of direction • At each intersection of corridors • Outside & near to each final exit • Near each first aid post • Near each piece of fire fighting equipment & call point <p>any other location approved by E-I-C</p>	Supplying and fixing of self-contained rechargeable LED emergency egress routes lighting type wall mounted/ceiling suspended escape lighting luminaire made of 22 SWG CRCA white powder coating housing having wattage more than 11 watt with constant voltage charger i/c re-chargeable Ni-Mh/Ni-cd battery capable of Emergency back-up up to 3 hours, Technical lifetime of LED > 100 000 hours, Reading distance 18-30 meters as required. Single phase 230V 50Hz-IP 42, conforms to IS 9583-1981 / EN 60598-2-22&CE certified/ROHS compliance, complete with all other accessories i/c connection etc as required.

13. **Painting:**

Painting at site of all exposed metal surfaces of the installation other than pre-painting items like fittings, fans, switchgear / distribution gear items, cubicle switchboard etc. damages to finished surface of these items while handling and erection, shall however be rectified to the satisfaction of the Engineer-in-charge.

14. **QUALITY ASSURANCE PLANS- Internal Electrical Installations**

- a. The detailed instructions on safety procedures given in BIS code no. 5216:1982
- b. "Code of safety Procedures and Practices in Electrical works" shall be strictly followed.
- c. Safety procedures given in Chapter 10 of CPWD General Specifications for Electrical works Part-1(Internal) shall be followed.
- d. Safety recommendation as per IE rules 1956 as per Appendix "C".
- e. The materials shall be tested from 3rd Party laboratories are conduit, wires, cables etc. Expenses of testing to be borne by department, if found satisfactory.
- f. Provisions and fixing of check-nuts for conduit work as per CPWD Specifications.
- g. No. of wires in one conduit shall be ensure as per CPWD Specifications.
- h. Colour coding of wires to be ensured.
- i. Lugs and thimbles at cable/ wire ends in switch boxes as per CPWD Specifications. Flexible

GI conduits/PVC sleeve to be provided for the wiring wherever required, particularly for the light fittings below the roof and above the false ceiling areas, with proper coupling arrangements.

- j. Labeling of switch boxes shall be ensured.
- k. Termination of earth terminals in earth pits, switch box, DBs and accessories to be ensured. Earth chamber to be constructed and proper marking to be done.
- l. A comprehensive schematic diagram is prepared starting from the main board up to the final DBs. All such boards are duly marked and numbered.

15. Test:

- a. After completing the work, necessary test results as envisaged in CPWD General Specifications Part-I (Internal)-2013 & Indian Electricity Rules 1956, shall be recorded and submitted to the department. The results shall be in the permissible limits. Test report forms duly signed by authorized person/owner shall be submitted to electricity company by the agency. It will be the responsibility of contractor to get provides electricity connections.
- b. The pre-commissioning testing of the installation shall be carried out such as
 - (i) Insulation resistance test.
 - (ii) Polarity test of switch.
 - (iii) Earth continuity test.
 - (iv) Earth electrode resistance test.
- c. All the tests at site shall be carried out for the completed installations, in the presence of and to the satisfaction of the Engineer in Charge by the contractor. All the test results shall be recorded and submitted to the Department.
- d. On completion of an electrical installation (or an extension to an installation), a certificate shall be furnished by the electrical contractor, countersigned by the certified supervisor under whose direct supervision the installation was carried out.
- e. This certificate shall be in the prescribed form as given in Appendix “E” of CPWD
- f. General Specifications for Electrical Works Part-1(Internal) in addition to the test certificate required by the local electric supply authorities.
- g. All electrical & mechanical fittings / fixtures / appliances, to be provided for the work, should have latest minimum 5-star rating (of BEE) as available in market.
- h. The work of internal EI shall be carried out as per CPWD Specifications for Electrical Works Part I Internal Electrical – 2023, CPWD Specifications for Electrical Works Part II External Electrical-2023 and CPWD Specifications for Electrical Works Part IV Substation-2013. Work shall be carried out with copper wires, double door DBs, steel/PVC conduit, indoor floor panels.

16. Drawings for approval on award of the work

The contractor shall prepare and submit 03 sets of hard copy of following drawings and 03 sets in soft copy and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved drawings and agreement.

- (i) Layout drawings of the Light fittings along with DIALUX report/Lux calculations and IES files of fittings.
- (ii) Layout drawings of the Power points along with DB details (LDB, PDB, UPS DB) wiring sizes etc. as required.
- (iii) Layout of equipment’s to be installed including power and control cables, and supports/ structure for bus ducts/ cable trays.
- (iv) SLD’s
- (v) Earthing
- (vi) GAD of LT Panels and feeder pillars
- (vii) Street lighting Cables layout including fittings and lux calculations
- (viii) Drawings showing details of support for pipes, cable trays, ducts etc.

(ix) Any other drawings relevant to the work.

17. **Drawings after completion of work**

The contractor shall submit three sets of “As-built” drawings on white paper and 3 sets in soft copy to the owner/ Engineer-in-charge after completion of the work. In addition, the following shall also be provided:

- a. Test Certificates
- b. Warrantee Certificates
- c. O&M Manuals of equipments
- d. Any other information the Engineer-in-charge may deem fit.

D1.3 LIST OF INDIAN STANDARDS (IS) FOR INTERNAL ELECTRICAL INSTALLATION

IS : 374 - 1979	Ceiling fans and regulators (3rd revision)
IS : 694 - 1990	PVC insulated Electric cable for working voltage upto and including 1100 volts.
IS : 732 - 1989	Code of practice for electrical wiring and installation
IS : 1255 - 1983	Code of Practice for installation and maintenance of Power Cables upto and including 33 KV rating (Second Revision)
IS : 1258 - 1987	Bayonet lamp holders(Third revision)
IS : 1293 – 1988	Three pin plugs and sockets outlets rated voltage upto and including 250 volts and rated current upto and including 160 amps.
IS : 1646 - 1982	Electrical installation fire safety of buildings (general) Code of practice.
IS : 1885 - 1971	Glossary of items for electrical cables and conductors
IS : 1913 – 1978	General and safety requirements for fluorescent lamps luminaries Tubular.
IS : 2309 - 1989	Protection of building and allied structures against lightning
IS : 3043 - 1987	Code of practice for earthing.
IS : 3480 - 1966	Flexible steel conduits for electrical wiring.
IS : 3837 - 1976	Accessories for rigid steel conduit for electrical wiring.
IS : 4146 - 1983	Application guide for voltage transformers
IS : 4615 - 1968	Switch socket outlets.
IS : 5216 - 1982 (Part-I)	Guide for safety procedures and practices in electrical work.
IS : 8130 - 1984	Conductors for insulated electric cables and flexible cords
IS : 9537 - 1981	Rigid Steel Conduits for electrical wiring (Second Revisions)
IS : 13947 - 1993	General requirement for switchgear and control gear for voltage not exceeding 1000 Volts.
IS : 374 - 1979	Ceiling fans and regulators (3rd revision)
IS : 694 - 1990	PVC insulated Electric cable for working voltage upto and including 1100 volts.
IS : 732 - 1989	Code of practice for electrical wiring and installation
IS : 1255 - 1983	Code of Practice for installation and maintenance of Power Cables upto and including 33 KV rating (Second Revision)

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IS : 2309 - 1989	Protection of building and allied structures against lightning
IS : 3043 - 1987	Code of practice for earthing.
IS : 3480 - 1966	Flexible steel conduits for electrical wiring.
IS : 3837 - 1976	Accessories for rigid steel conduit for electrical wiring.

D2: Electrical Sub-station

D2.1 SCOPE OF WORK

Scope of this sub head covers planning, designing, supply, installation, testing and commissioning of complete Electrical bulk supply and power distribution/ infrastructure works which includes not only the items exclusively defined hereunder but also any other item required to commission and complete the work as per site requirement in this sub head or as per good Engineering practice or as required under the codes or by local/statutory authorities.

Capacities of various equipments, like cable, MCCB, ACB, Bus bar etc. mentioned hereunder are minimum. EPC contractor shall do detailed design and calculations and provide the capacity of equipments like cable, MCCB, ACB, Bus bar etc. accordingly, subject to minimum capacities mentioned hereunder.

1. 11KV HT cable of size minimum 3 core x 185 sq.mm. 11 KV HT XLPE (E) Cable from supply company termination point to HT panel. All required works from supply agency termination point are in the scope of work.
2. Sources of electric connection will be taken from local electric supply agency.
3. HT VCB Panel having One number incomer, and minimum 3 nos of outgoing. (1 no. outgoing will spare for future extension of transformer)
4. 11KV HT panel board. In case, supply agency (local electric supply agency) desires for, the same will be in the scope of work.
5. Indoor type minimum 2x250 KVA (1 Working + 1 Stand by), 11 KV/433volt Dry type Transformer with ON load tap changer and RTCC and AVR. **Losses of the transformer shall be as per GRIHA 5 star requirement.**
6. HT panel and transformers shall be connected through 3 core 11 KV HT XLPE(E) Cable of minimum size 185 sq.mm or required circuit level.
7. Transformer and main LT panel will be connected with sandwich type bus duct of minimum 600 amps 50ka.
8. Main LT panel (normal supply) and sub-LT panel (normal supply) for receiving supply from Transformers having incomers EDO ACB and surge arrestor devices and various out goings.
9. Main LT panel (Essential supply) and sub-LT panel (Essential supply) for receiving supply from DG sets and Main LT Panel having incomers EDO ACB and surge arrestor devices and various out goings. System shall have auto DG synchronization panel. Auto Load Management system shall be provided so that incomer and bus couplers breakers are made ON and OFF automatically depending upon availability of Grid or DG supply while outgoing feeders are made off selectively in case of DG set supply.
10. 2 no APFC Panel each of minimum 120 KVAR with 7% detuned filters
11. Minimum 3.5x185 sq.mm. size XLPE insulated PVC sheathed aluminum conductor armored Cables for power supply from main LT panels and main emergency panel (of ESS) to various sub-LT panels and sub emergency panel of individual Block/ Building E&M services.
12. Minimum 3.5x70 sq.mm./ required size XLPE insulated PVC sheathed aluminum conductor armored Cables for power supply from main emergency panel (of ESS) to firefighting panels of each block.
13. Minimum 3.5x50 sq.mm. size XLPE insulated PVC sheathed aluminum conductor armored Cables for power supply from main emergency panel (of ESS) to different water supply pump panel.
14. Minimum 3.5x70 sq.mm. size XLPE insulated PVC sheathed aluminum conductor armored Cables for power supply from main normal panel (of ESS) to STP panel.
15. Firefighting system, water supply system, STP etc. i/c their connection /inter connection.
16. Sub LT panels as required for any service covered in the scope of E&M works.
17. Lift Panels at sub-station and cable for individual Lift DB at terrace/top floor or as per OEM requirement in the respective building where lift is provided
18. Earthing sets as per CPWD Specs and as per OEM requirements,

D2.2 DESIGN BASIS, SPECIAL REQUIREMENTS

- Scheme for the substation shall be as under.
 - a. Two number indoor type dry transformers of equal ratings i.e. One working one standby.
 - b. HT Panel and transformers will be connected through three core 11 KV HT XLPE(E) of minimum size 3X185 sq.mm.
 - c. Transformer and LT panel (main supply) will be connected with sandwich type bus duct, having current rating 25% more than the calculated required.
 - d. Main Sub LT Panel for supplying power to smaller loads having MCCB's as outgoing.
 - e. Main LT panel for receiving supply from 2 no Transformers, 2 nos. from SOLAR Power Plant and 1 No. Bus coupler and ACB's & MCCBs as outgoing.
 - f. Main Sub LT Essential Panel for supplying power to smaller loads having MCCB's as outgoing.
 - g. Lift panel/ DB in shall be provided for lifts in required blocks. This shall receive supply from of respective building.
 - h. Power supply to Fire pump panels through cables.
 - i. External lighting and façade lighting feeder pillar, STP plant panel, pump house panel shall be provided power supply from Essential Main Sub Panel.
 - j. The two number APFC panel shall be provided on two sections of main LT panel and having tripping arrangement in case of DG supply in the main panel.
 - k. The cable sizing shall be done on the basis of maximum demand and voltage drop to be kept within 5%.

- Load estimation/Load Calculation – The load calculation will be done on the basis of inventory of power outlets /points of all types in internal EI, Firefighting equipments, fire alarm system, lifts, Air conditioning, pumps, and any kind of connected (or proposed to be connected) equipments in the building. The maximum demand is to be calculated by assuming following factors.
 - (i) Diversity factor for light load - 80%
 - (ii) Diversity factor for power outlets load - 40%
 - (iii) Diversity factor for air-conditioning load - 80%
 - (iv) Diversity factor for pumps of any type– 50%
 - (v) Diversity factor for lift load – 50%
 - (vi) Maximum loading on transformer – 80% of rated capacity
 - (vii) Maximum loading on D.G. set – 80% of rated capacity
 - (viii) Power factor assumed for KVA calculation of transformer-0.99
 - (ix) Maximum loading on generator – 80% of rated capacity
 - (x) Power factor assumed for KVA calculation of DG set – 0.8

The selection of transformer rating shall be done after taking all above factors in consideration.

The incomers rating of LT breakers of Main Panel shall match with transformer rating or next available standard ratings of ACB.

D2.3 SPECIFICATIONS AND DESIGN

Work shall be generally executed as per CPWD specifications Part I Internal EI 2023 and Part IV SUB STATIONS 2013/ Part-III External 2023. In addition, following shall also be complied, observed and implemented.

1. HT supply

Supply agency (local electric supply agency) shall terminate 11 KV supply in their HT panel/meter room. All required works from supply agency termination point are in the scope of work.

2. HT Cable

- (a) Nos of cable: 1 no.
- (b) Size: minimum size 3 x 185 sq.mm (E)

- (c) Type of cable: steel armoured, Aluminium Conductor flat strip armoured XLPE 11 KV E Bearing IS 7098 (II)-2011 (with upto date amendments) HT cable
- (d) HT cable end terminations shall be Heat shrinkable type
- (e) The contractor shall ensure that for the HT cables brought at site, the test certificate in original issued by the factory before dispatch of the cable indicating the tests carried out and their results shall be produced to the Engineer-in-Charge. Without such certificate the cable shall not be accepted by the Engineer-in-Charge.
- (f) These cables shall have individually screened cores and be manufactured and tested according to IS: 7098 (Part II) - 2011 amended up to date & latest. All conductors shall be compacted circular in shape. The insulation shall be high-quality cross-linked Polythene - obtained by chemical cross linking of polythene molecules. The armoring applied over the common covering shall be of flat steel wires.
- (g) Each and every delivery length of the cable shall be subjected to routine tests as per IS:7098 (Part II) 2011 amended up to the date.

3. HT Panel

- (a) HT cable from that meter room shall be brought to main HT panel of our complex. 1 no incomer, and required no of outgoing HT panels with VCB, metering (in all panels and suitable for net metering) and protection equipments as per good engineering practice shall be provided.
- (b) The SLD of HT panel shall be got vetted from electricity company to avoid any complication at later stage.
- (c) HT Panel (indoor type)
 - (i) Nominal system voltage: 11KV as per Supply agency requirements
 - (ii) Frequency: 50 Hz
 - (iii) Nos. of section: 4 (1 incomer + 2 outgoing + 1 spare)
 - (iv) Type of Breaker: VCB
 - (v) Breaking capacity of breaker: 350 MVA for 1 Sec. at 11 KV
 - (vi) Rating, various types of protection, CT / PT / Relay / Auxiliary rely / master trip Relay / Bus bar / Ammeter / voltmeter / trivector meter / Power factor meter / various indication lamps / terminal blocks etc. as required for HT panel shall be as CPWD specifications and various IS codes.
 - (vii) For D.C. supply Battery bank of suitable capacity
 - (viii) Short circuit, overload and earth fault protection shall be provided.
- (d) Metering and Protection for Incomer Panels (1 sets) :
 - (i) 1 set (each of 3 nos.) 11 KV/ 110 Volts draw out type PT Class 0.5 accuracy and 100 VA burden with 1 No. Voltmeter (0-15 KV), digital type, selector switch for voltmeter and protection fuses/MCB for HT metering.
 - (ii) 3 nos. dual core dual ratio CTs of ratio 200/100//5A of 15 VA burden and accuracy class-0.5 for metering and class 5P10 for protection.
 - (iii) 1 No. - (0-200A) Ammeter, digital type with selector switches.
 - (iv) Master trip relay
 - (v) Trip circuit supervision relay
 - (vi) Microprocessor based numerical relay with IDMT setting for O/L, E/F and S/C protection.
 - (vii) Over and Under voltage relay (3 phase).
 - (viii) Timer and TNC switch
- (e) Metering and Protection for Outgoing Panels (3 sets)
 - (i) 3 nos. dual core dual ratio CTs of ratio 100/50/5/5A of 15 VA burden and accuracy class-1 for metering and class 5P10 for protection.
 - (ii) (0-100A) Ammeters, dual scale digital type & selector switches for

- ammeters.
- (iii) Microprocessor based numerical relay with IDMT & instantaneous element for O/L, E/F and S/C protection. (The relay having AUTO DOUBLING feature to prevent nuisance tripping during inrush current cycle of Transformer).
 - (iv) 12 window Annunciation panel with necessary relays, audio and visual indicators and push buttons.
 - (v) Auxiliary relay for WTI with alarm & trip.
 - (vi) TNC switch
 - (vii) Master trip relay
 - (viii) Trip circuit supervision relay
 - (ix) Note - Provide all type of Protection, Auxiliary relays, release for the transformer protection as the outgoing feeders shall feed the power to transformer.
 - (x) There is a provision in outgoing VCB that should be "trip off" after REF relay activated in downstream panel after transformer
- (f) The panel shall be fully compartmentalized, and of OEM make with separate compartments for CT/ cable termination, bus bar chamber, breaker compartment and LT chamber, housing the LT equipment, like meters/relays etc. The panels shall be suitable for fully draw out execution with horizontal isolation. The breaker track to have three distinct positions, i.e. test, service and isolated. Necessary interlocks to be provided to prevent operation of breaker in any intermediate position.
- (g) Bus-bars shall be of fine electrolytic copper, air insulated.
- (h) The breaker panel shall have power cable entries from top.
- (i) The enclosure shall be metal clad and shall comprise of standard prefabricated cold rolled sheet steel units assembled to form a rigid free standing dead front structure. The enclosure shall be totally enclosed dust and vermin proof housing conforming to protection class IP-42. Each unit of breaker enclosure shall have internal sheet metal barriers to form separate compartments for fuses, bus bars, instruments and relays, cable connections etc.
- (j) The draw out carriage on the board shall have three positions viz. services, test and draw out. Automatic Safety shutters shall be provided to ensure inaccessibility of all live parts after the breaker is drawn out. It shall not be possible to draw out the carriage with circuit breaker closed. Suitable interlocks shall be provided to prevent faulty operation.
- (k) It shall be possible to remove/check components without disturbing adjacent equipment. All auxiliary equipment shall be easily accessible. All mounted equipment shall have identification tags. Unused current transformer secondary terminals must be short circuited.
- (l) The incoming and outgoing power connections shall be through 11 KV 3core aluminum armoured XLPE(E) cable of required size. Ample space shall be provided for connection of these cables in the breaker. The termination of power cables shall be from top.
- (m) Control and Indication: Circuit Breaker closing devices shall be fed from the transformer at suitable AC supply and energy stored type power pack shall be provided for tripping and closing operation and panel lighting. The relays used shall be current operated relays.

- (n) Breaker positions ON/OFF/Spring charged/Test position/service position shall be indicated mechanically. For electric indication following colour shall be used.
- | | |
|--------------|-------------|
| Breaker ON : | Red lamp |
| Breaker OFF: | Green lamp |
| Auto trip : | Yellow lamp |
- (o) Push Buttons for ON and OFF positions shall be mounted on the panel for local operations.
- (p) Earthing connections: The earthing of the panel shall be in accordance with the CPWD specifications for electrical works amended up to date. The entire panel board shall have a common tinned copper earth bar of suitable section with two earth terminals for effectively earthing metallic portion of the panel.
- (q) Battery and battery charger: Supplying, installation, testing & commissioning of battery and battery charger with 240 Volt AC input & 24 Volt DC continuous output with provision of boost & float charging, suitable for closing/tripping/indication of 3 Nos. HT panel boards with 2 Nos. 12 Volts each maintenance free batteries of suitable AH, charging unit, capacitor bank for emergency delivering for trip system complete with suitable capacity of Ammeter & Voltmeter i/c connections with 2.5 sq.mm FRLS insulated copper conductor cable etc. including DC DB consisting of 10 nos 32 Amp DP MCB's for DC supply distribution to panels as required.

4. Transformer

- (a) Type: Dry Type indoor with OLTC, RTC, AVR
- (b) Rating: Minimum 250 KVA, 11 KV/ 0.433 KV Transformer, 3 phase, 50 Hz, Dyn -11, vector group copper wound, Nos of Transformers: minimum 2 nos. (i/c one for standby)
- (c) Other criteria like, various indicators, % impedance, tap changer, cable end box, and other accessories shall be as conforming to IS: 1180 and having maximum losses at 50% and Full Load as per table of ECBC 2017 code with amendments if any for Super ECBC. The entire work shall comply with the latest CPWD specifications for electrical works, substation part-II 2013.
- (d) The transformers shall be installed in substation building.
- (e) The transformer shall comply with the following Indian standards as amended up to date :
- (i) IS 11171 - 1985 – Dry type power transformers.
 - (ii) IS 10028 (Part II & Part III) - Installation and maintenance of Transformers.
 - (iii) IS 2099 – Bushing
 - (iv) IS 2705 – Current Transformers

Low voltage side of transformer shall be suitable for Aluminium flexible, sandwich type bus trunking terminals. HV side shall be provided with cable end box suitable for Push on type/Heat shrinkable joint of required size, 11K.V XLPE (earthed) cable.

It shall be equipped with winding temperature indicators and contactor actuated by means of temperature transducer either resistance type or Thermistor type embedded in each leg of LV windings. Contacts shall also be provided to operate alarm & trip circuits in case of high temperature. Suitable cabling for the facility of alarm at the first set point and tripping H.T. breaker at the second set point between the HT panels and transformers shall be provided by the contractor with in the tendered rates of transformers. The control shall be PVC insulated and PVC sheathed armoured having copper conductor of size not less than 2.5 sq.mm.

All routine and other tests prescribed by IS: 11171-1985 and IS: 2026-1977 shall be carried out at the manufacturer's works before dispatch and a copy of the same shall be furnished to the engineer-in-charge.

The transformers are to be suitable for running in parallel.

- (i) The transformer shall be suitably designed so that total maximum allowable losses shall be as per ECBC.
- (ii) The value of impedance voltage shall be as per IS.

(f) ENCLOSURE

Transformer shall be provided with a sheet steel enclosure with adequate provision for ventilation. The degree of protection of enclosure shall be IP 33.

(g) DOOR LIMIT SWITCH

Door limit switch for safety tripping, door limit switch to trip the HT breaker incase doors of transformer enclosure are opened.

(h) CABLE TERMINATION

The low voltage side of the transformer shall be suitable to connect bus ducting of 4000 Amp. from the top of the Transformer.

H.T. sides of the transformers shall have cable end boxes to receive 11 KV cable of size 3 x 300 Sq.mm XLPE (E) Aluminium Cable.

(i) Fittings

The transformer shall be complete with the following fittings :-

- OLTC link or tap switch.
- RTD temperature controller.
- Lifting lugs for all transformers.
- Bi-directional/Unidirectional Rollers to be specified.
- Rating diagram and terminal marking plate for all transformers.
- Additional Neutral separately brought out on a bushing for earthing for all transformers.
- Earth terminals (2 Nos.) for body earthing for all transformers.
- Necessary hardware, clamps, lugs etc. for termination on HV/MV etc. for all transformers.

(j) Parallel Operation

For parallel operation of transformers, the transformers shall have the same percentage impedance, same voltage ratio, same vector group, phase sequence etc.

(k) INSTALLATION & COMMISSIONING

- (i) The transformer shall be installed in accordance with IS 10028 (Part II & III) code of practice for installation and maintenance of transformer. Necessary support channels shall be grouted in the flooring.
- (ii) The transformer shall be moved to its location and shall be correctly positioned. Transformer wheels shall be either locked or provided with wheel stoppers.
- (iii) Wiring of devices shall be carried out as per drawings; Earthing of neutral and body of the transformer shall be done in accordance with section (7) of these specifications.
- (iv) All devices shall be checked for satisfactory operation.
- (v) All tests specified in 3.2.14 of these specifications shall be carried out by the contractor in the presence of inspecting officer/consignee free of cost.

(l) **TEST CERTIFICATES.**

The routine, special and type test certificate of the transformer shall be furnished for approval before the delivery of the equipment from the factory.

As regards the type tests in case these have been done earlier by OEM for similar design/type, same if produce shall be acceptable. In case, same is not done earlier, these will have to be done for one of the transformers of the present lot.

(m) **ROUTINE TESTS**

During manufacture and on completion, the transformer shall be subjected but not limited to the following Routine Tests as laid down in the latest revision of the IS 11171 IEC - 726

- (i) Applied voltage test
- (ii) Induced voltage test
- (iii) No-load loss and excitation current tests
- (iv) Impedance voltage and load loss tests
- (v) Resistance measurement
- (vi) Ratio tests
- (vii) Polarity and phase relation tests
- (viii) Insulation resistance tests
- (ix) Insulation power factor tests

(n) **Tests at Works**

All routine and other tests prescribed in IS 11171:1985 as amended/ revised up to date shall be carried out at the manufacturer's works before the dispatch of the transformer in the presence of inspecting officer. Copies of the test certificates shall be furnished to the department. In addition to the prescribed routine tests, temperature rise test shall be invariably done on one transformer of each design. A copy of the impulse test certificate done on the same type/ design of the transformer shall be furnished in accordance with IS 11171:1985 for purpose of record. If no impulse test was done in an earlier unit of the same design and type, one transformer will be subjected to impulse test in consultation with the Inspector at the firm's cost. Copies of the impulse test for short circuit shall be supplied to the Department.

The type test certificates for the following type tests carried out on similar capacity rating shall be submitted along with the routine test certificates.

- Heat run test
- Impulse test

(o) **Tests at Site**

In addition to tests at manufacturer's premises, all relevant pre-commissioning checks and tests conforming to IS code of practice No. 10028 (part-II & III) shall be done before energization.

The following tests are to be particularly done before cable jointing or connecting up the bus bar trunking.

- Insulation test between HV to earth and HV to MV with a 5000 volts Megger.
- Insulation test between MV to earth with 5000 volts Megger.
- All test results are to be recorder and reports should be submitted to the department.

After installation at site, the transformer shall be subjected to the following field test before commissioning, besides any tests as per CPWD specification.

- Ratio tests
- Polarity test
- Tap change operation test.

- Insulation test.

(p) **Maximum Allowable Power Transformer Losses**

Power transformers of the proper ratings and design must be selected to satisfy the minimum acceptable efficiency of Super ECBC compliant at 50% and full load rating.

5. Bus trunking and rising mains

- Bus trunking and rising mains shall be Sandwich type IP65 rated, Aluminium conductor ,4 strip Neutral conductor of same size as that of Phase conductor, fire rated at 250 deg for 2 hours, complying IEC 61439 with integral earth and 2 runs of external earthing. All Bus trunking and rising mains shall have fault current rating of 50 Ka and shall have IP65 rating after all joints and assembly of tap off boxes.
- The current density of aluminium bus bar shall be maximum 1.0 Amp/ sq mm and The Maximum allowable temperature for the Bus bar to be restricted to 85 deg C. The temperature rise should be restricted to 35 deg C above design ambient temperature of 50 deg C.
- Major bus trunkings shall be as follows:
 - Between each Transformer and main MV panel (normal supply) 600 A

All Bus Bars of panels, Bus trunking and Rising Mains shall be of minimum 25% more capacity than the Ampere rating required.

- Major Rising Mains shall be as follows:
All Bus Bars of panels, Bus trunking and Rising Mains shall be of minimum 25% more capacity than the Ampere rating required.

6. Main Panels and Sub Panels

a. **Main LT panel (normal supply)**

- shall have 2 sections with 1 bus couplers for receiving supply from 2 no Transformers.
- It shall have only ACB's as outgoing to feed load through various bus trunkings and any load of more than 400 A.
- All incomers shall be 4 pole EDO ACB and shall have surge arrestor devices.
- 1 no 4 pole EDO ACB 800 A as bus coupler shall be provided.
- 2 nos. 4 pole EDO ACB 800 A from transformer to LT panel as incomer.
- 2 nos. 4 pole EDO ACB 800 A incomers from solar plant
- In addition to any other requirement,
 - It shall have required switchgear of capacity as per detail design.
 - It shall have 2 nos. 250 A capacitor duty FP MCCB for APFC panel.
 - 1 nos. Main Essential Panel with required size of switchgears as per detail design.
 - Any other feeder required as per design requirement
 - 20% for spare feeders i/c switchgears.
- This panel shall be TTA Panel, complete with all necessary metering FP Aluminium bus bars and indication lamps etc. as required and as per relevant CPWD specifications.

Note: -

- All Bus Bars of panels, Bus trunking and Rising Mains as mentioned in all above paras shall be of minimum 25% more capacity than the Ampere rating required.

2. Design and SITC of Further distribution from MDB/ feeder pillar to DB's and end consumers point shall also in the scope of work
3. All Electrical panels/feeder pillars shall be got fabricated from System integrator/channel partner of the ACB/MCCB manufacturer and strictly as per CPWD specifications. The drawing of panel boards must be got approved from Engineer – in – charge before fabrication work. The panel board shall consist of 4 pole MCCB as incomer, required no. of outgoing MCBs and 20% spare outgoing feeders with, 4 strip aluminum bus bar with 100% neutral, digital type multifunction meter with RS 485 port for remote monitoring through SCADA on Ethernet, selector switches, LED type indication lamps, cable alleys, gland plate, supported by angle iron frame etc. as per standard sound engineering practice.

7. ACB:

- (a) All ACB's shall be 4 pole EDO type, 100% neutral, minimum 50 Ka breaking capacity, with Numeric relay, Navigator for selection of parameter, Big size display of parameters, Shall have communication module with MODBUS protocol, built in CT, metering module, Password protection in releases for setting parameters, Test button for self diagnostic.
- (b) The protection release shall be Microprocessor based having inbuilt adjustable protections against Overload, Short circuit, Instantaneous and Earth faults. Microprocessor based release shall be EMI / EMC compatible. Protection release shall have following features:
 - (i) The release shall draw power from main breaker CTs and shall require no external power supply for its operation.
 - (ii) Multi state LED to indicate Power ON and micro-processor unhealthy condition. Release shall also provide separate fault indication by LEDs for each type of fault without using external power supply.
- (c) Four pole ACBs to have fully rated neutral pole.
- (d) It should be possible to carry out inspection and maintenance without removing ACB from panel.
- (e) It should be possible to directly terminate Aluminium links as specified in IS: 13947.
- (f) Automatically operated safety shutters shall be provided to screen the fixed isolating contacts when the breaker is drawn out from the cradle.
- (g) The ACBs shall be fully rated at free air ambient temperature of 40 degree C.
- (h) Necessary set of auxiliary contacts/switches shall be provided.
- (i) ACB shall have $I_{cs} = I_{cu} = I_{cw}$ for 01 second short circuit breaking capacity of minimum 50KA.
- (j) ACB shall be air break, horizontal draw out type.
- (k) All ACB's shall have RS 485 port for SACADA/monitoring purpose.

8. MCCB:

- (l) The breaking capacity of MCCB shall be minimum 35 KA for ratings up to 100 A, 50 KA for rating more than 100 A and upto 400 A. The rated service breaking capacity should be equal to rated ultimate breaking capacities ($I_{cs} = I_{cu}$). Where I_{cs} is service breaking capacity and I_{cu} is ultimate breaking capacity and they should be of approved make. The MCB/MCCB shall be same make of approved company. Built in CT or external CT as required shall be provided for metering.
- (m) All MCCB ratings up to 100 A shall be provided with Thermal Magnetic release having adjustable settings for Overload and instantaneous Short Circuit Protections. For ratings above 100 A protection release should be Microprocessor based having inbuilt adjustable protections against Over Load (L) and Short Circuit (S). If used as incomer then it should have earth fault protection and time delay in addition to above protection. Earth leakage

- modules are not acceptable.
- (n) All MCCBs should be provided the Rotary Operating Mechanism. The ROM should be door interlock (defeat feature) & padlock facility.
 - (o) MCCB should have Spreader links & Phase barriers as standard feature.
 - (p) MCCB of more than 400 A shall not be used, in such case ACB shall be used
 - (q) The MCCB should have double break, positive isolation current limiting, load line reversibility & horizontal cum vertical mounting features.
 - (r) MCCB shall comply with the requirements of the relevant standards IS13947 – Part 2 /IEC 60947-2 and should have test certificates for breaking capacities from independent test authorities CPRI / ERDA
 - (s) MCCB shall comprise of Make - break switching mechanism, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses.
 - (t) All MCCB's above 100 A shall have RS 485 port for SACADA/monitoring purpose.

9. Discrimination and Electrical Coordination:

Contractor needs to ensure the discrimination and coordination between all Medium voltage devices i/c ACB, MCCB, MCB's. There should be a total discrimination between i/c and o/g protection devices up to the breaking capacity of downstream device. For this purpose, contractor shall submit manufacturer's declared discrimination charts along with let through energy curves. Entire discrimination study needs to be submitted along with LT supply system drawings (LT Bus Bar, Panels, Distribution Boards) by the contractor at the time of submission of working drawing/scheme for approval

10. Drawings for approval on award of the work

- (i) The contractor shall prepare and submit three sets of hard copy of following drawings and 2 sets in soft copy and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved drawings and agreement.
- (ii) Layout drawings of the equipment's to be installed including power and control cables, and supports / structure for bus ducts/ cable trays.
- (iii) SLD's
- (iv) Discrimination and coordination charts
- (v) Earthing
- (vi) GAD of Panels
- (vii) Bus Trunking Layout
- (viii) Drawings including section, showing the details of erection of entire equipment's.
- (ix) Drawings showing details of support for pipes, cable trays, ducts etc.
- (x) Any other drawings relevant to the work.

11. Drawings after completion of work

The contractor shall submit Two sets of As built drawings on white paper and 2 sets in soft copy to the owner/ Engineer-In-Charge after completion of the work. In addition following shall also be provided:

- (i) Test Certificates
- (ii) Warrantee Certificates
- (iii) O&M Manuals of Equipments
- (iv) Any other information the Engineer-In-Charge may deemed fit.

12. Schedule of Technical Particulars to be submitted by the firm for equipment and submitted

before supply of material for approval of department after award of work

A. Transformers:

1. Make
2. Type
 - (a) Type of winding
 - (b) Type of enclosure
3. Output in KVA (continuous rating)
4. Frequency
5. Voltage between phases (HV on no-load)
6. Voltage between phases (LV on no-load)
7. Impedance at normal voltage ratio at 75 deg. C
8. Efficiency at unity power factor
 - (a) Full Load
 - (b) $\frac{3}{4}$ load
 - (c) $\frac{1}{2}$ load
9. Iron losses at normal voltage ratio
10. Copper losses at normal voltage ratio, at full load
11. Regulation at unity power factor at 75 deg. C
12. Reactance at normal voltage and ratio
13. Resistance of HV winding at 75 deg. C
14. Regulation at 0.8 PF at 75 deg. C
15. Resistance of MV winding at 75 deg. C
16. Over Load: The transformers are capable of carrying overload as follows: Percentage

Load	When starting Cold(in hours)	After Running continuously (in hours)
(a) 25%		
(b) 50%		
(c) 100%		

17. Overall dimensions of the transformer.
18. CPRI Type test certificates be enclosed for all type tests applicable as per I.S.

L.T. Panel:

1. Make
2. Thickness of the sheet metal
3. Size of the bus bars
4. Material of bus bars – copper/aluminum
5. Busbar insulation
6. Overall dimension
7. Degree of protection

Bus Trunking:

1. Name of manufacturer
2. CPRI certificate No. & validity
3. Thickness of the sheet metal
4. Size of the bus bars
5. Material of bus bars - copper / aluminum
6. Busbar insulation
7. General arrangement indication spacing of bus bars insulators.

8. No. of flexible/ expansion joints
9. Details of flexible joints

HT Panel:

1. Make
2. Type
3. Rated current Amps.
4. Overall dimensions & weight.
5. Breaking currentKA..... MVAat11000Volts.

D2.4 SAFETY REQUIREMENTS

SCOPE

This section covers the requirements of items to be provided in the sub-station for compliance with statutory regulations, safety and operational needs.

REQUIREMENTS

Safety provisions shall be generally in conformity with appendices (A) and (C) of CPWD General Specifications of Electrical Works (Part I-Internal), 2013. In particular following items shall be provided:

(a) Insulation Mats

Insulation mats conforming to IS 15652: 2006 shall be provided in front of main switch boards as well as other control equipments as specified.

(b) First Aid Charts and First Aid Box

Charts (one in English, one in Hindi, one in Regional language), displaying methods of giving artificial respiration to a recipient of electrical shock shall be prominently provided at appropriate place. Standard first aid boxes containing materials as prescribed by St. John Ambulance brigade or Indian Red Cross should be provided in each sub-station.

(c) Danger Plate

Danger Plates shall be provided on HV and MV equipments. MV danger notice plate shall be 200 mm x 150 mm made of mild steel at least 2 mm thick vitreous enameled white on both sides and with the descriptions in signal red colour on front side as required. Notice plates of other suitable materials such as stainless steel, brass or such other permanent nature material shall also be accepted with the description engraved in signal red colour.

(d) Fire Extinguishers

Portable CO₂ conforming to IS 2878: 1976/ chemical conforming to IS 2171: 1976 extinguishers, HCFC Blend A (P-IV) shall be installed in the sub-station at suitable places. Other extinguishers recommended for electric fires may also be used.

(e) Fire Buckets

Fire buckets conforming to IS 2546: 1974 shall be installed with the suitable stand for storage of water and sand.

(f) Tool Box

A Standard tool box containing necessary tools required for operation and maintenance shall be provided in the sub-station.

(g) *Caution Board*

Necessary number of caution boards such as “Man on Line” ‘Don’t Switch on’ etc. shall be available in the sub-station.

(h) *Key Board*

A keyboard of required size shall be provided at a proper place containing castle keys, and all other keys of sub-station and allied areas.

D2.5 LIST OF INDIAN STANDARDS (IS) for ESS

IS : 1255 – 1983	Code of Practice for installation and maintenance of Power Cables up to and including 33 KV rating (Second Revision)
IS : 1554 - 1988 (Part - I)	PVC insulated (Heavy Duty) electric cables for working voltages up to and including 1100 volts.
IS : 1646 - 1982	Electrical installation fire safety of buildings (general) Code of practice.
IS : 1651 & 1652 - 1991	Stationary cell and batteries, lead acid type
IS : 1180 and IS : 2026	Power Transformer (Oil type)
IS : 11171 : 1985	Power transformer (Dry type)
IS : 2071 - 1974 - 76	Methods of high voltage testing
IS : 2551-1982	Danger notice plate.
IS : 3837 - 1976	Accessories for rigid steel conduit for electrical wiring.
IS : 4146 - 1983	Application guide for voltage transformers
IS : 4615 – 1968	Sch socket outlets.
IS : 5133 – 1969 (Part -I)	Boxes for the enclosure of electrical accessories.
IS : 5424 - 1969	Rubber mats for electrical purposes.
IS : 5578 & 11353-1985	Marking and arrangement of bus bars
IS : 7098 - 1985 (Part - II)	Cross linked polyethylene insulated PVC sheathed cables. For working voltages from 3.3 KV up to and including 33 KV
IS : 8623 -1977 (Part -I)	Factory built assemblies of switchgear and control gear for voltages up to and including 1000 V AC and 1200 V D C.
IS : 8623 - 1980 (Part -II)	Bus Bar trunking system
IS : 8828 - 1996	Miniature Circuit Breakers

IS : 9537 - 1981	Rigid Steel Conduits for electrical wiring (Second Revisions)
IS : 10810 - 1988	Methods of test for cables.
IS : 11171 – 1985	Specifications for dry type transformers
IS : 12640 - 1988	Earth Leakage Circuit Breakers
IS : 13947-1989	Moulded Case Circuit Breakers
IS : 13947 - 1993	Degree of protection provided by enclosures for LV switchgear and control gear.
IS : 1651 & 1652 1991	Stationary cells and batteries lead acid type.

D-3 : DIESEL GENERATING SET

D3.1 SCOPE OF WORK

Scope of this sub head covers planning, designing, supply, installation, testing and commissioning of complete DG Set, cabling work etc. The work should be carried out as per CPWD General Specification for electrical work Part-VII- DG set 2013 & Part-I (Internal) & Part-II (External) 2023. This includes not only the items exclusively defined hereunder but also any other item required to commission and complete the work as per site requirement in this sub head or as per good Engineering practice or as required under the codes or by local/statutory authorities.

Capacities of various equipments like cable, MCCB, ACB, Bus bar etc. mentioned hereunder are minimum. EPC contractor shall do detailed design and calculations and provide the capacity of equipments like cable, MCCB, ACB, Bus bar etc. accordingly, subject to minimum capacities mentioned hereunder.

1. Outdoor Silent type (with outdoor acoustic enclosure) Diesel generating sets 1x125 KVA + 1x58.5 KVA as working (CPCB IV+/ latest amendment) Prime Power rating at 0.8 power factor, turbo charged water cooled, secondary cooling through top mounted radiator, Power Command Supervisor (PCS)/C&I AMF panel with arrangements for auto load sharing and synchronizing of DG sets.
2. PLC based system to ensure:
 - (i) Auto Synchronization of DG sets
 - Either Grid supply incomer breakers or DG supply incomer breaker only are made on in main essential Panel
 - Only required no. of DG sets are made on depending on Electrical Load
 - Programmable selection of outgoing feeders based on priority set, to control load.
3. Separate AMF panel outdoor/ indoor type with 2 incomers (1 no. for normal supply + 1 no. for DG supply) with required size of 4 pole MCCB to be provided for separately for each DG set.
4. LT panel with ACB for local control/Isolation of DG set, to be provided with in sound proof enclosure for emergency operation.
5. Complete Electrical and control wiring for various accessories etc.
6. Earthing system etc. as per CPWD specifications for electrical works Part-I (Internal) 2023.
7. Foundations for equipment's including vibration isolation springs/pads.
8. POL i.e. HSD oil and lub. oil for diesel engine for testing & commissioning for 12 hours i/c 1hr of 10% overloading at OEA/OEM works shall be arranged by the contractor. POL i.e. HSD oil and lub. oil for trial run of DG set for 120 Hrs or 15 days whichever is earlier at the available load at site shall also be arranged by the contractor.
9. The exhaust pipe shall be insulated with suitable thickness of fiber glass with aluminum jacket for its entire length.
10. All pipes or cable connections.
11. Painting of all exposed metal surface of equipment's and components in appropriate color.
12. Clearance/Approval of the complete installation from CPCB/State Pollution Control Board, Central Electricity Authority (CEA)/Local Bodies/Explosive Department and other licensing authorities as required/applicable.
13. In addition to in built diesel tank of each DG set, Diesel tank of minimum 285 ltr. for 125 KVA & 120 ltr. for 58.5 KVA for DG set fabricated of minimum 2 mm thick MS sheet.
14. Certificate from OEM/OEA or authorized service provider of engine manufacturer for satisfactory installation and commissioning of DG Set after completion of the work.
15. An undertaking that mandatory free service is carried out during the guarantee period by the authorized service provider of engine manufacturer.
16. The all work related to providing exhaust piping i/c insulation, aluminum cladding, structure support up to the Height of the nearest building or as per CPCB norms is in scope of work.
17. The AMC of all DG sets for 5 years including replacement of all defective parts and consumable is also the scope of work. The main contractor shall enter in MoU with OEM or his authorized service provider for carrying out AMC of DG set and shall submit to Engineer-in-charge for approval.

D3.2 DESIGN BASIS FOR DG SETS AND RELATED PANELS.

1. Load estimation/Load Calculation – The following installation shall be connected to DG set generator supply in the NRCW, Junagarh, Gujarat.
2. All internal and external lighting of NRCW, Junagarh, Gujarat.
3. The air conditioning system of 50% capacity of Split/ Stand along AC Unit at Training and capacity Block, Informatics and Analytics & Network and Outreach Unit Block, Wildlife Health Management and Disease Investigation and Surveillance Block, Administrative Department Block.
4. 50% lift of building where two or more lift are provided.
5. 100% lifts of the buildings where one lift is provided.
6. STP, drinking water pumps of NRCW, Junagarh, Gujarat.
7. 10% 15A power sockets of all buildings.
8. All ELV services like fire alarm, CCTV, EPABX, LAN system, Drinking water pumps, Audio-Video for class room etc. power plugs of work stations for computers and printers, 50% of Stair case light of each block, 100% light & 50% power of Sub-station room, STP, 100% of Street Light, Guard room, CCTV control room, LAN & EPABX room of NRCW, Junagarh, Gujarat.

The selection of DG Set rating shall be done after taking all above factors in consideration. The UG cable between DG set and Main Essential Panel shall have 25% more capacity than required Ampere rating of DG set.

The description of single line diagram of distribution system in substation will be as under.

- (i) There will be 02 nos. generators, minimum capacity 1x125 KVA + 1x58.5 KVA working.
- (ii) The supply from DG sets to main Essential panel through Aluminium armoured UG cable as per IS7098 (Part-I) 1988.

DG set shall be installed at ground PCC foundation as per CPWD General Specification Part-VII for DG set 2013 as amended upto date. The selection of set should be done after considering derating factor in respect to exhaust height, ventilation etc.

D3.3 Specifications

DG sets shall be silent type, minimum rating/ capacity specified is nominal capacity at standard test conditions. The DG Sets will be installed at suitable location as approved by Engineer-in-charge. DG set shall have all required features as per CPWD specifications.

Conformity to Statutory Acts, Rules, Regulations, Standards and safety Codes.

CPWD Specifications:

The entire work shall be carried out as per following CPWD General Specifications for Electrical works wherever applicable and as amended up-to-date.

CPWD General Specification for Electrical works (Part-VII) DG Set 2013 CPWD General Specification for Electrical works (Part-I) Internal – 2023 CPWD General Specification for Electrical works, (Part-II) External -2023 CPWD General Specification for Electrical works, (Part-IV) Sub-Station- 2013 The tender specifications wherever they differ from these specifications as indicated above, shall have overriding value and shall be followed for this work.

Central Pollution Control Board (CPCB) NORMS:

The DG Sets shall meet the requirements of environmental of latest CPCB norms regarding emission and noise norms amended up to date.

The firm need to furnish the certificate of Type approval and certificate of conformity of production issued by the Central Pollution Control Board (CPCB) or any authorized agency as prescribed in the above law.

The following parts should be installed as per CPWD General Specification for Electrical works (Part-VII) DG Set 2013 and additionally the mentioned points has to be incorporated while designing the DG set System.

Monitoring and metering facilities Microprocessor based Network communication module should be provided for generator set monitoring, metering, protection and control. It should be able to offer advanced levels of functions for reliability and optimum gensets performance. It should be able to address the functions of voltage regulator, governor control and protective relays. The control system should have an easy servicing capability that allows system parameters to be interrogated, monitored and adjusted with PC. It should have the facilities for monitoring and annunciation of the following parameters:

PARAMETERS which are to be monitored:

- i) Voltage (3-phase);
- ii) Current (3-phase);
- iii) Percentage Current;
- iv) Percent Load;
- v) Power Factor;
- vi) Frequency ;
- vii) Real Power;
- viii) Energy;
- ix) Ground Fault;
- x) High/Low A.C Voltage;
- xi) Reverse KW;
- xii) Reverse KVAR ;
- xiii) Overload;
- xiv) Engine speed;
- xv) Engine speed;
- xvi) Engine Temperature (L &R);
- xvii) Exhaust temperature (L&R);
- xviii) Oil pressure ;
- xix) Oil temperature;
- xx) Low/High battery voltage;
- xxi) Run Time;
- xxii) Pre-low oil pressure;
- xxiii) Pre-high engine temperature;
- xxiv) Over speed; Low coolant level;
- xxv) Low fuel level & z) AC charger failure.

PARAMETERS for which annunciation is required :

- i) High battery voltage
- ii) Low battery voltage
- iii) Genset running
- iv) Pre-low oil pressure
- v) High engine temp
- vi) Low engine temperature
- vii) Over speed
- viii) Fail to start
- ix) not in automatic'
- x) Low fuel
- xi) Low coolant level

PARAMETERS for which alarm is required:

a) High A.C voltage; b) Low AC Voltage ; c)Under frequency ; d)over current ; e) short circuit; f)Loss of field ; g)Fail to close ; h) overload ; i) Emergency stop ; j) **COMMUNICATION FAILURE**

Alternator

Synchronous Alternator: SEPARATILY excited, screen protected, self regulated, brush less alternator, Horizontal foot mounted in single bearing construction suitable for the following:

Insulation class	:	H
Temperature Rise	:	Within class H limits at rated load
Winding Pitch	:	2/3Pitch
Stator Winding	:	Double layer lap
Waveform distortion	:	No load < 1.8%, non distorting balanced linear load<5%
Total Harmonic Factor	:	Better than2%.

Alternator should be able to deliver output rating at 40 deg C. ambient at 1000 meter altitude at MSL & at 75 % RH.

Excitation:

- i) There should be a separate source of exciter field power from a small permanent magnet field a.c generator mounted on the same shaft as the main machine which would act as the separately excited system.
- ii) The permanent magnet will produce an output voltage which is only dependent on speed and is independent of the load conditions. This constant output voltage is required to be fed to the exciter field through the AVR.
- iii) By comparing the main output sensed voltage the AVR decides on the proportion of permanent magnet machine output to Rectify and feed to the exciter field
- iv) The exciter rotor output should then increase, establishing a strong main field and therefore a marked increase in main output voltage.
- v) The AVR should sense and compare voltages and adjust exciter field excitation until desired output voltage is developed.

Automatic Voltage regulators (AVR):

- i) Fully encapsulated AVR capable of withstanding humid and corrosive atmospheric conditions.
- ii) Soft start circuitry to be provided for smooth controlled build up of generator output voltage.
- iii) Remote voltage adjustment facility is to be provided.
- iv) Under frequency protection to be provided.

The alternator should be fitted with suitable nos Resistance Temperature Device (RTD) & Bearing Temperature Device (BTD) along with space heaters. The terminal of space heaters will be wired to terminal box and the temperature scanner shall be provided in control panel for

scaling the winding and bearing temperature.

Cable:

Multi core armored copper/Al. XLPE insulated PVC outer sheathed cable should be used for inter connecting the engine controls with the switch gear and other equipments.

Acoustic enclosure:

Sound proofing of the enclosure shall be done with high quality Fire Retardant insulation material i.e. Glass wool / mineral wool of minimum 100mm thickness and density of 75 KG/cubic meter to 100 Kg/cubic meter for sound absorption confirming to relevant IS to reduce the sound levels as per the CPCB norms. The sound proofing materials would be further covered with fine glass fibre cloth and would be supported by perforated MS sheet duly powder coated.

The doors shall be gasketed with high quality gaskets to prevent leakage of sound and the door handles shall be lockable type.

There shall be a provision for filling fuel from outside the enclosure with locking arrangement. Fuel tank should have provision for cleaning. The Fuel gauge shall have electrically operated – fuel gauge shall have to provided inside the enclosure. The fuel gauge should be able to show the level of the fuel even when the DG Set is not running.

The provision of external drain plug shall be kept for draining lub oil and diesel. Especially design attenuators shall be provided to control sound at air entry exit point. Especially design residential silencer shall be provided within the enclosure to reduce exhaust noise.

Adequate ventilation shall be provided to meet total air requirement. Suitable numbers of axial flow fan(with motor and auto-start arrangement) and suitable size axial flow exhaust fan of suitable dia meter to take the hot air from the enclosure complete with necessary motors and auto start arrangement shall be provided as per the manufacturers design. The forced ventilation arrangement should be provided with auto stop arrangement to stop after 5 minutes of the stopping of D.G. sets.

Temperature Control Relay which continuously indicates the inside temperature of the canopy with variable setting for tripping the generator. There shall be a provision of emergency shutdown from outside the enclosure.

Acoustic enclosure will be provided with flexible exhaust pipe connection with adequate and suitable arrangement of mounting of the residential silencer mounted on the top and concealed in the body of the enclosure. The exhaust pipe inside the enclosure must be lagged (except below).

The DG set will be provided with special spring mounted vibration damper to eliminate the vibration when DG set is working on full load.

The front panel should include engine RPM meter electrically operated.

There should have a provision of DC Emergency light operated automatically with door opening.

The inside of the enclosure shall be illuminated by the fluorescent tube with the help of PVC insulated copper conductor wiring in recess conduit suitable for single phase AC supply.

To avoid re-circulation of hot air, durable sealing between radiator and canopy is must.

Inspection And Testing of DG Sets

- (i) The successful tenderer will arrange staff/POL/for test run at his cost.
- (ii) For testing, following procedure will be followed: All major items/equipment's i.e. engine & alternative in assembled condition, associated electrical control panels etc. shall be offered for inspection and testing at factory/manufacturing works. The successful tenderer shall give a notice of minimum two weeks for carrying out such tests. All expenditure on diesel and lubrication oil for factory test shall be borne by the tenderer. The Engineer-in Charge/ or his authorized representative shall witness such inspection & testing at mutually agreed date. The cost of the representative's visit to the factory will be borne by the Department.
- (iii) The department also reserves the right to inspect the fabrication job at factory and the successful tenderer has to make arrangements for the same.
- (iv) DG set will be tested on load of unity power factor for the rated KW rating (to be calculated considering power factor as 0.80). During testing, each of the
- (v) D.G sets covered under of work, shall be operated for a period of 12 hours on the rated KW at DG set's KW rating including one hour on 10% overload after continuous run of the 12 Hours. During testing during all controls/operations safeties will be checked and proper record will be maintained. Any defect/abnormality noticed during testing shall be rectified. The testing will be declared successful only when no abnormally/failure is noticed during the testing. The DG set will be cleared for dispatch to site only when the testing is declared successful by authorized representatives/Engineer-in-Charge.

Trial Run/Running-in-Period

After successful testing of the DG Set's, a trial run at available load will be carried out for 120 Hours or 15 Days whichever is later. The DG Set will be operated and a log of all relevant parameters will be maintained during this period. The arrangement of staff for trial run/running in period will be made by the successful tenderer. The diesel and Lub oil shall also be provided by Contractor. The contractor will be free to carry out necessary adjustments. The DG Set will be said to have successfully completed the trial run, if no break-down or abnormal/unsatisfactory operation of any component of the entire installation included in the scope of work of the contract occurs during this period. After this the DG Set will be made available for beneficial use. After the DG Set has operated without any major break- down/trouble, Bidder has to replace lubricant oil/engine oil and then, it shall be taken over by the department subject to guarantee clause of the contract. This date of taking over of the DG Set, after trouble free operation during the trial run/ running-in period shall be the date of acceptance/taking over.

Safety Measures

All equipment shall incorporate suitable safety provision to ensure safety of the operating personal as per manufacturers' standard practice.

Statutory Clearance (s)

Approval/clearance of the complete installation shall be obtained by the contractor from CPCB/state pollution Control Boards/ Local Bodies/ Central Electricity Authority (CEA)/other licensing authorities wherever required. However, application shall be made by Department and any statutory fee, as applicable, shall be paid by Department directly to the govt. authorities concerned.

Drawings for Approval & Completion Drawings

Drawings for approval on award of the work

- (vi) The contractor shall prepare and submit three sets of following drawings and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved

- drawings and agreement.
- (vii) Layout drawings of the equipment's to be installed including control cables, fuel / lube oil pipes and supports / structure for exhaust piping, chimney and bus ducts/ cable trays.
 - (viii) Drawings including section, showing the details of erection of entire equipment's.
 - (ix) Drawings including section and elevation showing the details of erection of Chimney
 - (x) Dimensioned drawing of Acoustic enclosure/Engine-Alternator set and Electrical control panel.
 - (xi) Drawings showing details of support for pipes, cable trays, ducts etc.
 - (xii) Any other drawings relevant to the work.

Drawings / Documents to be furnished on completion of installation.

As built drawings as below shall be submitted

- (xiii) Two sets of the following laminated drawings shall be submitted by the contractor while handing over the installation to the Department. Out of this one set shall be laminated on a hard base for displayed in the Sub-station room. One set shall be displayed in Junior Engineer's room. In addition, drawings will be given as soft copy on Compact Disc (CD)/Pen drive:
 - (xiv) DG set installation drawings giving complete details of all the equipment's, including their foundation.
 - (xv) Line diagram and layout of all electrical control panel giving switchgear ratings and their disposition, cable feeder sizes and their layout.
 - (xvi) Control wiring drawings including all control components and sequence of operation to explain the operation of control circuits in Synchronization panel/PCC.
 - (xvii) Manufacturer's technical catalogues of all equipment's and accessories.
 - (xviii) Operation and maintenance manual of all major equipment's, detailing all adjustments, operation and maintenance procedure.
 - (xix) Test Certificate Routine and Type Test for Alternator, Engine and Acoustic Enclosure

After Sales Services

The contractor shall ensure adequate and prompt after sales service free of cost during guarantee period, and against payment after the guarantee period is over, in the form of maintenance, spares and personnel as and when required during normal life span of the equipment's and shall minimize the breakdown period.

Schedule of Technical Particulars to be submitted by the firm for equipment and submitted before supply of material for approval of department after award of work.

Sl. No.	Description	Parameters
1	DG Set-75 KVA (minimum capacity) (as per latest CPCB-IV standard)	
	Engine	
	Make	
	Model/ISS reference	
	No. of cylinders	
	Rated R.P.M.	
	Method of Starting	
	Aspiration Method	
	BHP	
	Specific Fuel oil consumption (gm/BHP/hr.)	
	Lub. Oil recommended	
	Lub. Oil pressure	

	Qty. of lub. Oil required	
	Time required for starting	
	Lub. Oil sump capacity.	
	Nos. of exhaust pipe required	
	Dia. of exhaust pipe	
	Whether meets CPCB norms for Emission.	
	Fuel Consumption at full load.	
	Any other data.	
2	Alternator	
	Make	
	Enclosure details	
	Full Load output in KVA	
	Full Load output in KW at 0.8 PF	
	Designed over load capacity at max. ambient temp.	
	Efficiency at full load.	
	Class of Insulation of rotor.	
	Class of Insulation stator.	
3	General	
	Overall Length of DG set LxWxH	
	Overall Weight of DG set.	
	Noise Level of DG Set at one Metre with Acoustic Enclosure.	
4	AMF Panels	
	Make.	
	Type (Floor / Wall mounted).	
	Overall dimensions (LxBxH)	
	Finish	
5	Generator Control Panel	
	Make	
	Acoustic Enclosure.	
	Make	
	Size	
6	Details of Acoustic lining Material & Make	
7	PCC /L.T. Panel:	
	Make	
	Thickness of the sheet metal	
	Size of the bus bars	
	Material of bus bars –Aluminium.	
	Bus bar insulation	

	Over all dimension	
	Degree of protection	
	Copy of CPRI Test certificate for fault level attached –	Yes/ No

D-4: FIRE FIGHTING (DOWN COMER SYSTEM)

D4.1 SCOPE OF WORK

Scope of this sub head covers planning, designing, Supplying, Installation, Testing and commissioning of fire protection system including down comer, Yard hydrants, internal hydrants, first aid hose reels, electrical pumps etc. designed and provided as per provision given in NBC 2016, relevant BIS codes, local Fire Bye Laws & CPWD Specification Part V- Wet Riser and Sprinkler System-2020, all with up-to-date amendments, pipe materials and other fixtures for Fire Fighting, plumbing work shall be as per CPWD specifications. This includes not only the items exclusively defined hereunder but also any other item required to commission and complete the work as per site requirement in this sub head or as per good Engineering practice or as required under the codes or by local/statutory authorities.

- A. Pump House with 1 set of pumps of required Head and discharge and 1 sets of Panels along with all accessories for following systems:
 - 1. Down comer system in Administrative Block, Wildlife Health Management and Disease Investigation and Surveillance Block, Informatics and Analytics & Network & Outreach Unit Block, Training & Capacity Building Block, Utility Block, Sub-stations and Security Building Block.
 - 2. Yard Hydrant system with ring mains in whole campus around all the building, structure.
 - 3. Layout of Pumps and panel shall be as per CPWD specification.
 - 4. FBC connection at main gate and outside each Building, Block, etc.

- B. Piping for Down comer, hydrant along with all type of valves, Gauges, SS orifice plates for adjustment of pressure, stainless steel cabinet for external hydrants internal hydrants in (FHC shafts), RRL hose pipes type-II, primary hose reels, pipe supports/welding, Fire Brigade inlet and outlet connections, Pressure vessel, Air release valve for each riser.

Note for B above: Pipes of diameter 80 mm and above shall be provided with flexible groove type coupling at every 24 Mtr. distance (either horizontal or vertical) to take care of seismic movements

Note: This sub head covers all requirements except construction of under-ground water tank of required capacity and required capacity of OH water tank at each terrace.

- C. **Pump House**
There shall be following minimum installations:-
 - a. Terrace pump/s- 2 nos. 450 LPM minimum (1 No. Standby) with necessary butterfly valves, non-return valves, necessary pipe connection to the risers with Electrical Control Panel for Administrative Block, Wildlife Health Management and Disease Investigation and Surveillance Block, Informatics and Analytics & Network & Outreach Unit Block, Training & Capacity Building Block, etc as per statutory Requirement
 - b. Electrical Control panels: 1 no. i/c XLPE insulated Aluminium/ Copper armoured cable from panel to pump etc. on suitable size powder coated cable tray/ race way. Electrical works, including Cabling, earthing etc. for the installation, equipment Specification shall be executed as per relevant and latest CPWD norms.

Electrical Control Panel shall be cubicle type meeting CPWD specifications for Sub stations

2013 CPWD specifications for wet riser and Sprinkler system 2020, and as amended up to date requirements.

A stainless-steel flexible connection shall be provided between the engine exhaust outlet and the exhaust pipe. An exhaust silencer shall be provided as required to satisfy the acoustic requirements

D4.2 DESIGN CONCEPT AND SPECIFICATIONS

The Design of firefighting system shall meet the requirement of NBC 2016 and requirement of UP fire service. Execution of work shall be broadly in line with CPWD specifications for wet riser and Sprinkler system 2020 as amended up to date.

- 1. Hydraulic Calculations and selection of pumps:** The capacity of fire pumps mentioned above are minimum. The successful EPC contractor shall provide detailed hydraulic calculations to comply with CPWD Specifications, NBC-2016, Relevant BIS Codes, NFPA Standards and to the requirements of local body.
- 2. Piping General and Hydrant System**
 - a. The risers shall be terminated with air release valve at the highest points to release the trapped air in the pipe work.
 - b. Pipes of diameter 80 mm and above shall be provided with flexible groove type coupling at every 24 mtr. distance (either horizontal or vertical) to take care of seismic movements.
- 3. Fixed Type Fire Extinguishers**
 - a. Minimum 2 sets of Fire Extinguishers (ABC-6kg, CO2-4.5 kg capacity and water CO2 9 ltrs.) in the corridor at each floor in each building as per locations approved by the engineer in charge.
 - b. A set of Fire Extinguishers (ABC-6kg, CO2-4.5 kg capacity) at each floor near stair case in each building
 - c. 2 nos. Fire Extinguisher ABC type-2 kg in all pantry of each building.
 - d. Minimum 10 sets of Trolley mounted CO2 cylinder of 25 KG and Fire Extinguishers ABC type -25 kg in sub-station, HT room, STP room etc. as per locations approved by the engineer in charge.
 - e. In addition to above, 2 sets of Fire Extinguishers (ABC-6kg, CO2-4.5 kg capacity) in all FHC Shafts at all floors, Electrical room, lift machine rooms, pump rooms, security room, FAS Room, guard room, CCTV control room, Server room, Electrical shaft at each floor shall be provided. Extra number of fire extinguishers shall be provided at the locations where hazardous materials is stored.
- 4. FBC (Fire Brigade Inlet Connection)**
 - a. One No. four way Fire Brigade Inlet Connections and one no 3 way FBC outlet at fire tank shall be provided.
 - b. For supplying water to individual wet riser directly by Fire department in case of emergency (and fire pumps fail to start), one no. two way Fire Brigade inlet connection shall be provided along with necessary Valves to isolate the system for each internal Fire riser.

5. TESTING:

To be done as per CPWD Specification Part V Wet Riser & Sprinkler System 2020.

6. Commissioning, Fire Department Inspection And Handing Over:

- a. All commissioning and testing shall be done by the contractor to the complete satisfaction of the engineer in charge.
- b. Once internal testing is complete, contractor to invite Fire service officers for their inspection, make all additions/alterations, replacements, rectifications etc as required by fire officer, obtain NOC and then the job handed over to the engineer in charge, or his authorized representative.
- c. Contractor shall also handover, to the engineer in charge, all maintenance & operation manuals and all other items as per directions of Engineer in Charge/ terms of the contract.

7. Painting:

Painting of all exposed metal surfaces of equipment and component with appropriate colour as per relevant para of CPWD general specification.

8. Scope:

Scope of firm for getting approval and NOC from local body and local fire authorities.

D4.3 DRAWINGS FOR APPROVAL ON AWARD OF THE WORK

The contractor shall prepare and submit three sets of hard copy of following drawings and 2 sets in soft copy and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved drawings and agreement.

- (i) Layout drawings of all equipments (hydrants) along with hydraulic calculations and data sheets of pumps, sprinklers and other fittings.
- (ii) Layout of equipment's to be installed in pump house including power and control cables, Cable trays etc.
- (iii) Earthing
- (iv) Drawings showing details of support for pipes, cable trays etc.
- (v) Any other drawings relevant to the work.

D4.4 DRAWINGS AFTER COMPLETION OF WORK

The contractor shall submit Two sets of “As-built” drawings on white paper and 2 sets in soft copy to the owner/ Engineer-In-Charge after completion of the work. In addition, the following shall also be provided:

- (i) Test Certificates
- (ii) Warrantee Certificates
- (iii) O&M Manuals of Equipments
- (iv) Any other information the Engineer-In-Charge may dam fit.

D4.5 TECHNICAL DATA

(To be submitted by the firm to whom work is awarded, after the award of work as per the time schedule set).

A. Electrical Motor Driven Terrace Pumps:

Sl. No.	Description	Parameters			
		Fire Hydrant Pump	Sprinkler Pump	Jockey Pump	Water Curtain
1.	Quantity				
2.	Make				
3.	Model				
4.	Fluid Handled				
5.	Type				
6.	Suction				
7.	Delivery				
8.	Impeller Type				
9.	Coupling				
10.	Base Plate with Foundation Bolt				
11.	No. of Stage				
12.	Flow Rate (m ³ /hr)				
13.	Total Head (m)				
14.	Speed of Pump (rpm)				
15.	Efficiency at rated duty point				
16.	Material of construction (MOC)				
17.	Casing material				
18.	Impeller material				
19.	Shaft material				
20.	Shaft sleeve				
21.	Casing Ring				
22.	Impeller Ring				

D4.6 LIST OF IS CODES

The following Indian Standards shall be applicable with up-to-date amendments

Codes And Standards for Pumps, Motors And Diesel Engine:

1. Pumps:

The pumps shall conform to the standards and codes as given below:

- a. IS: 1520 Horizontal centrifugal pumps for clear, cold and fresh water.
- b. BS: 599 methods of testing pumps.
- c. PTC: 8 ASME Power test Codes – Centrifugal Pumps.

2. Motors:

The following codes shall be applicable for the motor:-

- a. IS:7538 Electrical motors
- b. IS: 325 Induction motor, three – phase.
- c. IS: 900 code of practice for induction motors, installation and maintenance.
- d. IS: 7816 guide for testing insulation resistance of rotating machines.
- e. IS: 4029 guide for testing three phase induction motor.
- f. IS: 3043 code of practice for earthing.
- g. Further to those stated above, the design, manufacture, installation and performance of motors shall conform to the latest Indian Electricity Act and Indian Electricity Rules.

3. Code Of Practice:

- a. Code of practice for fire safety of building (general) fire fighting equipment and maintenance. - IS : 1648
- b. Code of practice for installation of internal fire hydrant in multistoried buildings. - IS : 3844
- c. Recommendations for providing first aid and fire fighting arrangements in public buildings. - IS : 2217
- d. Code of practice for the selection, installation and maintenance of portable first aid and fire appliances - IS : 2190 National building code.

4. Fire Fighting Appliances:

- a. External fire hydrants. - IS : 5290
- b. Internal landing valves. - IS : 5290
- c. 2 way & 3 way suction collecting heads. - IS : 904
- d. RRL hosepipe - Type-II, IS :636-1979
- e. First aid hose reels. - IS : 884
- f. Dunlop high pressure rubber pipe. - IS : 5132

5. Hand Appliances

- a. Specification for portable CO2 fire extinguisher: - IS : 2878
- b. Specifications for portable chemical fire extinguisher foam type: - IS : 933

6. Piping and Valves

- a. MS tubes up to 150 mm - IS:1239 (Part –I)
- b. MS tubes 200 mm above - IS:3589
- c. G.I. Pipes - IS:1239 (Part I)
- d. C.I. double flanged sluice valves class I - IS:780
- e. C.I. double flanged non return valves - IS:5312

D-5: MANUAL FIRE ALARM AND PUBLIC ADDRESS SYSTEM

D5.1 SCOPE OF WORK

Scope of this sub heads covers planning, designing, supply, erection, testing and commissioning of fire alarm system as per the requirement of local body Fire Service by laws, NBC 2016 & General Specifications for Electrical Works Part-VI Fire Detection And Alarm System 2018, IE Rules, BIS/IEC, Indian Standards amended up to date, covering manual Fire Alarm System complete with items like detectors, manual call boxes, cabling/ wiring, fire panels, etc. The FAS system shall include not only the items exclusively defined here under but also any other item required to commission and complete the work as per site requirement in this sub head or as per good Engineering practice or as required under the codes or by local/statutory authorities.

1. Manual Call point, Strobe cum Hooter, Telephone Jack point, shall be provided at every staircase floor landing, exit points of Training & Capacity Block, Informatic and Analytic & Network and Out Reach Unit Block, Wildlife Health Management and Disease Investigation and Surveillance Block, Administrative Department Block, Utility Block, Sub-station and Security Block etc.
2. Main Control panel with MIMIC diagram at Security Block, local control panel in each building.
3. The integration of fire alarm system for monitoring and control with Lifts, Public Address system and etc. as required.
4. Repeater panel in Guard Room
 - (i) Strobe cum hooter shall be activated from FAS panel, so that occupant gets alarm signal whenever there is smoke/fire and occupant is required to be alerted /evacuated.
 - (ii) External power supply with suitable size online single/ three phase UPS with battery backup of 30 minutes for FAS system and other accessories as per design calculation shall be provided.
 - (iii) Zoning of Fire Alarm system and public address system on each floor/ area.
 - (iv) Providing Public Address System - voice alarm controller with seamless integration with main Fire Alarm panel, Audio Amplifiers, speakers with housing, Voice command keypad, gooseneck mic, cabinet, etc. along with associated wiring system for Training & Capacity Block, Informatic and Analytic & Network and Out Reach Unit Block, Wildlife Health Management and Disease Investigation and Surveillance Block, Administrative Department Block, Utility Block, Sub-station and Security Block etc.
5. There shall be dedicated FAS Panels for each block which shall be integrated with main fire alarm panel in security control room through fiber optic cable.
6. Fire alarm panels shall be provided with communicable port suitable for fiber optic cable interface.
7. Providing suitable compatibility in the Main Fire Alarm Control Panel for Integration of Public Address System.
8. Fire Fighter's talk back system in each staircase.
9. PA system may be Analogue or digital type. System shall act either in Auto or Manual Mode.
10. PA system shall be manually selective for announcements at: Floor wise, Building Wise.
11. Pre-recorded standard announcement messages shall be stored in memory for auto announcement. System shall be capable to record fresh messages also for future use.
12. The system shall be used for public announcements, evacuation, playing music building wise tower wise as a whole and floor wise independently.
13. Electrical works, including Cabling, earthing etc. for the installation, equipment Specification shall be executed as per relevant and CPWD General Specification for Electrical Works (Part-I for Internal 2023 & Part-II External 2023) as amended upto date. Either copper conductor armoured Fire survival cables of suitable size or copper wire in heavy duty MS conduit of suitable size shall be used complaint to the relevant IS. Public Address system with Audio Amplifiers, speakers & required wiring shall be provided to cover all the areas as per the requirement of CPWD specification, NBC 2016 and local bye laws.
14. The required PC and printers for monitoring the system.
15. Safety Signages/ Sign Boards: Photoluminescent Signages for Warning/ Information/ Egress Route Guiding Strip, Electrical Signages etc. in all buildings.

16. Any other item required to make Fire Alarm and Public Address system as per approved plan / scheme functional, but is not specifically mentioned in this scope.
17. In corridors/ lobbies/ common area of all buildings Electrical signage shall be provided as per IS 9583. These shall be IP 65 rated, shall have an inbuilt 5 years maintenance free battery with 2 hours backup along with charging arrangement. The electrical signage's shall be connected to UPS supply. The online UPS of required capacity with maintenance free batteries with 30 minutes backup shall be provided.
18. Photoluminescent Signs shall be provided with in staircase at every landing and mid landing, Main Lobby and Lift Lobbies, Fire Extinguisher, Halls and Toilet. Floor Map for evacuation purpose (minimum 2 at each floor of minimum A3 size) shall also be of Photoluminescent type. These Photoluminescent signages shall be on 1.2 mm thick Aluminium sheet and in conformity with BS ISO 3864-1 (2011). These shall be Rigid photoluminescent based Glow-in the dark rigid sheet with high intensity luminous properties (glow visible for more than 12 hours in total darkness) enclosed in a transparent weather proof UV stabilized coated sheet.
19. Size, color, design of Signage shall be as per IS:9457 (Safety Color and safety Sign) and IS 12349 (Fire Protection safety signs). Required no of signages of both types Electrical and Photoluminescent shall be provided.
20. Fire Fighter's Phone system: Complete in all respects shall be provided with phone at all landings of all staircase. It will have battery backup of 8 hours.
21. The works shall be executed as per CPWD's General specification for Electrical Works, Part -VI Fire detection and Alarm system-2018, NBC 2016, IE Rules, BIS/IEC, Indian Standards amended up to date and as per direction of Engineer-in- Charge. The additional specifications/conditions are applicable.

D5.2 PA SYSTEM

A. General

- (i) Seamless Integrated PA with Fire Alarm system shall be provided. System shall be in accordance with latest NFPA guidelines and NBC requirement for evacuation system.
- (ii) PA system may be Analogue or digital type. System shall act either in Auto or Manual Mode.
- (iii) PA system shall be manually selective for announcements at: Floor wise, Building Wise, Basement wise.
- (iv) Automatic as well as manual announcement system in fire affected Zone shall be provided.
- (v) Speakers (ceiling or box type) placement and wattage shall be so selected as to be audible in all areas. Neither too loud or too faint in any area.
- (vi) Minimum two no. Amplifiers including one as standby shall be provided for PA system.
- (vii) Media player shall be provided for playing content/music etc.
- (viii) Necessary hooters shall be provided at appropriate places.
- (ix) For making announcements Mike shall be provided at Security control room and at lift lobby of each tower. From the lift lobby of each tower one should be able to make announcement at stilt and basement parking area for call of car.

B. Public Announcement System

This system shall be in addition to PA system provided for integration with fire alarm system. Control of this PA system shall be provided in Security control room or location as decided by engineer-in-charge, comprising of speakers, amplifier, microphone and control panel, associated wiring etc.

- (i) The wall/ ceiling speakers shall be installed in all the areas including Washrooms.
- (ii) Speakers shall be looped zone wise and building wise. PA system's High-End Equipment will be installed in the security control room center.
- (iii) Speaker shall be compatible for fiber optics cable interface.
- (iv) Each zone shall have its own amplifier as per detailed engineering and shall be located in the Security control room.
- (v) The wiring shall be done in MS conduit of required size.

C. Test:

- (i) After completing the work, necessary test results as envisaged in CPWD General Specifications shall be recorded and submitted to the department.
- (ii) The pre-commissioning testing of the installation shall be carried out such as
 - Facilities at Panel
 - Integration of various services with FAS and its response.
- (iii) All the tests at site shall be carried out for the completed installations, in the presence of and to the satisfaction of the Engineer in Charge by the contractor. All the test results shall be recorded and submitted to the Department.

D5.3 DRAWINGS FOR APPROVAL ON AWARD OF THE WORK

The contractor shall prepare and submit three sets of hard copy of following drawings and 2 sets in soft copy and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved drawings and agreement.

- (i) Layout drawings of the speakers, devices.
- (ii) Layout of equipment's to be installed including power and control cables, and supports/ structure for bus ducts/ cable trays.
- (iii) SLD's
- (iv) GAD of Fire control and other panels in Fire Control room
- (v) Any other drawings relevant to the work.

D5.4 DRAWINGS AFTER COMPLETION OF WORK

The contractor shall submit Two sets of "As-built" drawings on white paper and 2 sets in soft copy to the owner/ Engineer-In-Charge after completion of the work. In addition, the following shall also be provided:

- (i) Test Certificates
- (ii) Warrantee Certificates
- (iii) O&M Manuals of Equipments
- (iv) Any other information the Engineer-In-Charge may deem fit.

D-6 EPABX

D6.1 SCOPE OF WORKS

Scope of this sub head covers planning, designing, supply, installation, testing and commissioning of EPABX and telephony network system. Work includes not only the items exclusively defined hereunder but also any other item required to commission and complete the work as per site requirement in this sub head or as per good Engineering practice or as required under the codes or by local/statutory authorities.

IP EPABX for NRCW, Junagarh

1. The IP EPABX system shall support hardware, software and licensing for minimum 120 users expandable to 500 endpoints/users. The telephony system must be able to register SIP phones, SIP video Phone, H.323 Phone directly to IP PBX Server. All lifetime users license and software **with suitable capacity online UPS with 30 minutes backup having maintenance free batteries with 5 years warranty** are in the scope of work.
2. One no. telephone point shall be provided at each work station and at each officer/executive table in all building i.e. (Training & Capacity Block, Informatic and Analytic & Network and Out Reach Unit Block, Wildlife Health Management and Disease Investigation and Surveillance Block, Administrative Department Block, Utility Block, Sub-station and Security Block etc.).
3. Telephone fiber cable of minimum 12 pair starting from termination point of service provider to the EPABX located in Server Room.
4. **Star** topology with minimum 12 core fiber optic cable from EPABX room to L3 network switch for providing connectivity of EPBAX room to each building.
5. Cat-6A wiring in steel conduit, face plate, suitable telephone outlet from user point to EPABX complete as required.
6. Telephone armored copper cable of minimum 10 pair starting from EPABX to sub-station, each guard room, pump house etc. along with 10 pair krone tag block with IP 65 metal housing.
7. Minimum 10 Nos. IP type-1 Telephone for executives.
8. Minimum 75 nos. IP type-2 Telephone for each room, work station,
9. Minimum 10 nos. push button type telephone instrument with digital display for sub-station, each guard room, each pump house etc.
10. Cat-6A wiring in steel conduit, face plate, suitable telephone outlet from user point to IP EPABX complete is included in **this** sub-head as required.
11. Ferruling and identification of all telephone wires/ cables for all the workstations and at junction box.
12. **The AMC for 5 years the IP EPABX, all telephone equipments i/c replacement of all defective parts are also in scope of work. The main contractor shall enter in MoU with OEM or his authorized service provider for carrying out AMC of IP EPABX and all telephone instruments and shall submit to Engineer-in-charge for approval.**

Note: The above minimum requirement is for information. Contractor has to assess the requirement as per actual use as approved by the E-I-C.

D6.2 SPECIFICATIONS

IP Based Communication System (IP PABX/ VoIP Server): Minimum Technical Specifications as follows:

1. The Architecture of the exchange must be completely IP based Server & Gateway type communications system. The IP telephony system must support SIP, Digital and Analog trunks connectivity. Support SIP IP Phone, H.323 IP Phone, Digital Phone and Analog phone.
2. Call control server / appliance should be Intel based hardware with necessary configuration to support the desired expandability, no proprietary hardware is acceptable. Support for virtualization should be available from Day-1.

3. The system should consist of HA servers (Active/Active or Active/Standby redundancy mode). Based on server gateway architecture with external server running on Unix / Linux or similar / equivalent. All the users to be managed in a single database, centrally. Multiple databases are not acceptable.
4. The IP EPABX system shall support hardware, software and licensing for **minimum** 120 users expandable to 500 endpoints/users. The telephony system must be able to register SIP phones, SIP video Phone, H.323 Phone directly to IP PBX Server
5. The system should be fully compliant to VOIP standards like H.323 and SIP (session initiation protocol). the system should be able to operate with any H.323 and SIP compliant, The SIP proxy, sip registrar should be inbuilt in the system and should support any open sip stack compliant hard phones or soft phones, if required, it should be able to inter operate with H.323 and SIP standard based external gatekeepers.
6. The offered system should have Voice compression and decompression in accordance with G.711, G.722, G.729AB, H.264 recommendations and optional echo-cancellation in accordance. The G.711, G.722, G.729A/ILBC & H.264 codecs.
7. System should support the following SIP RFCs:
 - RFC 3261 (SIP: Session Initiation Protocol)
 - RFC 3262 (Reliability of Provisional Responses in Session Initiation Protocol)
 - RFC 3263 (Locating SIP Servers)
 - RFC 3264 (An Offer/Answer Model with Session Description Protocol (SDP))
 - RFC 3265 (Specific Event Notification)
 - RFC 2327 (SDP- Session Description Protocol)
 - RFC 1889 and 1890 (RTP/RTCP)
 - RFC 3515 (REFER)
 - RFC 2833 (DTMF over IP)
8. System should support the QOS features for the VOIP implementation. It should be compliant with both QOS standards (layer 2 – 802.1 p/q) and (layer 3- diffserv/tos).
9. The entire solution (IP PBX, IP Phones, SIP Gateway, E1 PRI Gateway etc.) should be from same OEM for seamless integration and support.
10. The call control system should be fully redundant solution with no single point of failure and should provide 1:1 redundancy by separating the servers over LAN / WAN. Call servers should have High-availability redundancy for switchover between redundant call servers.
11. In case of a failed server, all endpoints should register with redundant server. In progress IP Calls should not be interrupted in the event of Primary Call Server failure.
12. The system gateway must be able to restart automatically without human intervention when the external AC power supply is resumed after complete power failure.
13. The IP EPABX Server must be COTS (Commercial Off-the-Shelf servers) with Dual Intel CPU, minimum 4 RAM slot, Dual Power Supply and RAID 1/6 HDD to avoid a single point of failure.
14. System should have commercial grade encryption security with minimum 128-bit key security for both signaling and voice. Support encrypted voice and signal between phone and server/gateway.
15. System should use TLS (Transport Layer protocol) to encrypt SIP, HTTP and SRTP (Secure Real-time Transport Protocol) and SRTCP to encrypt RTP and RTCP.

16. Media Gateway must be standard rack-mountable solution having flexibility in putting any type of interface cards/modules for Analog, Digital Subscriber & Trunks including ISDN PRI/BRI. FXO/FXS based gateway solutions will not be considered.
17. Media Gateway should have modular architecture with the ability to stack multiple gateways in a single location. Support minimum 30 gateway in single location or multiple locations.
18. Media Gateway should support Analog line, Digital Line and E1 PRI Line. Gateway should be from the same OEM of IP telephony system.
19. The IP EPABX system shall offer the following functions:
 - Automatic call back on busy set
 - Call Forward and overflow.
 - Consultation Call
 - Group Call
 - Music on Hold
 - Hotline features
20. Internal/External audio-conferencing system to support minimum 8 conferencing of 10 Party Meet-me or Adhoc Conference.
21. Support at least 8 department/Management Users to have dedicated conference bridge
22. System should be able to send emails to all the participants giving them the conferencing details
23. System should support PIN based security for conference calls and support scheduling of conference call.
24. Unified Communication (Required 10 users Lic from day-1) Specification of UC Client/Soft phone
 - a) Solution must work on all platforms like Desktop, Laptop, Windows and MAC OS, iOS and Android mobiles.
 - b) The application should work on any WiFi or 3G/4G
 - c) The solution should be part of IP PBX / IP Telephony with UC functionality like presence, Instant Messaging, showing user calendar Point-to-Point Video Call etc.
25. Voice Mail
 - Voice Messaging system must be fully integrated to the call server
 - When a call is forwarded to the voice messaging system, it should have standard / Customized announcement.
 - The voice mailbox must be able to record internal or external calls. Recorded calls will receive the same service as messages that have been left by callers
 - The notification of messages must be on LED/icon on the phone
26. Voice Call Recording
 - System should have in-built/external recording for 10 users/extensions from day-1.
 - Central database, for later retrieval, sorting, searching through a web-based browser interface
 - Recordings should be able to be made on the basis of Caller ID / Extension
 - System should support automatic deletion of oldest recordings, if needed
27. System Management and Monitoring

The management platform must provide a client Graphical User Interface (GUI) as well as a web-based interface to allow the administrator to manage the system from any PC with an browser based web interface over HTTPS. The management platform must provide different levels for accessing the system based on the role being played by the user who is accessing the system. The administrator

should have the highest authority. Support Configuration backup automatically or manually. System should support SNMP based network management

A. SIP Video IP Phone with Camera (Type-1) (Minimum Technical Specifications)

Sl. No.	Specifications of Video IP Phone	Compliance (Yes/No)
1	Minimum 7.5” or more Touch screen color display phone with 1000 x 600 pixel or better	
2	Min 2 Megapixels camera or better with 1080p30 (Full HD)	
3	SIP protocol support and Standards-based codec support: G.711, G.726, G.729A/B/ILBC, G.722, H 264. Message Waiting Indicator	
4	Support 1X RJ9 analog headset port, 1X 3.5 mm audio jack socket for headset	
5	Dual Port RJ45 (10/100/1000 Base T) connected Ethernet. Power over Ethernet IEEE 802.3af (Class 3) or 802.3at (Class 4)	
6	Support Video call and any standard based cloud video conferencing. Phone support Android OS or equivalent	
7	Support TCP, SIP, DHCP, DNS, TLS, HTTP / HTTPS, RTP / SRTP, RTCP / SRTCP, 802.1x, Layer 3 QoS	
8	Video phone should be from the same OEM of IP telephony system	

B. 2. Basic SIP IP Phone (Type -2): Minimum Technical Specifications

Sl. No.	Specifications	Compliance (Yes/No)
1	Single-line SIP IP phone with monochrome 128x30 pixel display or 2.2” monochrome display	
2	Support for transfer, Forward, Mute, 3-Way-Ad-Hoc-Conference	
3	Three context sensitive soft keys	
4	Fixed hard buttons for Mute, Hold, Transfer, Conference, Forward, Call Park / UnPark	
5	Should support call History with up to 50 entries	
6	Support G.711a/u, G.722, G.726A, G.729AB	
7	Support Full duplex speakerphone	
8	Should be able to support failover if one server fails	
9	Message Waiting Indicator	
10	Navigation buttons for easy manipulation.	
11	Dual 10/100 Ethernet ports to support co-located PC	
12	TLS / SRTP support for encryption	
13	Supports Power over Ethernet (PoE) 802.3af/az as a Class 1 device	
14	Should support optional Wireless Module for Wi-Fi connectivity	
15	Same OEM IP Phone as SIP enabled EPABX system for complete feature availability from day-1	

C. Specifications of PRI Gateway:

- 1) PRI gateway should have Configuration – 1 PRI (30 Channels) or 2 PRI (60 Channels) and should be from the same OEM of telephony system.

- 2) Voice Processing – G.711, G.729A, G.723.1, GSM, iLBC; echo cancellation:
 - i. G.168 with 64ms echo tail; dynamic jitter buffer; VAD and CNG.
- 3) Calling Control – called/calling party number translation; second stage dialling; voice detection; auto dialling with DTMF; ring back tone generation and detection; voice announcement.
- 4) Voice Proxy – RTP voice proxy function for NAT/firewall traversal
- 5) Fax Relay – T.30 transparent mode, T.38 fax relay
- 6) Remote Management – Telnet, HTTP, TR069
- 7) PSTN – ISDN PRI
- 8) DTMF – tone detection generation and detection; DTMF relay: RFC2833, INFO (SIP)
- 9) DTMF detection and progress tone detection
- 10) Play ring-back tone
- 11) T.30 and T.38
- 12) RTP proxy for NAT traversal
- 13) Ethernet – RJ-45, 10/100 Base-T
- 14) Trunking Interface – RJ-45
- 15) System Memory – 128MB or higher
- 16) System Flash – 16MB or higher
- 17) Operation Humidity – 10% to 90% (non-condensing)
- 18) Operation Temperature – 0 to 40°C

IP data network provided in Sub work Data Networking System (LAN) shall be suitably designed/augmented to serve the needs of this Sub Head as well. No separate dedicated IP network is required for this Sub head.

D6.3 DRAWINGS FOR APPROVAL ON AWARD OF THE WORK

The contractor shall prepare and submit three sets of hard copy of following drawings and 2 sets in soft copy and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved drawings and agreement.

- (i) Layout drawings of the Telephone points along with Layout of equipment's to be installed.
- (ii) SLD's
- (iii) Any other drawings relevant to the work.

D6.4 DRAWINGS AFTER COMPLETION OF WORK

The contractor shall submit Three sets of “As-built” drawings on white paper and two sets in soft copy to the owner/ Engineer-In-Charge after completion of the work. In addition, the following shall also be provided:

- (i) Test Certificates
- (ii) Warrantee Certificates
- (iii) O&M Manuals of Equipments
- (iv) Any other information the Engineer-In-Charge may deem fit.

D7-CCTV SURVEILLANCE SYSTEM

D7.1 SCOPE OF WORK

Scope of this sub head covers planning, designing, supply, installation, testing and commissioning of CCTV. Work includes not only the items exclusively defined here under but also any other item required to commission and complete the work as per site requirement in this sub head or as per good Engineering practice or as required under the codes or by local/statutory authorities.

1. Suitable numbers of Day and Night IP based vision cameras (meant for safety of high standard) including its support with suitable mounting arrangement in a Vandal Proof Housing to cover following locations, all activities, identifications in the area:
 - a. Around the boundary wall: 5MP@ 20 fps, Bullet camera at a maximum distance of 30 metre.
 - b. 100% coverage of outdoor area in NRCW, Junagarh with combination of 2MP PTZ camera (for patrolling) @ 50/60 fps and 5MP Bullet cameras (for continuous surveillance) @20fps, minimum distance of 40 metre
 - c. 100% coverage of indoor area in Administrative Block, Wild Life Health Management and Disease Investigation and Surveillance, Informatic and Analytics & Network and Outreach Unit Block, Training and Capacity Block, Training and Capacity Block, Utility Block, Substation and Security Buildings Block of NRCW, Junagarh except toilets and office rooms with combination of 5MP Dome camera @ 20 fps and 5MP Bullet cameras @ 20 fps
 - d. Substation, Pump Room, 5MP @ 20 fps, Bullet camera
 - e. Terrace, and other common areas at suitable intervals 5MP @ 20fps, Bullet camera
 - f. Main Entry/ Exit & Auxillary Entry/ Exit gates. 5MP @ 20fps, Bullet camera
2. Integration of cameras provided in Lift cars by Lift vendor in CCTV system
3. **Providing**, Laying, terminating & connecting CAT 6A, **OFC** cables between cameras, switches and control room. However, connection between switches and control room shall be made with redundancy (through CAT 6A cables/ OFC cable). Active part (POE switch, POE+ switches for PTZ, LIU panels, patch panels, associated racks and patch cords etc. for satisfactory operation of CCTV and access control system shall be scope of work.
4. Minimum 60 days recording per camera 1944 P@25FPS with hard disk shall be scope of work.
5. Establishing CCTV Monitoring Station at control room having **minimum 2** nos. high resolution 55" professional LED display.
6. The whole CCTV system shall have provision of compatible VMSsystem (either separate software or embedded in NVR) and shall have seamless integration. The VMS software with lifetime free license for software and its updates (either separate or embedded in NVR) shall also be scope of work.
7. Provision of 2 Nos. CCTV client work station at distinct places with minimum Intel® Core i7 or i7 11800, 11th Gen family 3.5GHz or higher, 16GB RAM, Windows 10, 64-Bit OS, 1TB SSD Hard-disk, 42" Color flat panel LED Professional Monitor (1920 x 1080 resolution), 1 Gbps network card, Graphic Card 2 GB, antivirus software shall be scope of work.
8. The networking rack, all network switches, all NVR shall have minimum 20% spare space for future provisions.
9. The outdoor cameras power requirement shall be metfrom POE+ switches.
10. The CCTV Network shall be Design with Two-Tier Architecture i.e. with access network POE

switches and distribution network POE switches + NVR etc.

11. Dedicated Lan System for CCTV, Access Control, provision of POE Switch Jack Panel, LIU, Patch Cord, Fiber Cable Cat-6 cable etc as Required. 24 Port POE Switch with 10/100/1000 BaseT with 2 Sfp Port. Layer 3 switch with 24 port Base T and 4 No 10G SFP+ port etc. is scope of work.
12. The online UPS of suitable capacity with maintenance free batteries with 30 minute backup for above system shall be scope of work.
13. The mounting arrangement for outdoor cameras likes: - Pole, etc. shall be scope of work.
14. CCTV areas coverage analysis and drawings, band width calculations for PoE switches shall be done by contractor.

NOTE: Contractor shall design the CCTV surveillance system for all the mentioned building and external areas and evaluate the required quantity of indoor (Dome/ Bullet/ PTZ) type and outdoor type (PTZ/ Bullet) type.

D7.2 SPECIFICATIONS:

1. CCTV Specifications

Cameras should be of outdoor/ indoor application as required having following specifications

Item. No	Description	Specifications
	IP Bullet Camera for General Surveillance Specifications :	
1	Type of Camera	Outdoor Bullet
2	Image Sensor	1/2.7" or better progressive Scan CMOS
3	Signal System	PAL/NTSC
4	Resolution & frame rate	5MP (2592 × 1944) @20fps, 4MP (2560 × 1440) @ 25/30fps, 2MP (1920 × 1080) @ 50/60fps
5	Minimum Illumination	0.005Lux@ F1.5 or better, AGC ON, 0 lux with IR or better
6	Imaging	1/3s to 1/100000s, ROI, Defog, Auto Gain Control, White Balance- Auto, Back Light Compensation, Multi zone Privacy Masking, HLC and EIS.
7	Signal to Noise Ratio	56 dB or more
8	Lens Type	2.7mm ~ 13.5mm or Better
	Viewing Angle	Camera should have below viewing angle or better: - Horizontal:100°-28° Vertical : 72°-21°
9	Focus	Motorized Vari Focal
10	Day & Night	True Day & Night High Performance Mechanical IR cut filter with auto switch, IR Source- Inbuilt Smart IR LED's with effective distance upto 50 Mtr or better with the help of External/ Integrated IR.
11	Video Compression (Minimum)	H.265+/ Instastream, H.265, H.264+, H.264
12	Wide Dynamic Range	WDR (120db or more), HLC and BLC
13	Digital Noise Reduction	DNR (2D/3D) On/Off
14	Streaming	Triple streaming , configurable
15	Connectivity	LAN

16	Image Setting	Rotate Mode, saturation, brightness, contrast, sharpness adjustable through client software or web browser
17	Profile Management	User configuration import, export
18	Security	User Authentication, Water Marking
19	Onboard Storage	Camera should support built in Class-10 Micro SD/SDHC/SDXC Card slot upto 256 GB .
20	Recording Management	Format SD, overwrite, storage management, video to NAS device, remote archive access via FTP login
21	Edge based Video Analytics & Alarm Trigger	Motion detection, Face detection, track, face enhancement Human Detection, Video tampering, Scene change, Network disconnection, IP address conflict, Illegal Access, Storage anomaly, No SD card, SD card full, SD card error, Defocus Detection, abandoned object, missing object, loitering detection, people gathering, audio detection, people counting, Tripwire, Intrusion, parking detection.
Network Compatibility		
22	Network Protocol	IPv4/v6, HTTP, HTTPS, TCP, UDP, ARP, RTP, RTSP, RTCP, RTMP, SMTP, FTP, SFTP, DHCP, DNS, DDNS, QoS, UPnP, NTP, Multicast, ICMP, IGMP, NFS, PPPoE, SNMP, CGI.
23	User Access	5 User Simultaneously or more
24	System Capability	It should support ONVIF (Profile S, Profile G and Profile T). The Quoted Model Should be listed on ONVIF Official website. CCTV Camera OEM should be full time member of ONVIF and should not be blacklisted/ suspended by ONVIF.
25	VMS & OTA	Camera should support open source VMS and Online Device Upgrade.
26	Ethernet	1 RJ 45 10/100 Ethernet port
27	Audio In/ Out	1x Input & 1 Output port for external Mix & Speaker.
	Audio Compression	G.711a, G.711Mu, AAC, G.726, G.723
28	Alarm In/ out	Mini. 2 Input & 1 Output port for external sensors etc.
29	Power Input	Standard DC Jack
30	Power Requirement	12VDC \pm 10%, PoE (IEEE802.3 af)
31	Power Consumption	Max 10~12 W
32	Enclosure	IP67 weather proof and IK10
33	Operating Condition	-20°C to 60°C, humidity 95% (max) (non-condensing)
34	Standards	UL, CE, FCC, RoHS, BIS Certified

- **Network Dome Camera**

Item. No	Description	Specifications
IP Vandal Dome Camera for General Surveillance Specifications:		
1	Type of Camera	Vandal Dome
2	Image Sensor	1/2.7" or better progressive Scan CMOS
3	Signal System	PAL/NTSC
4	Resolution & frame rate	5MP (2592 \times 1944) @20fps, 4MP (2560 \times 1440) @ 25/30fps, 2MP (1920 \times 1080) @ 50/60fps
5	Minimum Illumination	0.005Lux@ F1.5 or better, AGC ON, 0 lux with IR or better

6	Imaging	1/3s to 1/100000s, ROI, Defog, Auto Gain Control, White Balance- Auto, Back Light Compensation, Multi zone Privacy Masking, HLC and EIS.
7	Signal to Noise Ratio	56 dB or more
8	Lens Type	2.7mm ~ 13.5mm or better
	Viewing Angle	Camera should have below viewing angle or better: - Horizontal: 100°-28° Vertical : 72°-21°
9	Focus	Motorized Vari Focal
10	Day & Night	True Day & Night High Performance Mechanical IR cut filter with auto switch, IR Source- Inbuilt Smart IR LEDs with effective distance upto 40 Mtr or better with the help of External/ Integrated IR.
11	Video Compression (Minimum)	H.265+/, Instastream, H.265, H.264+, H.264
12	Wide Dynamic Range	WDR (120db or more), HLC and BLC
13	Digital Noise Reduction	DNR (2D/3D) On/Off
14	Streaming	Triple streaming, configurable
15	Connectivity	LAN
16	Image Setting	Rotate Mode, saturation, brightness, contrast, sharpness adjustable through client software or web browser
17	Profile Management	User configuration import, export
18	Security	User Authentication, Water Marking
19	Onboard Storage	Camera should support built in Class-10 Micro SD/SDHC/SDXC Card slot up to 256 GB.
20	Recording Management	Format SD, overwrite, storage management, video to NAS device, remote archive access via FTP login
21	Edge based Video Analytics & Alarm Trigger	Motion detection, Face detection, face image capture, Line crossing/Region/Queueing people counting, Abandoned Object /Missing Object, Heat Map, Video tampering, Scene changing, Network disconnection, IP address conflict, Illegal Access, Storage anomaly, Tripwire, Intrusion, loitering detection, parking detection, people gathering.
	Network Compatibility	
22	Network Protocol	IPv4/v6, HTTP, HTTPS, TCP, UDP, ARP, RTP, RTSP, RTCP, RTMP, SMTP, FTP, SFTP, DHCP, DNS, DDNS, QoS, UPnP, NTP, Multicast, ICMP, IGMP, NFS, PPPoE, SNMP, CGI.
23	User Access	5 User Simultaneously or more
24	System Capability	It should support ONVIF (Profile S, Profile G and Profile T). The Quoted Model Should be listed on ONVIF Official website. CCTV Camera OEM should be fulltime member of ONVIF and should not be backlisted/ suspended by ONVIF.
25	VMS & OTA	Camera should support open-source VMS and Online Device Upgrade.
26	Ethernet	1 RJ 45 10/100 Ethernet port
27	Audio In/ Out	1x Input & 1 Output port for external Mix & Speaker.
	Audio Compression	G.711a, G.711Mu, G.726, AAC, G.723
28	Alarm In/ out	Mini. 1 Input & 1 Output port for external sensors etc.
29	Power Input	Standard DC Jack

30	Power Requirement	12VDC \pm 10%, PoE (IEEE802.3 af)
31	Power Consumption	Max 10~12 W
32	Enclosure	IP67 weather proof and IK10
33	Operating Condition	-20°C to 60°C, humidity 95% (max) (non-condensing)
34	Standards	UL, CE, FCC, RoHS, BIS Certified

- **PTZ Camera**

Item. No	Description	Specifications
IP IR PTZ (Pan. Tilt and Zoom) Camera Specifications: :		
1	4MP IP IR PTZ Camera	Motorized PAN TILT ZOOM with IR
2	Image Sensor	1/2.8" 2MP or better progressive Scan CMOS
3	Signal System	PAL/NTSC
4	Resolution & frame rate	2MP @ 50/60fps
5	Minimum Illumination	0.005Lux@ F1.6, AGC ON, 0 lux with IR, or better
6	Imaging	1/1s to 1/30000s, Auto Gain Control, White Balance- Auto, Back Light Compensation, Multi zone Privacy Masking (upto 8 area), HLC.
7	Signal to Noise Ratio	55 dB or more
8	Lens Type	Focal Length: varifocal 3.95mm~177.7mm or better, Focus Adjustment: Automatic, manual
9	Zoom	45x Optical zoom and 16x Digital zoom with angle of view H: 70.3° ~ 1.8° and having Close Focus Distance of 100mm~1000mm
10	Day & Night	True Day & Night High Performance Mechanical IR cut filter with auto switch, IR Source- Inbuilt Smart IR LED's with effective distance. The camera should have IR LED's and cover distance up to 250 mtr. or above
11	Auto Tracking	The camera should be equipped with Deep-learning-based auto tracking function using simultaneously all of the panning, tilting and zooming should be available. When a motion is detected in a registered monitoring area, the camera should track the motion (object) and capture it.
12	Pre/Post Event Buffering	The camera should support at least of 5 seconds of pre & post event buffering.
13	PAN Travel	Pan: 0° ~ 360° endless; Manual Pan: 200° /s, Preset: 300° /s
14	Tilt Travel	Tilt: -20° ~ 90°, auto flip 180°, Manual Tilt: 120° /s, Preset: 200° /s
15	Presets & Privacy Masks	300 Presets and 24 Privacy Masks
16	Event Notification	Through Relays, E-Mails or FTP
17	Video Compression (Minimum)	H.265+/ Instastream, H.265, H.264+, H.264
18	Wide Dynamic Range	WDR (120db or more), HLC & BLC
19	Digital Noise Reduction	DNR (2D+3D) On/Off
20	Streaming	Triple Streaming, configurable
21	Connectivity	LAN

22	Image Setting	Rotate Mode, ROI, EIS, Defog, saturation, brightness, contrast, sharpness adjustable through client software or web browser
23	Profile Management	User configuration import, export
24	Security	User Authentication, Water Marking-
25	Onboard Storage	Camera should support built in Class-10 Micro SD/SDHC/SDXC Card slot up to 512 GB.
26	Recording Management	Format SD, overwrite, storage management, video to NAS device, remote archive access via FTP login
27	Edge based Video Analytics & Alarm Trigger	Motion detection, Human Detection, Vehicle detection, Scene Change, Audio Detection, Camera Tampering alarm, IP address conflict, Storage full, Storage error, Tripwire, Intrusion, Heat Map.
Network Compatibility		
28	Network Protocol	TCP/IP/ICMP, HTTP, HTTPS, SSL, UDP, UPnP, FTP, DHCP, DNS, DDNS, RTP, RTSP, RTCP, PPPoE, NTP, SMTP, SNMP, IGMP, 802.1X, QoS, IPv4/v6, Bonjour.
29	User Access	5 User Simultaneously or more
30	System Capability	It should support ONVIF (Profile S, Profile G and Profile T). The Quoted Model Should be listed on ONVIF Official website. The proposed CCTV OEM should not be blacklisted/ suspended by ONVIF.
31	VMS	Camera shall support open-source VMS
32	Ethernet	1RJ 45 10/100 Ethernet port
33	Power Input	Standard DC/ AC Jack
34	Power Requirement	24 VDC, 2.5 A ($\pm 25\%$) PoE+ (802.3at)
35	Power Consumption	Not to exceed 25W when IR on
36	Enclosure	IP67 weather proof and IK10.
37	Operating Condition	-20°C to 70°C, humidity 95% (max) (non-condensing)
38	Audio Support	Audio Interface : The camera should have 1/1 Audio In/Out to connect External Mic and Speaker Audio Compression : G.711a/ G.711u/ PCM
39	Alarm In/Out	Alarm In/out- 7/2 Ch In/Out
40	Standards	UL, CE, FCC, RoHS, BIS Certified

- **PTZ Joystick Controller**

SI No.	Specification	Description
JOYSTICK & KEYBOARD		
1	VMS Compatibility	The Joystick must be compatible with all distributed network video management components.
3	Design	The full-size, soft-coated hand rest positions the hand comfortably, and 15 large, soft-touch, function keys allow quick access to frequently used commands.
4	Quick View Keys	Fingertip access to 12 views makes it easier to switch cameras
5	Function Keys	Easy access to 4 application commands for an optimized workflow.

6	Display	Provides a visual reminder of function key assignments on your computer screen
7	Modifier	Fingertip access to Ctrl, Shift, Alt and Esc keys saves time by reducing the need to move your hand between mouse and Joystick
8	Numpad	Allows direct numerical input into your application using your standard mouse rather than the Joystick
9	System flexibility	The Joystick must be part of an integrated system and shall be configured so any number can be added to the system. When combined with user interfaces (UIs), network storage managers (NSM's), encoders, IP cameras, and video consoles, the Joystick forms an integral part of a complete network-based video control system
10	Joystick Interface	USB 2.0
11	Cable	USB
12	Joystick Module	Fully proportional PTZ, variable speed; with zoom, iris and focus controls
13	Operating temperature	0° to 40°C
14	Keyboard	*NVR/VMS shall also provide functionality when connected to a keyboard *The keyboard must be compatible with all distributed network video management systems. *The keyboard must support USB 2.0 protocol, and the USB must operate at full-speed

Recording Server and VMS

S. No.	Feature	Specification
1	Technical Specifications for Central Server with VMS for Surveillance Management	
	Hardware	
1	Processor	Minimum Intel i5 (6600) 64 bits 4 Core Processor or better
2	Operating System	Embedded Linux/Windows
3	Memory	Minimum 16GB or better
4	Device and Channel support	It should be scalable up to 1000 channels or better as per the Camera resolution and bandwidth and shall be extended for more channels using distribution system architecture.
5	Bandwidth per Server	It should have Bandwidth Capacity of : - Incoming B/W minimum 600 Mbps/ Server Outgoing B/W minimum 600 Mbps/ Server Playback B/W minimum 100 Mbps/ Server Storage B/W minimum 600 Mbps/ Server
6	Redundancy and server clustering.	The application shall support N + M Hot standby for redundancy and server clustering.
	Storage	

7	HDD Capacity	The system shall support at least 15 No.s or more hot pluggable SAS/SATA HDD (3.5") HDD per server for storage with minimum 8TB/ Slot and shall have storage extension over iSCSI storage link.
8	Storage capacity	Up to 200TB per server
9	RAID	It should support Single, Raid 0/1/5/6/10
Interfaces		
10	Ethernet	4 RJ-45 Ports (100/1000Mbps)
11	RS232	1 x RS232
12	RS485	1 x RS485
13	USB	4 x USB 2.0
14	Display interface	3 x HDMI, 1 x VGA
Power & Environment		
15	Power	Max power up to 315W, stable power up to 210W
16	Temperature	Working Temp. : 0°C~40°C Storage Temp. : -20°C ~ +70°C
17	Humidity	Working Humidity : 10% ~ 80% (non-condensation) Storage Humidity : 5% ~ 90% (non-condensation)
Video Management Software Specifications :-		
1	The VMS application shall support all the features & functionalities of the offered cameras.	
2	VMS should consist of Base license and Channel Licenses.	
3	Must support Resolution: 12MP, 3840*2160, 1920×1080, 1280×1024,1280×720, 1024×768	
4	Must support recording resolution up to 12MP	
5	Must support Continuous, Alarm, Motion, Instant, Panic Recording Mode	
6	When alarm recording is enabled and an event occurs, you can click the alarm icon on monitoring page to view the alert details. The snapshot function is supported on monitoring and playback page	
7	The Network Video Recorder (NVR) shall be configured to send email whenever a system message is created or an alarm event occurs. The email server shall be a valid SMTP server. Each recipient email address shall be configured to receive any combination of critical, warning, or informational messages or alarm notifications. When an alarm occurs, the email message includes the NVR/Server name, time of alarm and a list of camera that is configured to record upon alarm	
8	It should support Network Support: HTTP, TCP/IP, SMTP, DHCP, DNS, DDNS, FTP, NTP, UPnP, Multi IP Setting. Convert multiple recording files to one avi/MP4 file.	
A Performance and Reliability		
1	The application shall have the capability of proactive backup automatically/manually in the event of breakdown and capable of quick recovery.	
2	The application shall support addition of devices via auto search, IP, IP Segment, auto register (for 3G, 4G, DHCP device).	
3	The application shall be able to manage connected network devices such as network camera, NVR, DVR, etc. and modify device IP address, password, binding camera channel with alarm configurations, etc.	
4	The application shall support integration with POS machine along with binding camera and POS channel for transaction tracking.	
B Analytical feature		
1	Object Detection	Minimum 20 channels
2	Object Detection	40 per second
3	Heatmap Channel	Minimum 64 channels
4	Alarm Rules	200
5	Alarm with Picture	40 per second
6	Face Library	50

7	Total Person for Face Library	5000
8	Face Images Imported Each time	1000
9	Face Capture	120 per second
10	Face Recognition Channel	Up to 100 Channels or better
11	People Counting	Minimum 100 channels
12	ANPR Device	Up to 64 Devices or better
13	ANPR Vehicle Blocklist	100
14	ANPR Event with Picture	12 per second
C	Map functionality	
1	Hierarchy Map with Submaps	8 hierarchy Maps and 32 submaps per hierarchy
2	Map Size of Raster Map	14.7 MB
3	Spot per Map	Up to 300 (GIS & Raster)
4	The application shall have integrated with Google map or raster map application and view live video along with playback on the map.	
5	The map function in the application shall support area or length calculation for GIS.	
6	The application shall be able to display alarm indicator on the map when alarm is triggered.	
7	The map module in the application shall support at least 8-levels of submap.	
8	The map module in the application shall allow to configure hot spots for camera, alarm input, intelligent channel, etc. and sub maps on the map.	
D	User Management	
	The application shall have user management for role based user control. The user management shall include but not limited to the following:	
1	User management shall provide role based user management.	
2	Role based user management shall provide device and control permissions to specific user.	
3	Users shall be defined with specific role based permissions.	
4	User's roles shall be defined by the user's MAC address and expiry data.	
5	User's role shall support allowing or withdrawing of permissions for PTZ setting.	
6	The admin control shall have the capability to block or unblock users.	
7	User management shall have the capability to import domain users and define role as per user category.	
E	Event Management	
1	The application shall have specific module for event management. The event management module shall have specific sections to define types of alarm, alarm scheme, priority and linkage.	
2	The alarm module shall define specific alarm types based on the alarm triggered, such as device, video channel, alarm input, IVS alarm, thermal, vehicle blacklist, face arming, etc.	
3	The alarm module shall define specific template for alarm scheme based on the scheduling of alarm to be triggered, such as all day template, Weekday template, Weekend template and custom template, etc.	
4	The alarm module shall define priority of an alarm such as Low, Medium, High.	
5	The alarm module shall be able link different actions for each alarm trigger and shall initiate action such as record, snapshot, live video, alarm output, PTZ, video wall, E-mail, User, etc.	
6	The alarm module shall maintain real-time log for all types of alarm and maintain logs for history of alarm detail info, live video, record and pictures from related camera, alarm source location on the map.	
7	The alarm management module shall maintain information of alarm acknowledge and initiate corresponding action such as arming control for alarm source, forward the alarm to relevant user, etc.	
8	The alarm management module shall be flexible to allow to send alarm email to relevant person manually.	
9	The application shall be able to search alarm events with different data types such as alarm source,	

	alarm time, status, handled by user, priority, etc. and export the alarm list for analysis.
F	Storage, Backup and Restore
1	The application shall support edge and central storage.
2	The application shall have capability create recording plan by time template such as All day template, Weekday template, Weekend template and custom template, etc.
3	The application shall support backup of recorded video footage by scheduling from the edge storage such as NVR, DVR, etc.
4	The application shall have the feature of Disk Quota such as Group the disk, cameras can be allocated to different disk groups, etc.
6	The application shall have functionality of automatic backup application database in daily, weekly, monthly basis.
7	The application shall be capable of backup of application database manually.
8	The application shall have capability to restore application database from server or local file.
G	System Dashboard, Logs and Service Management
1	The application dashboard shall be user friendly and shall provide an overview of the complete application along with few detail information such as CPU usage, storage status, bandwidth consumption, etc.
2	The dashboard shall show current status information of CPU usage, storage utilization, bandwidth consumption, etc.
3	The application shall be to produce information reports of current service, connected device, users online, device health status, etc.
4	The application shall be able to generate statistical information of Events such as total events occurred and events processed, etc.
5	The application shall be able to show input source information such as video channel, alarm channel, etc.
6	The application shall be able to generate logs of all activity transactions related to the application, admin, client, etc.
7	The application shall leverage the admin user to search and export the logs for analysis and future reference.
8	The application shall allow the administrator to add or delete the slave server from the system hierarchy.
9	The application shall allow the administrator to Enable and disable slave server from the system hierarchy.
10	The application shall support secured HTTP (HTTPS) protocol to enable secured web interface.
11	The application shall allow device time calibration to sync date & time of all connected devices.
12	The application shall be capable to store all types of log data generated by the system such as setting log, alarm info, POS data, heatmap storage time, etc.
H	Live View
1	The application shall have features to displays device tree, show/hide offline device in the device list.
2	The application shall features to displays the device IP address or device name of all connected device on the device tree.
3	The application shall have the capability to view real-time video, tracking, etc.
4	The application shall support various predefined and customized display layouts/matrics to display the number of video channels simultaneously. The feature shall be ready with predefined/ common layout of video channel(s) 1, 4, 6, 8, 9, 13, 16, 20, 25, 36, 64 and customized layout.
5	The application shall be ready with PTZ control for PTZ camera operation.
6	The application shall be ready with soft control for electric focus.
7	The application shall be able to record manually to store the recording on PC or central storage.
8	The application shall be enabled with common playback functions such as capturing snapshot, instant playback, digital zoom, fisheye image/video de-warping, smart tracking function for fisheye and speed dome camera.
9	The application shall be ready with smart tracking functionality of for panoramic camera.

10	The application shall have control function for audio talk, set alarm window, quickly decode the video to video wall, etc.
11	The application shall have control function to turn on/off the audio in live view.
12	The application shall support RoI (Region of Interest) function, which shall divide one window into 4 or 6 parts, one window shall show whole image and others shall show the detail of RoI.
13	The application user interface shall have capability to display map in Live View and save the current live view setting as a view for future use.
14	The application shall support minimum 4 Live View tabs with different display layout with different video channels.
15	The application shall support add/delete channel(s) to/from favourite.
16	The application shall support video tour by device, favourite, view, etc.
17	The application shall support quickly switch to playback window from any other function window.
18	The application shall supports network keyboard/joystick to control camera on Live View.
19	The application shall support integration of POS and embed POS transaction receipt with subsequent video as overlay.
20	The application shall have provision to set different POS overlay style while integrating POS transaction to the specific video channel.
21	Adjust the video image, Adjust the display mode (full screen and original).
I	Playback
1	The application shall support replay from the front-end devices or central storage.
2	The application shall support various video filters for different playback modes such as normal, motion, alarm, Synchronous playback, Reserve playback, frame-by-frame playback, slow and fast forward up to 64X and 1/64X, etc.
3	The application shall provide option to lock or mark important record for central storage system.
4	The application shall be ready with decoding facility to decode the video and broadcast to video wall.
5	The application shall be able to de-warp video stream from fisheye camera and display the de-warped image/stream.
6	The application shall have image correction/adjustment/enhancement feature to adjust the video image, capturing snapshot, etc.
7	The application shall be flexible to switch between operational windows and quickly switch to live view from playback window.
8	The application shall be able to toggle between full screen and original and adjust different display modes.
J	Download Center
1	The application shall allow to download the recorded video from central storage or connected recording device. The downloaded file format shall be avi, dav, flv, mp4, asf.
2	The application shall allow download recorded files followed by timeline, files or tags.
3	The application shall supports multi-task download feature
K	Video Wall Control Capability
1	The application shall have integrated module for video wall which shall include but not limited to decode the real-time video to wall, Manually/automatically decode to wall, Manage the video wall split, screens combination, Change the stream type of video channel, Tour the video channel in one screen, etc.
2	The video wall module in the application shall bind the decoded channel with the corresponding screen.
3	The video wall module in the application shall have task scheduler to schedule task and indicate on the task on timeline, looping different tasks with different time duration.
4	The video wall module in the application shall support network keyboard/ joystick to control the video wall.

2. POE Network switches

The proposed Closed-Circuit Television (CCTV) network design employs a robust two-tier architecture to ensure scalability, high availability (HA), and efficient management of surveillance data. The architecture comprises Core Switches, Access Switches, and a resilient fiber-based star topology for connectivity.

I. Core Switches:

- Configuration:

- Each Core Switch with 24x10G SFP+ ports and 4x25G SFP28 ports.
- Configured in High Availability mode to provide redundancy and minimize downtime.

II. Access Switches:

- Type:

- Access Switch 1: 24x1G BaseT POE+ with 2x10G SFP+ and 2x10G Base-T uplink/stacking support & POE+.
- Access Switch 2: 8x1G BaseT POE+ with 2xSFP+ uplink.

- Configuration:

- Access Switch 1 supports Power over Ethernet Plus (POE+) for connecting and powering CCTV cameras.

Technical Specifications distribution switch of CCTV	
Physical Interfaces	24 # 1/10G Base-X SFP+ Port
	4 # 1/10G/25G SFP+ Ports
	Out of band : 1 x RJ45 10/100/1000BASE-T, Console: USB-C (front)
	Full width 1U rack mount
CPU/ Memory	1.8Ghz 64-bit
	RAM: 2 GB, Flash: 512 MB, Packet buffer memory: 32 MB
Performance	Stack height: 8 switches
	Switching fabric: 680 Gbps Line-Rate (non blocking fabric)
	Throughput: 505.92 Mpps
	Forwarding mode: Store-and-forward
	Address database size: 16,000 MAC addresses (48-bit MAC address)
	Number of VLANs: 4,093 (IEEE 802.1Q) simultaneously
	Jumbo frame support: up to 12K packet size
Mean time between failures (MTBF):778,741 hours (~88.9 years)	
L2 Services	Protocol based VLAN, IP Subnet, ARP, Subnet based VLAN, Double VLAN Tagging (QoQ)
	GARP with GVRP/GMRP
	MVR (Multicast VLAN Registration)
	Multiple Registration Protocol (MRP)
	Multicast VLAN Registration Protocol (MVRP), LAG Hashing
	Per VLAN STP (PVSTP) with Fast Uplink and Fast Backbone, Per VLAN Rapid STP (PVRSTP)
L3 Services	IGMPv2/3 Snooping Support
	IGMP Proxy
	MLD Proxy
	Multicast streams routing between subnets, VLANs

	Multicast Static Routes (IPv4, IPv6), DVMRP
	Neighbor discovery (IPv4, IPv6)
	PIM-DM (IPv4, IPv6)
	Static Routing (IPv4, IPv6)
	Port based Routing, ECMP Static Routing
	OSPF v2 and v3, RIP v1 and v2, VRRP, IPv6 Routing, DNS v4 and v6, VLAN Routing
QoS	Automatic (6to4) tunnels
	IEEE 802.1p CoS
	DiffServ QoS
	WRED (Weighted Deficit Round Robin)
	Strict Priority queue technology
	Auto-VoIP
Security	Minimum Bandwidth per-interface
	Broadcast, Multicast and Unicast Network Storm Protection
	CPU Protection
	DoS attack protection
	802.1x MAC Address Authentication Bypass (MAB), DAI
	Port MAC Locking
IEEE Network Protocols	IEEE 802.3ad Trunking (LACP)
	IEEE 802.1AB LLDP with ANSI/TIA-1057 (LLDP-MED)
	IEEE 802.1D, IEEE 802.1s, IEEE 802.1w
Management	GARP -Generic Attribute Registration Protocol
	802.1ab LLDP and LLDP-MED
	SNMP v1, v2 and v3, RMON 1, 2, 3, 9
	Command Line Interface (CLI) & Web-based graphical user interface (GUI)
	Admin access control via Radius and TACACS+, Telnet
	Non disruptive Config Management
	Remote Port Mirroring (RSPAN)
Network Traffic	Persistent log supported
	Access Control Lists (ACLs) L2 / L3 / L4
	Time-based ACLs
	ACL over VLANs
	IPv6 RA Guard Stateless Mode
	802.1x MAC Address Authentication Bypass (MAB)
LEDs	Per port: Speed, link, activity
	Power, Fan, Stack Master, Stack ID
Environmental	Operating Temperature: 32° to 122°F (0° to 50°C)
Warranty	5 years on site replacement Warranty after completion of work.

24 Port PoE+ Switch (Access switch)	
	Non Blocking architecture, EAL3/NDcPP/NDPP/TEC certification.
Architecture:	Switch should support stacking up to 8 switches or more with stacking bandwidth of 40Gb/s per switch.
	Should support internal/ external redundant PSU
	The switch should have 24 x 10/100/1000Base t ports with 2x1 G / 10 G SFP+ & 2x1G/10G Base-T ports. Min 550 Watt PoE power budget supporting IEEE 802.3at/IEEE 802.3af Should be supplied with hot swappable redundant power supply from day-1
	Should have min 4x Stacking/uplink port with min 40 Gbps stacking bandwidth from day 1.
	Should have Minimum 1GB RAM Available
	Stacking should be ready from day 1 with accessories /cables. Stacking mechanism could be achieved over a diversified location as minimum 800 Meters.
	Switch should have dedicated 1 x 10/100/1000 BaseT port for Out of band Management port.
Performance & Scalability :	Switch should have switching fabric performance of minimum 128Gbps switch fabric.
	Switch should have forwarding rate of 90 Mpps
	Switch should have 16K MAC entries table. Should have 8 Hardware QOS Queues per port ,OS should support individual process (eg.ssh, snmp, telnet, dhcp etc.) restart to prevent reboot in case of Software Process Crash by running processes on top of Kernel.
Layer 2, IP v4 & IPv6 :	Switch should have IEEE 802.1Q VLANs and trunks.
	Switch should have IEEE 802.1ak MVR, Vlan Trunking Protocol (VTP) OR equivalent for dynamic vlan creation
	Switch should have IEEE 802.1AB Link Layer Discovery Protocol LLDP
	Switch should have Routing Information Protocol Version 2 (RIPv2) and RIP from day 1 , Scalable to OSPF
	Switch should have Policy-based routing (PBR) for IPv4 and IPv6.Should have traffic rate limiting with Configurable bandwidth granularity of 8 KBps
	Switch should be upgradeable to Open Shortest Path First (OSPF) and VRRP
Network-based availability & Security Features	Switch should have Port, vlan, IPv4, IPv6, and time based Access Control Lists for both directions
	Switch should support creation of minimum 100 number of Access Control Lists on each Port, vlan, IPv4 & IPv6.

	Switch should have Ethernet OAM : IEEE 802.1ag Layer 2 Ping & trace route, Multicast trace route, Should support AVB to ensure set of standards that provide the means for highly reliable delivery of low- latency, time-synchronized AV streaming services through Layer 2 Ethernet networks, Should have SSH-2, SCP/ SFTP for secure management ,Should have MAC security – Lockdown & Limit and MAC address tracking with syslog & snmp notification, Multicast, trace route.
	Should have scheduled archiving / uploading of configuration and system log to a central server
Energy Efficiency	Switch should have variable fan speed control for the energy efficiency.
Warranty	5 years on site replacement Warranty after completion of work.

Technical Specifications 8 Port POE Switch (Access Switch)	
Physical Interfaces	8 # 1G Base-T Copper PoE+ Ports
	02 # 1G Base-T Copper Ports
	02 # 1/10G Base-X Fiber SFP+
	Console ports : Serial RS232 RJ45 (rear); USB-C (rear)
CPU/ Memory	Integrated ARM A9 1.25Ghz CPU in switching silicon (32-bit)
	RAM: 2 GB, Flash: 256 MB, Packet buffer memory: 16 Mb
POE	240W PoE Budget
Performance	Switching fabric: 60 Gbps Line-Rate (non blocking fabric)
	Throughput: 44.64 Mpps
	Address database size: 16,000 MAC addresses (48-bit MAC address)
	Number of VLANs: 4,093 (IEEE 802.1Q) simultaneously
	Mean time between failures (MTBF): 576,889 hours
L2 Services	IEEE 802.1Q VLAN Tagging
	Auto-Trunk
	Private Edge VLAN
	Private VLAN
	IEEE 802.1x
	Per VLAN STP (PVSTP) with Fast Uplink and Fast Back bone
	Per VLAN Rapid STP (PVRSTP)
L3 Services	Static Routing / ECMP Static Routing
	IPMC replication (hardware support)
	DHCP IPv4 / DHCP IPv6 Client
	DHCP IPv4 / DHCP IPv6 Server (Stateless, Stateful)
	Auto Install (DHCP options 66, 67, 150 and 55, 125)

	RIPv1 / RIPv2, Router Discovery Protocol, Policy Based Routing (PBR)
QoS	Access Lists
	DiffServ QoS
	IEEE 802.1p COS
	Single Rate Policing
	PTPv2
Security	Broadcast, Unicast, Multicast DoS Protection
	CPU Rate Limiting
	Radius accounting
	TACACS+
	Malicious Code Detection
Management	Password management
	Admin access control via Radius and TACACS+
	Industry standard CLI (IS-CLI)
	Web-based graphical user interface (GUI)
	Telnet
Network Traffic	Access Control Lists (ACLs) L2 / L3 / L4
	Time-based ACLs
	ACL over VLANs
	IPv6 RA Guard Stateless Mode
	Network Authentication Successive Tiering
	802.1x MAC Address Authentication Bypass (MAB)
Environmental	Operating Temperature: 32° to 113°F (0° to 45°C)
	Operating Humidity: 90% maximum relative humidity, non-condensing
Warranty	5 years on site replacement Warranty after completion of work.

D7.3 MINIMUM REQUIREMENT OF CCTV

S.no	Description	Floor	Dome	Bullet	16 Port Switch	12 Port Switch	8 Port Switch	Lift camera (Dome)	PTZ
1	ADMINISTRATIVE DEPARTMENT	Ground	8	2	1			2	1
2	ADMINISTRATIVE DEPARTMENT	First	7			1			
3	WILDLIFE HEALTH MANAGEMENT AND DISEASE INVESTIGATION AND SURVEILLANCE	Ground	10	2	1			2	1
4	WILDLIFE HEALTH MANAGEMENT AND DISEASE INVESTIGATION AND SURVEILLANCE	First	8			1			

5	INFORMATICS AND ANALYTICS & NETWORK AND OUTREACH UNIT	Ground	6	2		1		1	
7	INFORMATICS AND ANALYTICS & NETWORK AND OUTREACH UNIT	First	5		1		1		
8	TRAINING AND CAPACITY BUILDING	Ground	5	2		1		1	
9	TRAINING AND CAPACITY BUILDING	First	4				1		
10	MAIN ENTRANCE			4			1		1
11	AUXILLARY ENTRY/EXIT			4			1		1
	TOTAL		53	16	3	4	4	6	4

D7.4 SAMPLE

The contractor shall bring sample of materials for approval of the Engineer-in-charge. (For Equipments Model and makes shall be got approved) . Sample of approved materials must be kept at site for inspection/comparison with materials to be used in work by senior officers. All materials shall be delivered with manufactures test certificates and technical catalogues, instructions manuals, wiring diagram etc. as required.

D7.5 DRAWINGS FOR APPROVAL ON AWARD OF THE WORK

The contractor shall prepare and submit two sets of hard copy of following drawings and 2 sets in soft copy and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved drawings and agreement.

- (i) Layout drawings of the various system along with Layout of equipment's to be installed.
- (ii) SLD's
- (iii) Any other drawings relevant to the work.

D7.6 DRAWINGS AFTER COMPLETION OF WORK

The contractor shall submit Two sets of as-built drawings on white paper and 2 sets in soft copy to the owner/ Engineer-In-Charge after completion of the work. In addition, the following shall also be provided:

- a. Test Certificates
- b. Warrantee Certificates
- c. O&M Manuals of Equipments
- d. Any other information the Engineer-In-Charge may deem fit.

D-8 DATA NETWORKING SYSTEM

D8.1 SCOPE OF WORKS

Scope of this sub head covers planning, designing, supply, installation, testing and commissioning of Data Networking System. Work includes not only the items exclusively defined hereunder but also any other item required to commission and complete the work as per site requirement in this sub head or as per good Engineering practice or as required under the codes or by local/statutory authorities.

1. Rack-as per design requirement plus 20% spare space—separate for EPABX and Data Networking System.
2. POE switch as per design requirement with 20% spare capacity.
3. The indoor type and outdoor type Wifi 6 access point (with suitable mounting poles arrangement and IP 67 housing for outdoor type box for wifi unit and data points) have radios to support 2.4 Ghz and 5Ghz channels. 11ax Wave-2, 4 x 4 MU-MIMO with through put upto 6 Gbps for the following areas shall be provided :-
 - a. Inside complete area of Administrative Block, Wild Life Health Management and Disease Investigation and Surveillance Block, Informatics and Analytics & Network and Outreach Unit Block, Training and Capacity Block, Utility Block, Sub-stations and Security Building Block, Lifts, STP, substation etc. except toilets. as per drawing approved by the Engineer In-charge.
4. Jack Panel for connecting all wires
5. Cat-6A/ minimum 6F OFC cable wire in steel conduit for inside area and in DWC pipe for outside area.
6. OFC cable for connectivity from LIU upto rack required ONT, Patch cord, 1F/2FFTB, 1F/2F BIF Pig Tail, 6F BIF Cable, Splitters, Switch/ ports etc. included) as per design.
7. Splicing of all OFC
8. One no. data point along with associated wiring etc. shall be provided at each work station, at each officer/executive table and with each WIFI units in the complex.
9. One no. data point along with associated wiring etc. at each Printer location, **each** Access control unit, each automated doors (if provided), fire alarm system, EPABX room, server room, CCTV control room etc. as per drawing approved by the Engineer In charge.
10. **Necessary Data point for any other services requiring data connection in E&M Section.**

NOTE 1: Service Provider shall be providing Fiber cable upto 1st stage splitter only. All balance work is in the scope of contractor.

NOTE 2: Complete system shall be executed in close coordination with Service Provider as per their requirements.

D8.2 DATA AND WIFI NETWORK DESIGN:

I. Three-Tier Architecture

This network design is a comprehensive solution for a modern and scalable Data and WiFi network. The architecture should incorporate a three-tier design with Core, Distribution in server room, and Access layers for individual locations, providing high availability (HA) for core switches and star topology for connecting distribution switches, efficient data transfer, and cloud-managed (with free license for 5 year) WiFi-6 access points.

II. Core Switches:

- Configuration:

- Each Core Switch with 48x10G/25G SFP28 ports and 8x40G/100G QSFP28 ports.
- Configured in High Availability mode for redundancy and failover.

III. Distribution Switches:

- Distribution Switch 1: 24x10G SFP+ and 4x25G SFP28 ports.

- Configuration:

- Deployed in various buildings to serve as the aggregation layer.
- Interconnected with the Core Switches using 25G fiber links for high-speed data transfer.

IV. Access Switches:

- Access Switch 1: 24x1G BaseT POE+ with 2x10G SFP+ and 2x10G Base-T uplink POE+.
- Access Switch 2: 24x2.5G with 4x10G SFP+ uplink POE++.
- Configuration
- Access switches are connected to Distribution switches using 10G fiber links.
- Access Switch 1 supports Power over Ethernet Plus (POE+) for devices such as IP cameras.
- Access Switch 2 provides 2.5G connectivity for devices requiring higher data rates with POE++ Power.
- Uplinks to Distribution switches ensure seamless connectivity to the Core layer.

V. WiFi-6 Access Points:

- Deployed with 1G/2.5G Ethernet ports for flexible connectivity.

- Configuration:

- Managed via cloud for centralized control and monitoring.
- Multiple SSIDs configured to support different user groups or services.
- Connected to Access switches using 1G and 2.5G copper links based on the required data rates.

VI. Connectivity:

- Topology:

- Star Topology: Core to Distribution connected with 25G fiber links; Distribution to Access connected with 10G fiber links; Access to WiFi-6 Access Points connected with 1G/2.5G copper links.

VII. Security Considerations:

- VLAN Segmentation:
- Implement VLANs to segregate traffic for enhanced security.
- Separate VLANs for data, management, and guest WiFi networks.

VIII. IX. Management and Monitoring:

- Cloud Management:

- WiFi-6 Access Points managed via the cloud for centralized control.
- Monitoring tools utilized for real-time visibility and proactive issue resolution.

D8.3 SPECIFICATIONS

Technical Specifications Core Switch Data/WiFi Network -	
Physical Interfaces	48 # 1G/10G/25G Base-X Fiber SFP28 Ports (Dedicated) on day 1
	8 # 40G/100GBASE-X Fiber QSFP28 Ports (Dedicated) on day 1
	Ethernet: Out-of-band 1G port (Front)
	Console: RJ45 RS232 (Front)
	Modular 2 bays 2 PSU on day 1
	Six modular fan trays with fans pre-installed
CPU/ Memory	CPU: x86 Intel Atom® Processor C3558
	RAM: 8GB DDR3/ ECC, Code storage (flash) : 128 GB SSD
	Packet buffer memory: 256 MB
Performance	Switching fabric: 4 Tbps (non blocking fabric), Throughput: 2 Bpps
	Forwarding mode: Store-and-forward
	Address database size:32K MAC addresses (48-bit MAC address)
	Number of VLANs: 4,093 (IEEE 802.1Q) simultaneously
	Number of Link Aggregation Groups (MLAG) : 63 groups with up to 32 ports per MLAG

	Number of hardware queues for QoS: 8 (Standalone)
	Number of routes: 32K IPv4 Unicast routes
	Number of routes: 24K IPv6 Unicast routes
	Jumbo frame support: up to 9K packet size
L2 Services	IEEE 802.1Q Tagged Based VLAN
	Port-Based VLAN, Private VLAN
	Link Aggregation (802.3ad with LACP : total : 64, EtherChannel Total : 64 , Maximum member per group : 32
	IGMP Snooping v1/v2/v3, Unicast / Multicast traffic Balance over Trunking port
	Enhanced IGMP Plus for plug & play L2 Multicast between Core & Distribution switches
	Loop Protection, Port backup, QinQ, IP Subnet, MLD Snooping v1/v2
L3 Services	Source Specific Multicast (SSM)
	Multicast streams routing between subnets, VLANs, Multicast Static Routes
	Static Routing (IPv4, IPv6)
	ECMP support
	BGP4
	PIM-SSM, PIM-SM, VRRP v2 and v3, Policy based routing, OSPF v2 and v3
	VLAN Routing
	Tunnel interfaces
	IP Source Guard
	Proxy ARP
	Multinetting
	IPv6 Routing
QoS	Number of priority queues : 8 queues/port
	WRR Priority scheduling
	Strict Priority scheduling
	802.1p based COS
Security	Static/Dynamic Port Security (MAC-based)
	Broadcast, Multicast and Unicast Network Storm Protection
	TACACS+
	MAC, IPv4, IPv6, TCP, UDP, ACL
	IEEE 802.1x Radius Port Access Authentication
	802.1x MAC Address Authentication Bypass (MAB)
	Dynamic ARP Inspection
IEEE Network Protocols	IEEE 802.3ad Trunking (LACP)
	IEEE 802.1AB LLDP with ANSI/TIA-1057 (LLDP-MED)
	IEEE 802.1s, IEEE 802.1w
	IEEE 802.1p Quality of Service
	IEEE 802.1Q VLAN tagging
	IEEE 802.1X Radius Network Access Control, IEEE 802.3x flow control
Management	Industry standard CLI
	Software Download/Upload : TFTP/FTP/SCP/SFTP
	Configuration Download/Upload : TFTP/FTP/SCP/SFTP
	SNMP v1/v2c/v3
	RMON I (1,2,3,9 group)
	In-Service Software Upgrade (ISSU)

Network Traffic	Access Control Lists (ACLs) L2 / L3 / L4, MAC ACL
	IPv6 RA Guard Stateless Mode
	802.1x MAC Address Authentication Bypass (MAB)
Environmental	Operating Temperature: 32° to 122°F (0° to 50°C)
	Operating Humidity: 90% maximum relative humidity, non-condensing
Certifications and Safety	CE: EN 55032:2012+AC:2013/CISPR 32:2012, EN 61000-3-2:2014,
	Class A, EN 61000-3-3:2013, EN 55024:2010
	VCCI : VCCI-CISPR 32:2016, Class A
	BSMI: CNS 13438 Class A, BSMI: CNS 14336-1
Warranty	5 years on site replacement Warranty after completion of work.

Technical Specifications Distribution Switch-Data & WiFi	
Physical Interfaces	24 # 1/10G Base-X SFP+ Port
	4 # 1/10G/25G SFP+ Ports
	Out of band : 1 x RJ45 10/100/1000BASE-T, Console: USB-C (front)
	Full width 1U rack mount
CPU/ Memory	1.8Ghz 64-bit
	RAM: 2 GB, Flash: 512 MB, Packet buffer memory: 32 MB
Performance	Stack height: 8 switches
	Switching fabric: 680 Gbps Line-Rate (non blocking fabric)
	Throughput: 505.92 Mpps
	Forwarding mode: Store-and-forward
	Address database size: 16,000 MAC addresses (48-bit MAC address)
	Number of VLANs: 4,093 (IEEE 802.1Q) simultaneously
	Jumbo frame support: up to 12K packet size
	Mean time between failures (MTBF):778,741 hours (~88.9 years)
L2 Services	Protocol based VLAN, IP Subnet, ARP, Subnet based VLAN, Double VLAN Tagging (QoQ)
	GARP with GVRP/GMRP
	MVR (Multicast VLAN Registration)
	Multiple Registration Protocol (MRP)
	Multicast VLAN Registration Protocol (MVRP), LAG Hashing
	Per VLAN STP (PVSTP) with FastUplink and FastBackbone, Per VLAN Rapid STP (PVRSTP)
L3 Services	IGMPv2/3 Snooping Support
	IGMP Proxy
	MLD Proxy
	Multicast streams routing between subnets, VLANs
	Multicast Static Routes (IPv4, IPv6), DVMRP
	Neighbour discovery (IPv4, IPv6)
	PIM-DM (IPv4, IPv6)
	Static Routing (IPv4, IPv6)
	Port based Routing, ECMP Static Routing
	OSPF v2 and v3, RIP v1 and v2, VRRP, IPv6 Routing, DNS v4 and v6, VLAN Routing
QoS	Automatic (6to4) tunnels

	IEEE 802.1p CoS
	DiffServ QoS
	WRED (Weighted Deficit Round Robin)
	Strict Priority queue technology
	Auto-VoIP
Security	Minimum Bandwidth per-interface
	Broadcast, Multicast and Unicast Network Storm Protection
	CPU Protection
	DoS attack protection
	802.1x MAC Address Authentication Bypass (MAB), DAI
	Port MAC Locking
IEEE Network Protocols	IEEE 802.3ad Trunking (LACP)
	IEEE 802.1AB LLDP with ANSI/TIA-1057 (LLDP-MED)
	IEEE 802.1D, IEEE 802.1s, IEEE 802.1w
Management	GARP -Generic Attribute Registration Protocol
	802.1ab LLDP and LLDP-MED
	SNMP v1, v2 and v3, RMON 1, 2, 3, 9
	Command Line Interface (CLI) & Web-based graphical user interface (GUI)
	Admin access control via Radius and TACACS+, Telnet
	Non disruptive Config Management
	Remote Port Mirroring (RSPAN)
Network Traffic	Persistent log supported
	Access Control Lists (ACLs) L2 / L3 / L4
	Time-based ACLs
	ACL over VLANs
	IPv6 RA Guard Stateless Mode
	802.1x MAC Address Authentication Bypass (MAB)
LEDs	Per port: Speed, link, activity
	Power, Fan, Stack Master, Stack ID
Environmental	Operating Temperature: 32° to 122°F (0° to 50°C)
Warranty	5 years on site replacement Warranty after completion of work.

24 Port PoE+ Switch (Access switch)	
	Non Blocking architecture, EAL3/NDcPP/NDPP/TEC certification.
Architecture:	Switch should support stacking up to 8 switches or more with stacking bandwidth of 40Gb/s per switch.
	Should support internal/ external redundant PSU
	The switch should have 24 x 10/100/1000Base t ports with 2x1 G / 10 G SFP+ & 2x1G/10G Base-T ports. Min 550 Watt PoE power budget supporting IEEE 802.3at/IEEE 802.3af Should be supplied with hot swappable redundant power supply from day-1
	Should have min 4x Stacking/uplink port with min 40

	Gbps stacking bandwidth from day 1.
	Should have Minimum 1GB RAM Available
	Stacking should be ready from day 1 with accessories /cables. Stacking mechanism could be achieved over a diversified location as minimum 800 Meters.
	Switch should have dedicated 1 x 10/100/1000 BaseT port for Out of band Management port.
Performance & Scalability :	Switch should have switching fabric performance of minimum 128Gbps switch fabric.
	Switch should have forwarding rate of 90 Mpps
	Switch should have 16K MAC entries table. Should have 8 Hardware QOS Queues per port, OS should support individual process (eg. ssh, snmp, telnet, dhcp etc.) restart to prevent reboot in case of Software Process Crash by running processes on top of Kernel.
Layer 2, IP v4 & IPv6 :	Switch should have IEEE 802.1Q VLANs and trunks.
	Switch should have IEEE 802.1ak MVR, Vlan Trunking Protocol (VTP) OR equivalent for dynamic vlan creation
	Switch should have IEEE 802.1AB Link Layer Discovery Protocol LLDP
	Switch should have Routing Information Protocol Version 2 (RIPv2) and RIP from day 1, Scalable to OSPF
	Switch should have Policy-based routing (PBR) for IPv4 and IPv6. Should have traffic rate limiting with Configurable bandwidth granularity of 8 Kbps
	Switch should be upgradeable to Open Shortest Path First (OSPF) and VRRP
Network-based availability & Security Features	Switch should have Port, vlan, IPv4, IPv6, and time based Access Control Lists for both directions
	Switch should support creation of minimum 100 number of Access Control Lists on each Port, vlan, IPv4 & IPv6.
	Switch should have Ethernet OAM : IEEE 802.1ag Layer 2 Ping & trace route, Multicast trace route, Should support AVB to ensure set of standards that provide the means for highly reliable delivery of low- latency, time-synchronized AV streaming services through Layer 2 Ethernet networks, Should have SSH-2, SCP/ SFTP for secure management ,Should have MAC security – Lockdown & Limit and MAC address tracking with syslog & snmp notification, Multicast, trace route.
	Should have scheduled archiving / uploading of
	configuration and system log to a central server
Energy Efficiency	Switch should have variable fan speed control for the energy efficiency.
Warranty	5 years on site replacement Warranty after completion of work.

Technical Specifications 8 Port POE Switch (Access Switch)	
Physical Interfaces	8 # 1G Base-T Copper PoE+ Ports
	02 # 1G Base-T Copper Ports

	02 # 1/10G Base-X Fiber SFP+
	Console ports : Serial RS232 RJ45 (rear); USB-C (rear)
CPU/ Memory	Integrated ARM A9 1.25Ghz CPU in switching silicon (32-bit)
	RAM: 2 GB, Flash: 256 MB, Packet buffer memory: 16 Mb
POE	240W PoE Budget
Performance	Switching fabric: 60 Gbps Line-Rate (non blocking fabric)
	Throughput: 44.64 Mpps
	Address database size: 16,000 MAC addresses (48-bit MAC address)
	Number of VLANs: 4,093 (IEEE 802.1Q) simultaneously
	Mean time between failures (MTBF): 576,889 hours
L2 Services	IEEE 802.1Q VLAN Tagging
	Auto-Trunk
	Private Edge VLAN
	Private VLAN
	IEEE 802.1x
	Per VLAN STP (PVSTP) with FastUplink and FastBackbone
	Per VLAN Rapid STP (PVRSTP)
L3 Services	Static Routing / ECMP Static Routing
	IPMC replication (hardware support)
	DHCP IPv4 / DHCP IPv6 Client
	DHCP IPv4 / DHCP IPv6 Server (Stateless, Stateful)
	Auto Install (DHCP options 66, 67, 150 and 55, 125)
	RIPv1 / RIPv2, Router Discovery Protocol, Policy Based Routing (PBR)
QoS	Access Lists
	DiffServ QoS
	IEEE 802.1p COS
	Single Rate Policing
	PTPv2
Security	Broadcast, Unicast, Multicast DoS Protection
	CPU Rate Limiting
	Radius accounting
	TACACS+
	Malicious Code Detection
Management	Password management
	Admin access control via Radius and TACACS+
	Industry standard CLI (IS-CLI)
	Web-based graphical user interface (GUI)
	Telnet
Network Traffic	Access Control Lists (ACLs) L2 / L3 / L4
	Time-based ACLs

	ACL over VLANs
	IPv6 RA Guard Stateless Mode
	Network Authentication Successive Tiering
	802.1x MAC Address Authentication Bypass (MAB)
Environmental	Operating Temperature: 32° to 113°F (0° to 45°C)
	Operating Humidity: 90% maximum relative humidity, non-condensing
Warranty	5 years on site replacement Warranty after completion of work.

Specifications Multigig POE++ (Access Switch for WIFI)	
Physical Interface	24 Port of 1G/2.5G Ethernet RJ-45 Copper ports (100M/1G/2.5G)
	4 Port of 10G SFP+ (fiber) ports (1G/10G) - 1000BASE-X
	Should have Internal Power Supply
Memory/performance	Should Have Minimum 1GB RAM, 64 MB SPI Flash
	Should have 200 Gbps of Bandwidth (non-blocking, full duplex)
	32K MAC Address database size (48-bit MAC addresses)
	512 Multicast groups
	Should support 256 Number of VLANs
	Should Have 100 shared for MAC, IP and IPv6 ACLs (ingress) Access Control Lists (ACLs)
	Minimum 10K Jumbo frame support
	Mean Time Between Failures (MTBF) @ 25° C : 1,017,939 hrs (116.12 yrs)
POE	Number of PoE (802.3af) / PoE+ (802.3at) / PoE++ (802.3bt) ports must be 24
	Must have at least 720 Watt Total PoE power budget with Uninterrupted PoE features & Advanced per-port PoE scheduling/timers
L2/L3 Services/management	IEEE 802.1Q VLAN tagging, IEEE 802.3x (full duplex and flow control), IEEE 802.3ad - LAGs (LACP)
	Should Have STP/RSTP/MSTP
	IGMP snooping (v1, v2 and v3)
	MLD snooping support (v1 and v2)
	Multicast groups
	Multicast VLAN Registration (MVR)
	DHCP snooping
	DHCP Server, DHCP IPv6 Server
	DHCP Relay, DHCP IPv6 Relay
	IEEE 802.3ad - LAGs (LACP)
	IPv4/v6 static routing, VLAN routing
	Host ARP table (number of entries)
	ICMP Router Discovery Protocol (IRDP)
	Number of IP VLAN interfaces (routed VLANs)
	Should have features: Guest VLAN, Dynamic ARP inspection, IEEE 802.1x, IEEE 802.1p COS, IPv4 and v6 DSCP
	Dual software (firmware) image

	Syslog (Server)
Environmental	Operating Temperature: 0° to 50°C (32° to 122°F)
	Humidity: 95% maximum relative humidity (RH), non-condensing
	Storage Temperature: -20° to 70°C (-4° to 158°F)

8-Port Multi-Gigabit/10G Ethernet (Access Switch for WiFi)	
Physical Interfaces	4 x 1G/2.5G ports and 4 x multi-gig/10G ports
	2 dedicated 10G SFP+ fiber uplink ports
	Ultra60 PoE++ (60W/port) Ports (PoE Budget 295W)
CPU/Memory/Performance	1GHz dual core
	256MB RAM
	64MB SPI FLASH
	32K Max MAC
	256 VLANs
	ACL - 100 shared (ingress)
	Fabric - 140 Gbps
	Latency (64-Byte Packet) - 2.5G Copper: <5.903µsec 10G Copper: <2.420µsec 10G Fiber: < 1.257µsec
	Multicast IGMP Group - 256
	Number of DHCP snooping bindings -256
	Jumbo frame - 10 KB
	IEEE 802.3x (full duplex and flow control)
	IEEE 802.1D Spanning Tree Protocol
	IEEE 802.1w Rapid Spanning Tree Protocol
	IEEE 802.1s Multiple Spanning Tree Protocol
	IGMP snooping (v1, v2 and v3)
	MLD snooping support (v1 and v2)
	IGMP snooping querier
	Multicast groups
	DHCP client
	DHCP snooping
Features/QOS/Security	Broadcast, multicast, unknown unicast storm control
	DoS attacks prevention
	Port-based rate limiting
	DiffServ QoS
	IEEE 802.1p COS
	IPv4 and v6 DSCP
	Weighted Round Robin (WRR)
	Strict priority queue technology
	Admin access control via RADIUS and TACACS+
	IPv6 management
	SNMP v1/v2c/v3
	Advanced per-port PoE controls (enable/disable/power limit)

	IEEE 802.3x (full duplex and flow control)
	IEEE 802.1D Spanning Tree Protocol
	IEEE 802.1w Rapid Spanning Tree Protocol
	IEEE 802.1s Multiple Spanning Tree Protocol
	IGMP snooping (v1, v2 and v3)
	MLD snooping support (v1 and v2)
	IGMP snooping querier
	Multicast groups
	DHCP client
	DHCP snooping
	Number of DHCP snooping bindings
	IEEE 802.3ad - LAGs (LACP)
	IEEE 802.1x
	HTTP/TLS Web-based access (version)
	Dual software (firmware) image
	Syslog (Server)
	Port mirroring
	Cable test utility
	Auto-VoIP VLAN / Auto-Voice VLAN
	Zero-touch provisioning
Environmental	Operating Temperature -0° to 50°C (32° to 122°F)
	Humidity 95% maximum relative humidity (RH), non-condensing
	Storage Temperature -20° to 70°C (-4° to 158°F)
Warranty and Support	5 years on site replacement Warranty after completion of work.

Technical Specifications Indoor Access Point	
Physical Interfaces	1x 100/1000/2.5GBASE-T Gigabit Ethernet (RJ-45) ports with Auto Uplink, (Auto MDI-X) supporting IEEE 802.3af or 802.3at Power over Ethernet (PoE)
	Min. Internal 2.86/4.41/4.98 dBi (2.4GHz/5GHz L/5GHz H)
	Power and Cloud connection; LAN speed; 2.4GHz status; 5.0GHz status
	provision for power adapter : 12V DC, 3.5A
Standards	IEEE 802.11AX, IEEE 802.11ac, IEEE 802.11n
	5GHz H: 2400Mbps, 5GHz L: 2400Mbps; 2.4GHz: 1200Mbps
	WMM - Wireless Multimedia Prioritization
	WDS- Wireless Distribution System
	Min. Power over Ethernet (PoE++) 802.3bt required.
Security	Wi-Fi Protected Access (WPA3)
	Wired Equivalent Privacy (WEP) 64-bit, 128-bit, and 156-bit encryption
	Wireless access control to identify authorized wireless network devices
	MAC address filtering with access control
	Basic Service Set Colouring (BSS Colouring)
	Security Socket Layer (SSL) remote management login
Network Management	Remote configuration and management through Web browser, SNMP or Telnet

	SNMP management supports SNMP
Manageability	As standalone & remote/Cloud Manageable.
Advanced Wireless Features	Wireless Distribution System (WDS)
	Wireless backhaul to form Mesh Network
	Bridge mode: Point-to-multipoint wireless WDS mode
	Adjustable Transmit Power Control (TPC) Device detection
	AirQual feature enables spectrum analysis and interference identification
Other Specifications	PoE power consumption should not be more than 32 Watts
	OFDM and OFDMA both should be available
	AX6000 (6Gbps) throughput
	Target Wake Time (TWT)
	Block SSID Broadcast
	Ceiling mounting/ Wall mounting
	Bidir and MU-MIMO
	Deployment Options: Standalone, Mobile App
Warranty and Support	5 years on site replacement Warranty after completion of work.

Technical Specifications Outdoor Access Point	
Physical Interfaces	One 100/1000/2.5GBASE-T Gigabit Ethernet (RJ-45) ports with Auto Uplink, (Auto MDI-X) supporting IEEE 802.3af or 802.3at Power over Ethernet (PoE)
	Internal 3.6/4.4dBi (2.4GHz/5GHz)
	Power and Cloud connection; LAN speed; 2.4GHz status; 5.0GHz status
	Powered by PoE Only
Standards	IEEE 802.11AX, IEEE 802.11ac, IEEE 802.11n
	5GHz: 1200Mbps; 2.4GHz: 600Mbps
	WMM - Wireless Multimedia Prioritization
	WDS- Wireless Distribution System
	Power over Ethernet (PoE) IEEE 802.3af/802.3at
Security	Wi-Fi Protected Access (WPA3)
	Wired Equivalent Privacy (WEP) 64-bit, 128-bit, and 156-bit encryption
	Wireless access control to identify authorized wireless network devices
	MAC address filtering with access control
	Basic Service Set Colouring (BSS Colouring)
	Security Socket Layer (SSL) remote management login
Network Management	Remote configuration and management through Web browser, SNMP or Telnet
	For setup, monitoring and management through Standalone, Software\ Cloud based controller and Mobile App
Manageability	As standalone & remote/Cloud manageable.
Advanced Wireless Features	Wireless Distribution System (WDS)
	Wireless backhaul to form Mesh Network

	Bridge mode: Point-to-multipoint wireless WDS mode
	Adjustable Transmit Power Control (TPC)
	Device detection
Other Specifications	PoE power consumption should not be more than 16.1W Watts
	Band steering
	AX1800 1.8Gbps or better
	Target Wake Time (TWT)
	Block SSID Broadcast
	Ceiling mounting/ Wall mounting/ Pole mounting
	Bidir and MU-MIMO
Operating temperature	10° to 50°C (10° to 122°F) (no solar radiation)
Outdoor Use	IP55 rating for water and dust resistance, long sun exposure, snow, hail, frost, etc.
Warranty and Support	5 years on site replacement Warranty after completion of work.

D8.4 CERTIFICATION

- (i) UL/ BIS, ROHS, CE, FCC, VCCI certified.
- (ii) All the switches, Access Points and the fiber modules (MSA compliant) should be from the same OEM. The OS for all the switches should be on the same OEM platform.
- (iii) The OEM should have R&D center in India. The OEM should have at least 2 RMA depot in India and should have India Toll free number with India TAC center - reflected on the official website.

D8.5 DESIGNANDEXECUTION:

- a. For data networking system shall be designed for networking bandwidth of minimum 40 Gigabits per second between core and distribution and networking bandwidth of minimum 10 Gigabits per second between access switch and core switch. All components shall be suitably selected to meet this requirement.
- b. Complete design and solution with heat mapping for WiFi system shall be prepared and executed by professional in the field. The work shall be executed by trained/competent personnel with due care and as per best practice in industry.

D8.6 SAMPLES

A list of items of materials and equipment, together with a sample of each shall be submitted to the Engineer – in – charge after award of the Contract.

Samples and drawings of equipment shall not be departed from without the written instructions of the Engineer – in – charge. Approvals given by the Engineer – in – charge to any samples or drawings submitted by the Contractor shall not in any way exonerate the Contractor from his liability to carry out the work in accordance with the terms of the contract.

D8.7 DRAWINGS FOR APPROVAL ON AWARD OF THE WORK

The contractor shall prepare and submit two sets of hard copy of following drawings and 2 sets in soft copy and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved drawings and agreement.

- (i) Layout drawings of the system along with Layout of equipment's to be installed.
- (ii) SLD's
- (iii) Any other drawings relevant to the work.

D8.8 DRAWINGS AFTER COMPLETION OF WORK

The contractor shall submit Two sets of as-built drawings on white paper and 2 sets in soft copy to the owner/ Engineer-In-Charge after completion of the work. In addition, following shall also be provided:

- (i) Test Certificates
- (ii) Warrantee Certificates
- (iii) O&M Manuals of Equipments
- (iv) Any other information the Engineer-In-Charge may deem fit.

D-9: LIFTS

D9.1 SCOPE OF WORK:

Scope of this sub head covers planning as per traffic analysis, designing, supply, installation, testing and commissioning of passenger lifts in each block in accordance with NBC 2016 and CPWD General Specification Part-III (Lifts & Escalators) 2003 as amended upto date and the requirement of local bye laws. Work includes not only the items exclusively defined hereunder but also any other item required to commission and complete the work as per site requirement in this sub head or as per good engineering practice or as required under the codes or by local/statutory authorities.

1. Six nos. 13 passenger lift , VVVF, Gearless, regenerative, ARD, 1.0 m/sec speed, center opening doors of height 2.4mtr, MRL (Machine Room less) lift serving (Ground + 1st floor) with SS doors and cabins, having disable friendly features, 25mmthick Granite Flooring.
2. Required civil work such as beams, all structural steel fascia work, wood work, emergency windows and trap door, plastering work of shaft, pit depth etc.
3. Required electrical works such as fascia strip lighting, shaft lighting, earthing etc.
4. All electric motors shall be Super ECSBC compliant (Super ECSBC norms of ECSBC 2024 as amended upto date).
5. **The AMC of all lifts for 5 years including replacement of all defective parts is also scope of work. The main contractor shall enter in MoU with OEM for carrying out AMC of Lift and shall submit to Engineer-in-charge.**

D9.2 SPECIFICATIONS AND DESIGN CONCEPT:

1. All the works shall be carried out as per CPWD General specification for Electrical Works, Part-I(Internal-2023); Part-II (External-2023) and Part-III (Lifts& Escalators)-2003, amended up to date and should also comply with relevant provisions of the Indian Electricity Rules and Acts, BIS for Lifts and Escalators as applicable, amended up to date.

TECHNICALPARAMETERSCOMMONFORALLLIFTS

S. NO.	TECHNICALPARAMETERS	REQUIREMENTS
1	(a) Inside size of lift well	As per relevant IS/NBC2016
	(b)Pit Depth	As per relevant IS/NBC2016
	(c)Head room	As per relevant IS/NBC2016
2	Position of counter weight	At the back of the car
3	Position of machine room	Over hoist way/ at the top of lift shaft
4	(a) Type of control	Microprocessor based AC VVVF, Gearless, Regenerative type
	(b) Type of operation	Microprocessor based duplex selective collective with/ without attendant in a group of two lifts installed adjacently
	(b) Potential free Contacts for IBMS	Potential free contacts for each floor position up and down movement of the lift shall be provided in the controller which can be used for the building Management system.
	(d) Type of ropes	Belt type with anti-rust coating
5	Car entrance door	

S. NO.	TECHNICALPARAMETERS	REQUIREMENTS
	(a) Number	1No. (Centre Opening)
	(b) size	As per relevant IS/NBC2016
	(c) type of doors	Stainless Steel Framed full glass door
	(d) Car opening	In Front only, All opening on same side
6	Construction design and finish of car body work.	<p>1. Car shall be complete having stainless steel scratch proof surface Hairline finish cabin and doors having metal effect finish, 25 mm thick Granite flooring and toe guard of adequate depth.</p> <p>2. The car shall be with pleasing false ceiling, minimum required nos. LED fittings & cabin fans/ noise free ventilation fan. (The fans should be auto switch off when there is no passenger inside the lift car.)</p> <p>3. Stainless steel handrail on three sides not less than</p>
		<p>600mm long at a height suitable for physically challenged persons but should not be at a height more than 900mm.</p> <p>4. Automatic cum manual flush mounted luminous braille button suitable for barrier free environment for physically challenged persons</p> <p>5. Looking mirror of full width and 1 m height on front side.</p> <p>6. The type of metal finish of stainless steel shall be decided by engineer in charge amongst the standard designs of OEM.</p> <p>7. Color and finish of Granite shall be pleasing and matching with surroundings.</p> <p>8. Emergency power supply: Required for Lighting and fans in the car having battery backup of 30 minute.</p>
7	Type of signal system	<p>a) Digital floor position indicator, 4.5” TFT screen, in the car and at all landings (May be integrated in car operating panel/ Hall call button)</p> <p>b) Travel direction indicator in the car and at all landings.</p> <p>c) Gongs / car chime & Visual indication through directional arrows on all landings for pre arrival of the car at all floors.</p> <p>d) Overload warning Audio & Visual indicator, inside the car (lift should not start on overload)</p> <p>e) Battery operated alarm bell and emergency light duly fed by suitable inverter SMF batteries with 30 minutes backup.</p> <p>f) Car operating panel, luminous buttons in car intercom with Braille (3way-at car, lobby and controller)</p>

S. NO.	TECHNICAL PARAMETERS	REQUIREMENTS
8	Landing entrance a) Location of landing entrance in Different floors b) size c) type of doors d) lift in use/lift out of order sign	g) Luminous hall buttons at all landings. Landing call registered indicator at all floors.
		h) Fireman's switch at ground floor
		i) Voice annunciation system. This will announce the position of the car landing.
		j) Emergency stop switch
		k) Braille button in car.
9	Electric supply	All doors on the same side (Power Operated)
		As per relevant IS/NBC 2016
10	Protection	Landing door stainless steel scratch proof surface Hairline finish with Architectural finish 2 hr. fire rating
		A suitable box above the lift landings with LED illuminated bilingual (in English & Hindi) sign of "LIFT OUT OF ORDER" coming up simultaneously at all floors.
11	Automatic Rescue Device	a) Power: 415 V, AC, 3 phase, 50 Hz, 4 wire system. b) Lighting; 230 V, AC, 50 Hz
		1. Protection against (i) overload voltage (ii) under voltage (iii) single phasing 2. Full height infrared curtain door protection. 3. Door time protection 4. Parking Key switch 5. All other standard safety features as per CPWD specs
12	Manual Switch	Provisions of Automatic Rescue Device for the purpose of bringing the lift car to the nearest floor should be provided, one for each individual lift. This shall consist of: 1. Control panel necessary interface/ integration of device with the main controller. 2. Inverter of required capacity. 3. Maintenance free batteries of required Ampere- hours capacity. 4. Battery charging unit. 5. "Rescue Operation on" indicator in the lift car.
		Shall be provided in controller located in top floor nearer to landing door to operate the lift manually.
		Full height infra light curtain door safety in addition To pressure operated switch.
		Summer-39°C, RH-25% Winter-16°C, RH-80%
		Required for all Lifts at ground floor.
13	Door close safety	Conforming to IS:14665
14	Environmental condition at site of installation	Full duplex collective selective operation. All floors (except lower most basement) shall have Up and down key.
15	Fireman switch	
16	Dimensions of car platform	
17	Operating System	

S. NO.	TECHNICALPARAMETERS	REQUIREMENTS
18	Car Fittings	Overload Device, Emergency Car Light Unit, Emergency Alarm Button, Door Open/Close Button, Manual Rescue Operation, Belt Inspection Drive.
19	Intercom system	Intercom system should be in each lift for communication between passengers and any other telephone in the complex. The intercom with lift to be considered as extension of intercom system in the complex.
20	CCTV camera	2 MP IP based CCTV camera in each car along with required travelling cable etc. IP socket shall be made available at required location by agency dealing with Sub head of Data networking and integration of camera with CCTV system shall be done by agency Dealing with Subhead of CCTV system.

SPECIFIC TECHNICAL PARTICULARS FOR 13 PASSENGER LIFTS

S. NO.	Technical parameters	Requirements
1	Type of Lift	Passenger lift
2	Numbers of lifts required	06 (Six) Nos.
3	Load: Number of persons	13passenger (884Kg.)
4	Rated Speed	1.0MPS
5	No of stops	2 Nos: Ground+ 1 st floor
6	Type of doors	Center Opening Minimum 900mm Wide

TECHNICAL DATA TO BE FURNISHED IN METRIC SYSTEM UNLESS TECHNICAL OTHERWISE SPECIFIED, FOR EACH TYPE OF LIFT IN NIT)

S.NO	Particulars Of Details	Details To Be Provided As Per Firm's Proposal	Remarks
A	General:		
	1.Name of Manufacturer.		
	2.CountryofManufacture.		
	3.Capacities (Persons/Weight).		
	4. Service		
	5. Speed of Travel		
	6. Height of Travel.		
	7. No. of Floors served.		
	8. No. of openings.		
	9. Position of counter weight.		
	10. Type of Levelling method.		
B	Machine:		
	1.Type of Motor		
	2.CapacityofMotor		
	3.Make.		
	4.WhetherconfirmtoBIS		
	5.Classof Insulation		
	6.Voltage Tolerance		
	7.General/Geared		
	8.RPM		
C	Rope		
	1.Sizewith No. of Strands.		
	2.Make		
	3.Whether confirm to BIS		
	4.FactoryofSafetyas perIS:4666		
D.	Door Opening Motor		
	1.CapacityofMotor		
	2.MakeofMotor		
	3.WhetherconfirmtoBIS		
E.	Counterweight		
	1.PositionofWeights		
	2.Weights (Kgs.)		
F.	Travelling Cable		
	1.Size		
	2.Make		

G.	Automatic Rescue Device		
	1.Make		
	2.No. of Batteries & Capacity in (Amp/Hr.)		
	3. No. operation per hour.		
H.	Car and Doors:		
	1.Clear inside size of the Car.		
	2.Thickness of Stainless steel sheet.		
	3.Outside dimensions of car.		
	4.Construction of car		
	5.Design type of enclosure of car.		
	6.Details of flooring		
	7.Attachment and fitting inside		
	8.Car Doors:		
	(a)Size		
	(b) Operation		
	(c)Construction, Design & finish		
I.	Safety Devices:		
	1.Car safety-type		
	2.Counter weight safety-type		
	3.Door inter locks in car-type		
	4.Door locks in landing-type.		
J.	Other Safeties included in the offer:		

9. DRAWINGS FOR APPROVAL ON AWARD OF THE WORK

The contractor shall prepare and submit three sets of hard copy of following drawings and 2sets in soft copy and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved drawings and agreement.

- (i) Layout drawings of Lifts indicating all Architectural dimensions, Structural requirements and electrical works.
- (ii) Layout of equipment's to be installed including power and control cables, and supports/ structure.
- (iii) Earthing
- (iv) GAD of Lift Machines and Electrical supply
- (v) Any other drawings relevant to the work.
- (vi) DATA SHEET of lifts

10. DRAWINGS AFTER COMPLETION OF WORK

The contractor shall submit Three sets of As-built drawings on white paper and 2 sets in soft copy to the owner/ Engineer-In-Charge after completion of the work. In addition, following shall also be provided:

- (i) Test Certificates
- (ii) Warrantee Certificates
- (iii) O&M Manuals of Equipments
- (iv) Any other information the Engineer-In-Charge may deem fit.

D10 - SEWAGE TREATMENT PLANT, ETP PLANT, PUMPS FOR WATER SUPPLY AND DRAINAGE

D10A.1 SCOPE OF WORK :

Scope of this sub head covers planning, designing, supply, installation, testing and commissioning of MBBR/ SBR based STP for the complex based on the norms of local body, CPCB, MoEF&CC, NBC 2016. Works includes not only the items exclusively defined hereunder but also any other item required to commission and complete the work as per site requirement in this sub head or as per good engineering practice or as required under the codes or by local/statutory authorities.

Capacities of various equipments mentioned here under are minimum. EPC contractor shall do detailed design and calculations and provide the capacity of equipments, accordingly, subject to minimum capacities mentioned hereunder

1. Providing STP Plant of minimum 1 x 20 KLD & ETP Plant of minimum 1x5 KLD which can cater load of 50% extra population based on norms of local body, CPCB, MoEF&CC, NBC 2016.
2. Heavy duty required class of PVC piping.
3. De-watering pumps (with automation) as required with 50% standby pumps.
4. VFD based pumping system for transfer of water from/to various Buildings/ Towers
5. Sensors and Automatic operations
6. **On site warranty 5 years after handing over of plant i/c replacement of all defective part.**
7. **The main agency shall enter in MoU with OEM or his authorized service provider for carrying out AMC of “STP & ETP, pumps for water supply and drainage” and shall submit to Engineer-in-charge.**

Civil work for STP:

1. Following tanks made out of minimum 6mm thick MS sheet coated with 3mm thick FRP (Fiber Glass Reinforce Thermosetting Plastic) for 1 set
 - (a). Equalization Tank -1 no.
 - (b). Sludge Holding Tank -1 no.
 - (c). Anoxic Tank - 2 nos.
 - (d). Moving Bed Bio Reactor/ SBR Tank -2 nos.
 - (e). Tube Settler Tank (Not required in SBR) -2 nos.
 - (f). Clear Water Tank - 1 no.
 - (g). Treated Water Tank - 1 no.
2. Various sleeves / pipes between Tanks made out of MS sheet coated with FRP for connection.

E&M Works

E&M equipments: Following shall be treated as 1 set

Sl No.	Description of item	Qty.
1	Bar screen having maximum 8mm opening, made of SS 304 of suitable size	02 Nos.
2	Oil Skimmer	01 Nos.
3	Mixer for each Anoxic Tank	02 Nos.
4	Twin type Rotary Air Blower coupled with TEFC motor of required HP suitable for 3 phase 415± 10 Volt, 50 Hz. AC supply.	03 Nos. (2 Working + 1 Standby)
5	Coarse and Fine Bubble Membrane type Air Diffuser complete with valve and air distribution grid.	LOT

Sl No.	Description of item	Qty.
6	3 Ph. Sewage Submersible, non clogging type Pump set for Raw Sewage Transfer having solid handling 15 – 20mm ,	03 Nos. (2 Working + 1 Standby)
7	3 Ph. Non-clogging type horizontal centrifugal, monobloc pump set for Sludge Recirculation having solid handling min.7mm..	03 Nos. (2 Working + 1 Standby)
8	Filter Press consisting of minimum 12 Nos. of P.P. plates of size of 12x12 Plates and M.S. frame suitable for dewatering the sludge and making its cakes with moisture contents of 75% to 80% complete as required.	2 Lot
9	Filter Press Feed Pump Screw Type	2 No (1 Working +1 Standby)
10	3 Ph. Monobloc Pump Set for Filter Feed Pump	03 Nos. (2 Working + 1 Standby)
11	3 Ph. Monobloc Pump Set for Balance Treated Water Transfer Pump	03 Nos. (2 Working + 1 Standby)
12	3 Ph. Monobloc Pump Set for Plant Room Drainage Pump	02 Nos. (1 Working + 1 Standby)
13	MBBR Media (400 sqmtr/ Cumtr)/ SBR decanting system	2 Lot
14	Tube Deck Media 11m2/m3 (60° Slope) 13m2/m3 (55° Slope)	2 Lot
15	Ozonator System with Multigrade Filter and Activated Carbon Filter	2 set
16	Electro Magnetic Water Flow Meter	2 No.
17	Filters (Pressure sand filter and activated carbon filter) , UV sterilizer, chlorine dosing pumps and softener as tertiary treatment	2 sets
18	Bulk Water Meter	2 No.
19	Butterfly valve, NR valve, Motorized valves etc	2 Lot
20	GI Pipe / U PVC pipe	2 Lot
21	Sensors, switches , wiring etc. required for automation	2 Lot
22	Floor mounting type cubical indoor type compartmentalized Control Panel suitable for operation on 3 phase 415± 10 Volt, 50 Hz. AC supply, fabricated from 2mm CRCA sheet steel of suitable size, complete with 4 pole suitable size of aluminum bus bar, incoming FP MCCB and required number of outgoing TP MCCBs / SP MCB,VFD's automation PLC etc. for controlling the all electrical equipments + Spare 4 nos.(2 TP MCCB & 2 SP MCB) outgoing of required rating and incase of SBR PLC based panel should be provided.	1 No.
23	Stainless Steel safe railing around walk way for inspection of tanks	1 set
24	Stainless Steel Ladder for access and inspection as required	1 set
25	UG cable of required size	1 Lot
26	G.I. Pipe Earthing	4 Set

D10A.2 DESIGN CRITERIA:

1. Capacity and duration

- Capacity - 20 KLD (minimum)
- Operation : Sewage (round the clock)

2. Treated water

- a. pH - 7.0 -8.5
- b. BOD3 –@ 27 deg. C. - less than 10 mg/l
- c. COD - less than 30 mg/l
- d. Total Suspended solids (TSS) - less than 10 mg/l
- e. Oil & grease (after grease trap) - less than 5 mg/l
- f. Turbidity - less than 1 NTU
- g. E-Coli Removal - Removal to the level of **log 6**
- h. Ammonical Nitrogen [NH₄-N] - Less than 5mg/l
- i. Total Nitrogen(N-Total) - Less than 10mg/l
- j. Phosphate (PO₄-P) - Less than 1mg/l
- k. Fecal coliform - Less than 100MPN/100ml

3. Salient Features

- a. The plant should be suitable for low/peak flow in line.
- b. The plant should not create any noticeable noise, Noise level shall be less than 70 db at 2 mtr away from boundary of plant, with no nuisance on fly or mosquito and no foul odours.
- c. The plant should be provided with tertiary treatment in form of filters, UV sterilizer, chlorine dosing pumps and softener to provide zero bacteriological standard for reuse on:
 - i. Irrigation system
 - ii. Flushing System of toilets (provision for normal water supply also)
- d. The plant should be eco-friendly.
- e. Approval from local/pollution control board authority shall be obtained by the agency.
- f. Drain channel, sump with a drainage submersible pump (1 working + 1 standby) with pipe work, valves and discharge pipe up to nearest external manhole in plant room shall be provided by others.
- g. Provide water meter on outgoing treated effluent for measuring the outflow.
- h. Dewatering pumps (with automation) as required with 100% standby pumps.
- i. A walk way of suitable size shall be provided over the tanks area to view the performance of tank etc.
- j. The diameter of pipes/sleeves used shall be as per sound engineering practice however it shall not be less than 40mm. (NB).

D10A.3 TECHNICAL SPECIFICATIONS

1. Compliance

The capacity/ rating of pumps and equipment etc. shall hold good for the capacity of 1 plant of minimum 20 M³ / Day and shall be good for meeting the treated parameters requirement as follows:

- a. Permissible limit as prescribed in IS: 2490 (Part-I) - 1974 and environment (Protection) Rules 1986.
- b. Water (Prevention and Control of Pollution) Act, 1977 & 1978.
- c. Environment (Protection) Act, 1986.
- d. Environment (Protection) Rules, 1986.
- e. Hazardous Wastes (Management & Handling) Rules, 1989.
- f. Manufacturer, Storage and Import of Hazardous Chemicals Rules, 1989.
- g. Manufacturer, use import and storage and hazardous Micro-Organizers, Genetically Engineered organizations or Cell Rules, 1989.
- h. Manual on sewage & sewage treatment - CPHEEO
- i. The Public Liability Insurance Act, 1991.
- j. All standards as laid down by Central Pollution Control Board and any other relevant statutory authority.
- k. 100% recycle of waste water and removal of sludge in cake form, no water to be discharged outside the premises.

2. Process Description

- (a) Raw sewage will be brought into the Sewage Treatment Plant. The Contractor shall receive sewage from this point to the treatment plant for treatment process.

(b) The treatment process shall comprise the following stages:

(i) **Primary treatment** : Fine bar-screening

Inlet screen chamber : Raw sewage from main sewer line shall flow into the inlet screen chamber by gravity. This manually cleaned screen is provided to remove floating and large size solids particles which may choke the pumps and pipelines.

Equalization Tank : Screened sewage is then passed through equalization tank to homogenize the sewage quality and also even out flow fluctuations and feed sewage of uniform quality at constant rate to subsequent treatment units. Motorized Sewage cutter is also provided. Air mixing is also provided to mix the contents of the equalization tank. A coarse bubble aeration grid is provided to distribute air uniformly at the base of the equalization tank.

(ii) **Secondary (Biological) treatment:**

MBBR Tank : Sewage shall be retained in the MBBR tank for a minimum of 7-8 hours and subjected to biochemical oxidation by fine bubbles aeration. The MBBR tank shall have high surface area @ 400 Sq.mtr/cum ring type media to be used for bacterial growth installed in Moving Bed Bio reactor Tank. The media shall be duly glued as per manufacturer's recommendations or Sewage shall be retained in the retained in SBR tank which is based on sequence process with five cycle operation, it should be operated automatically and manually.

Tube Settler Tank : The sewage after MBBR tank shall enter the hopper bottom sedimentation tank where the sludge effectively settles to the tank bottom. The clear effluent shall weir into the chlorination chamber.

The activated sludge collected in the sludge tank shall be returned to the MBBR tank for further oxidation of the incoming organic matter. Excessive sludge shall be wasted in the sludge holding tank.

PVC tube deck media : PVC tube deck settling media is to be installed in Tube Settling Tank. The media shall installed at 60° angles with the horizontal and the total vertical height when installed should be 750 mm. The media shall be duly glued using recommended material and shall be installed as per the drawing to be given by the vendor as per manufacturer's recommendation.

Sludge Thickening / Holding Tank : Excessive sludge shall be stored in the sludge holding tank for final dewatering and disposal.

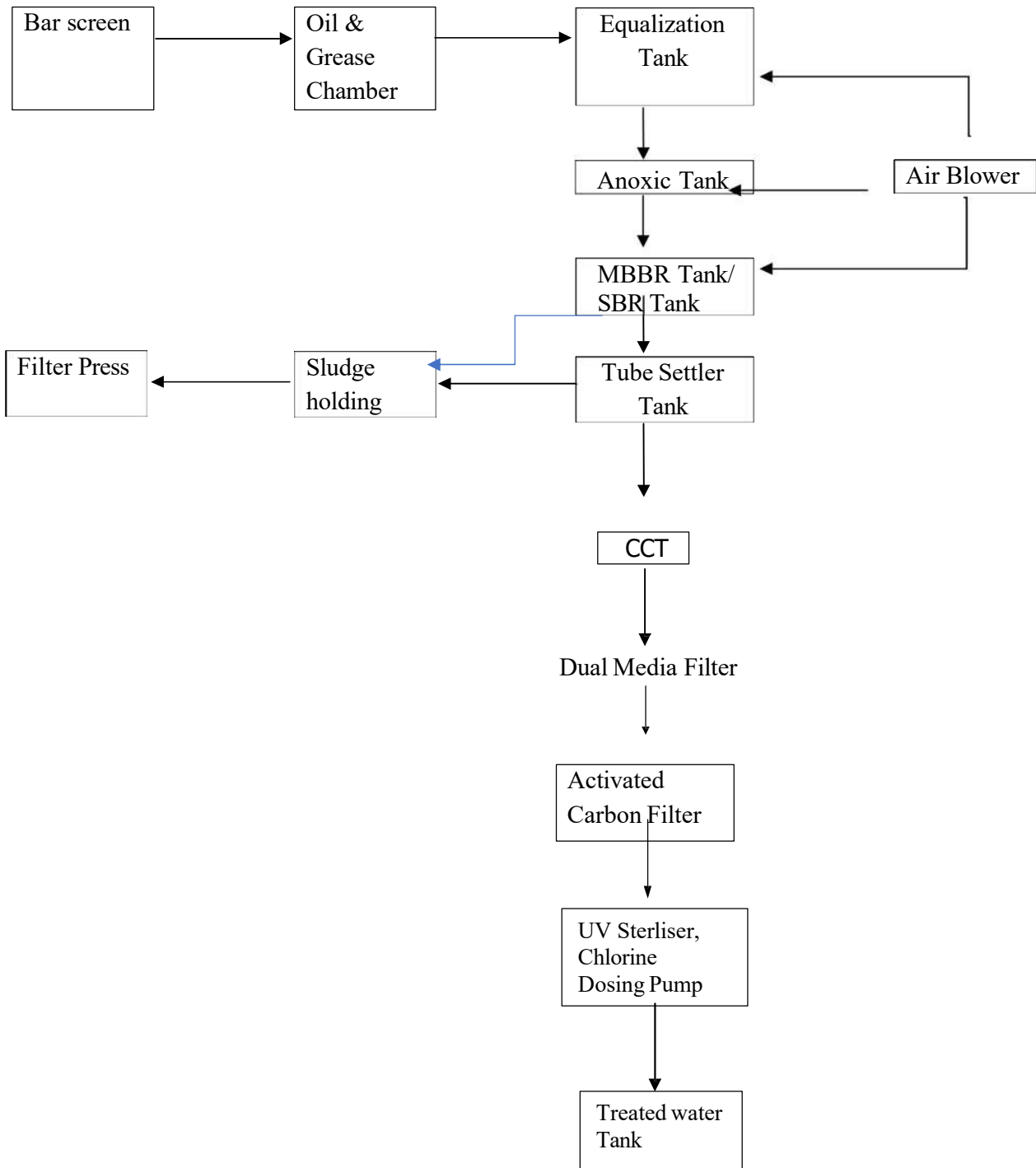
(iii) **Tertiary treatment:** The water after secondary treatment is to pass through tertiary treatment comprises of filtration with pressure sand filter for removal of suspended solids, activated carbon filter for removal of trace organic matter, colour and odour, UV sterilizer, chlorine dosing pumps and softener. The water after tertiary treatment is ready for use.

(iv) **Water reclamation:** The water after tertiary treatment is ready for use in irrigation flushing purposes.

(v) **Sludge disposal:** Sludge is to be converted as cakes using filter press. Cakes to be carried away in trolleys. The dried cakes/sludge can be used as a manure and excessive cakes/sludge can be disposed through truck to community disposal area.

Indicative Process Flow Diagram:

The systematic flow diagram is given below:-



D10A.4 EQUIPMENT

The following give the minimum requirements of the different components of the system.

All equipment and components of the system shall be of top quality construction and shall be corrosion resistant.

(a) Fine Screening Equipment

Bar screen (one sets) shall be of 304 stainless steel construction. Drip trays shall be provided for holding and drainage of the screenings. A manual by-pass screen of 30mm opening with stainless steel drip tray shall be provided. An isolation valve shall be provided to divert the flow to the by-pass screen when the screen requires service.

(b) Air Blowers

Air blowers 1 set (1 working and one standby) shall be provided. Blowers shall be either of positive displacement or centrifugal with pressure vessel type complete with motor, base-plate, inlet filter, intake silencer and off-load starting system outlet silencer, anti- vibration damper, flexible coupling, filter restriction indicator, non-return valve, pressure relief valve, V-belt system or direct drive coupling. The casing rotor shall be of cast iron construction. Bearings and gears shall be grease lubricated. Motor speed shall be 1500 rpm.

The size and performance of the air blower shall be so selected that it can provide a minimum air flow rate 0.5 l/sec / diffuser to 1l/sec/diffuser maximum, and to maintain a minimum of 2.0mg/l dissolved oxygen in the aeration tanks in operation.

(c) Air Diffusers

Air diffusers (1 set and 1 standby) shall be made to provide a uniform distribution of fine bubble air release performance in the system. The air diffuser shall be either made of elastomer rubber membrane or composed of crystalline fused aluminum oxide with a suitable ceramic bonding material.

Membrane endurance shall be more than 180,000 expansion/contraction cycles.

The Contractor shall submit calculations to justify the diffuser selection and air requirement during the detailed design.

(d) Equalization Tank

The equalization tank each of minimum 25% more than individual plant capacity of 20 KLD i.e. of minimum 6 hrs. retention.

(e) Sewage Pumps and sludge cutter

1 no Working and 1 no 100% standby sewage pumps of suitable capacity meant for sewage handling shall be provided with level switch control and automatic cut-in each equalizing tank. Motorized Sludge cutter shall also be provided in each tank.

(f) Chlorination System

A chlorine feed system (one set) shall be furnished as a complete package assembly for installation in the plant room. Assembly shall include base plate, electronic positive displacement type chemical feed pump, fibre glass solution tank, suction and discharge tubing and fittings.

Each chlorine solution dosing pump shall perform to achieve a residue not more than 1 mg/l in the treated effluent. Solution feed pump shall have a maximum capacity of 12 l/hr. chemical pump will operate on 50 Hz supply. Fiber glass solution tank shall be of no less than 100 litres capacity and include suction line fitted with strainer.

(g) Tertiary Treatment

This tertiary treatment shall be provided for the effluent used for irrigation, flushing & cooling tower purpose etc.

The tertiary treatment plant (one set) shall comprise of the MGF, ACF, UV sterilizer, chlorine dosing system, & softener. This shall be sized to accommodate 100% of the effluent discharge flow rate and shall achieve the performance as outlined and described in Design Criteria.

(h) Electrical Control

The operation of the treatment process shall be fully automatic.

A completely assembled and prewired control panel consisting of weatherproof cabinet shall be furnished. The control panel shall contain all metering and status indicators, VFD for each pump above 5 KW, program timers, on-off-auto changeover switches and duty selectors for equipment. The panel shall have 4 nos. (2 TP MCCB 100 A 35KA & 2 SP MCB 32A 10KA) spare outgoing for future use. For SBR PLC based panel.

(i) Other Equipment

Any other necessary accessories, such as buffer, riser, scum removal devices, partition, control panel, collection devices, etc. for all the tanks and pumps (where necessary) shall be provided in order to provide a fully working system.

(j) Piping Materials

MS epoxy or heavy grade PVC -Air piping and pumped effluent riser

G.I (Medium Grade) - Interconnecting pipeline after delivery header of pumps & filter.

(k) Valves

The Contractor shall supply and install all isolating valves and control valves as required for the proper and efficient operation and maintenance of the entire systems. All valves supplied shall be suitable for the working pressure and test pressure of the system as specified elsewhere in this specification.

All valves shall be full line size.

Plastic or metal plates (rust less) shall be provided to indicate the open / close status as well as the use of each valve in the pump and tank rooms.

D10A.5 PIPE SUPPORTS

Tender drawings indicate schematically the size and location of pipes. The Contractor, on the award of the work, shall prepare detailed working drawings, showing the cross-sections, longitudinal sections, details of fittings, locations of isolating and control valves, drain and air valves, and all pipe supports. He must keep in view the specific openings in buildings and other structure through which pipes are designed to pass.

Piping shall be properly supported on, or suspended from, on stands, clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchor, clamps and hangers, and be responsible for their structural stability.

D10A.6 INSTALLATION

The Contractor shall check the associated civil work prior to the installation of any item of machinery and advise the Project Engineer in charge, in writing, of any deviation of such work from the specified details.

The machinery shall be accurately installed to correct dimensions, alignments, levels, etc., all as indicated on the final drawings. The machinery shall be mounted on flat steel packing pieces of thickness suitable to take up variations in level of the concrete foundations. Suitable packing pieces shall be located adjacent to each holding down bolt and shall be properly bedded by grinding the concrete surface to a smooth, level finish.

The machinery shall be aligned and levelled and the nuts of the holding down bolts tightened with a spanner of normal length. The base plates shall be packed with grout after the machinery has been run and checked by the Project Engineer in charge for stability and vibration.

Installation shall include the provision and fixing of all necessary holding down bolts, washers, nuts etc.

D10A.7 TESTING

The performance of the system shall be demonstrated by taking hourly samples of the raw sewage and final effluent over a twelve-hour period. The sample shall be taken at periods approximately the flow rates specified by the plant. The sample shall be combined and a 5-day BOD shall be run, the results of which must verify the capacity of the treatment plant prior to acceptance.

D10A.8 Drawings for approval on award of the work

The contractor shall prepare and submit three sets of hard copy of following drawings and 2 sets in soft copy and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved drawings and agreement.

- (i) Layout drawings of the STP Room with sections, sleeve details
- (ii) Calculations of capacity of various tanks
- (iii) Treatment details on RCC Tanks and reinforcement
- (iv) Data sheets and drawings of all equipments
- (v) SLD of system
- (vi) SLD and GAD of Electrical Panel
- (vii) Layout of equipment's to be installed including power and control cables, and supports / structure for bus ducts/ cable trays.
- (viii) Earthing
- (ix) Any other drawings relevant to the work.

Drawings after completion of work

The contractor shall submit Three sets of As built drawings on white paper and 2 sets in soft copy to the owner/ Engineer-In-Charge after completion of the work. In addition following shall also be provided:

- (i) Test Certificates
- (ii) Warrantee Certificates
- (iii) O&M Manuals of Equipments
- (iv) Any other information the Engineer-In-Charge may dream fit.

D10A.9 LIST OF INDIAN STANDARDS ON SEWERAGE AND SEWAGE TREATMENT

- IS 2470 (PT 1)&(PT 2) : 1985 Code of practice for installation of septic tanks: Design criteria and construction (second revision)Secondary treatment and disposal of septic tank effluent (second revision)
- IS :4733-1972 Methods of Sampling Test Sewage Effluent IS : 6908-1975 Sewage and Drainage
- IS :7022 (PT II)-1979 Glossary of Terms Relating to Water Sewage and Industrial Effluents PT II
- IS:1538-(PT-XXIV)-1982 Press Pipes for Water, Gas and Sewage IS 5600: 2002 Pumps-sewage and Drainage-Specification
- IS 5611 : 1987 Code of practice for waste stabilization ponds(facultative type) (first revision) IS : 5600-1970 Specification for Sewage and Drainage Building Elements
- IS : 4764-1973 Tolerance Limits for Sewage Effluents Discharged In to In land Surface Water IS 6279 :1971 Equipment for grit removal devices
- IS 6280 : 1971 Sewage screens
- IS 7232 : 1974 Method for Imhoff cone test
- IS 7784: Part 1 & 2: Sec 1 to 5 Code of practice for design of cross drainage work : Part 1 General features
- IS 8413 (PT 1) : 1977 Requirements for biological treatment equipment Part 1 Trickling filters
- IS 8413 (PT 2) : 1982 Requirements for biological treatment equipment Part 2 Activated Sludge process
- IS 9110 : 1979 Hand operated augers for cleaning water closet, pipe and sewer IS 9213 : 1979 BOD Bottle
- IS 10037 : PT1 to 3 : 1981 Requirements for sludge dewatering equipment. Part 1 sludge drying beds-sand, gravel and under drains
- IS 10261 : 1982 Requirement for settling tank (clarifier equipment) for waste water
- IS 10552 : 1983 Buckets to be used in power driven buckets type sewer cleaning machine

D-10B : ETP of capacity minimum 5 KLD per day.

Civil work:

1. Following tanks made out of minimum 6mm thick MS sheet coated with 3mm thick FRP (Fiber Glass Reinforce Thermosetting Plastic) for 1 set
 - (a). Equalization Tank -1 no.
 - (b). Sludge Holding Tank -1 no.

- (c). Anoxic Tank - 2 nos.
- (d). Moving Bed Bio Reactor/ SBR Tank -2 nos.
- (e). Tube Settler Tank (Not required in SBR) -2 nos.
- (f). Clear Water Tank - 1 no.
- (g). Treated Water Tank - 1 no.

2. Various sleeves / pipes between Tanks made out of MS sheet coated with FRP for connection.

E&M Works

E&M equipments: Following shall be treated as 1 set

Sl No.	Description of item	Qty.
1	Bar screen having maximum 8mm opening, made of SS 304 of suitable size	02 Nos.
2	Oil Skimmer	01 Nos.
3	Mixer for each Anoxic Tank	02 Nos.
4	Twin type Rotary Air Blower coupled with TEFC motor of required HP suitable for 3 phase 415± 10 Volt, 50 Hz. AC supply.	03 Nos. (2 Working + 1 Standby)
5	Coarse and Fine Bubble Membrane type Air Diffuser complete with valve and air distribution grid.	LOT
6	3 Ph. Raw effluent lifting pumps	02 Nos. (1 Working + 1 Standby)
7	3 Ph. Physico-chemical treatment dosing pump	
a	Alum Dosing system	1 Lot
b	Poly Dosing System	1 Lot
c	Lime Dosing System	1 Lot
8	MS/ UPVC and isolation control valves for making the piping arrangement within the battery limits.	1 Lot
9	SBR feed Pumps Flow rate (each) – 0.5 m ³ /hr Head – 8-10 m	2 Nos.
10	SBR based Biological system Air Blowers for SBR tank Capacity: Approx. 5-10 m ³ /hr. @ 4500 mmwc Air Diffusers for SBR tank Decanter System for SBR tank Pipes and fittings for Air piping and Air Grid	1 Lot
11	Centrifugal Horizontal Filter Feed pumps	2 Nos.
12	Sludge Bag feed pump	1 Lot
13	Chemical dosing system	1 Set
14	Sludge Bag, FRP vessel, Multigrade Sand Filter, Activated Carbon Filter, Electrical Panel, Earthing	1 Lot
15	Physico-chemical treatment unit, SBR system with anoxic and Intermediate water Tank, Sludge Holding tank	1 Job

DESIGN CRITERIA:

1. Capacity and duration

- (a) Capacity - 5 KLD (minimum)

	2. Influent Characteristics (considered)
a. pH	- 7-9
b. BOD5	- 200-350 mg/l
c. COD	- 400-600 mg/l
d. S. Solids	- 250-300 mg/l
e. Oil & grease (after grease trap)	- < 50 mg/l

	3. Effluent discharge standard after treatment
a. pH	- 6.5 – 8.0
b. BOD5	- <10 mg/l
c. COD	- <50 mg/l
d. S. Solids	- <50 mg/l
e. Oil & grease (after grease trap)	- < 5 mg/l

4. Salient Features

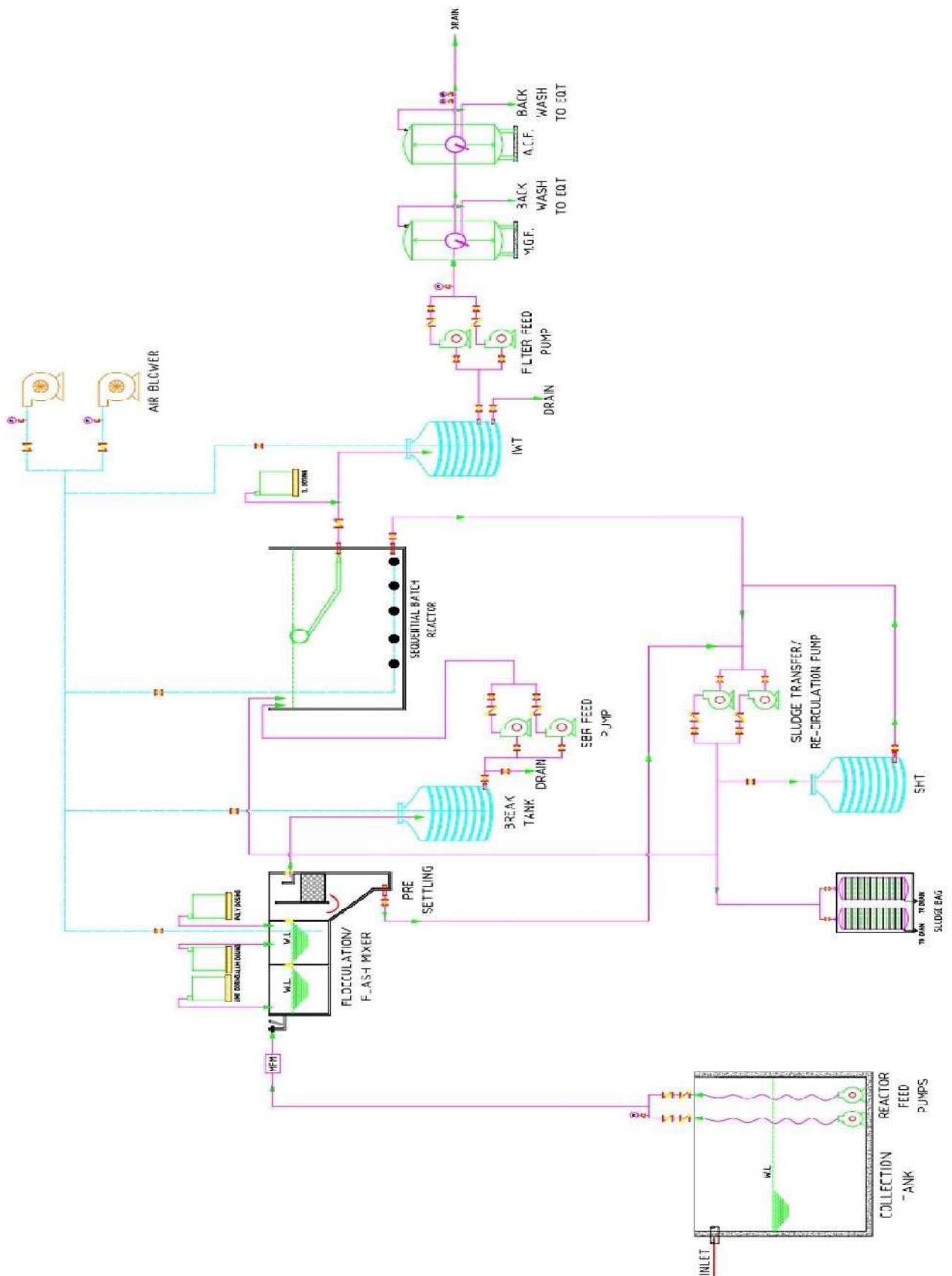
- k. The plant should be suitable for low/peak flow in line.
- l. The plant should not create any noticeable noise, Noise level shall be less than 70 db at 2 mtr away from boundary of plant, with no nuisance on fly or mosquito and no foul odours.
- m. The plant should be provided with tertiary treatment in form of filters, UV sterilizer, chlorine dosing pumps and softener to provide zero bacteriological standard for reuse on:
 - i. Irrigation system
 - ii. Flushing System of toilets (provision for normal water supply also)
- n. The plant should be eco-friendly.
- o. Approval from local/pollution control board authority shall be obtained by the agency.
- p. Drain channel, sump with a drainage submersible pump (1 working + 1 standby) with pipe work, valves and discharge pipe up to nearest external manhole in plant room shall be provided by others.
- q. Provide water meter on outgoing treated effluent for measuring the outflow.
- r. Dewatering pumps (with automation) as required with 100% standby pumps.
- s. A walk way of suitable size shall be provided over the tanks area to view the performance of tank etc.
- t. The diameter of pipes/sleeves used shall be as per sound engineering practice however it shall not be less than 40mm. (NB).

TECHNICAL SPECIFICATIONS

1. Compliance

The capacity/ rating of pumps and equipment etc. shall hold good for the capacity of 1 plant of minimum 5 M³ / Day and shall be good for meeting the treated parameters requirement as follows:

- a. Permissible limit as prescribed in IS: 2490 (Part-I) - 1974 and environment (Protection) Rules 1986.
- b. Water (Prevention and Control of Pollution) Act, 1977 & 1978.
- c. Environment (Protection) Act, 1986.
- d. Environment (Protection) Rules, 1986.
- e. Hazardous Wastes (Management & Handling) Rules, 1989.
- f. Manufacturer, Storage and Import of Hazardous Chemicals Rules, 1989.
- g. Manufacturer, use import and storage and hazardous Micro-Organizers, Genetically Engineered organizations or Cell Rules, 1989.
- h. Manual on sewage & sewage treatment - CPHEEO
- i. The Public Liability Insurance Act, 1991.
- j. All standards as laid down by Central Pollution Control Board and any other relevant statutory authority.
- k. 100% recycle of waste water and removal of sludge in cake form, no water to be discharged outside the premises.



SCHMATIC ETP

D-10C : PUMPS FOR WATER SUPPLY AND DEWATERING SYSTEM

D10C.1 SCOPE OF WORK

Scope of this sub head covers planning, designing, supply, installation, testing and commissioning of water supply pumping system which includes not only the items exclusively defined hereunder but also any other item required to commission and complete the work as per site requirement in this sub head or as per good engineering practice or as required under the codes or by local/statutory authorities.

Capacities of various equipments mentioned hereunder are minimum. EPC contractor shall do detailed design and calculations and provide the capacity of equipments accordingly, subject to minimum capacities mentioned hereunder:

1. Hydro pneumatic water supply system of suitably designed capacity pumping system for potable water with minimum 4 pump sets (each of minimum 16 CMH with residual pressure of 1.5 kgf/sq.cm at farthest point) for potable water including 2 no or 100% standby capacity with 2 No pressure tanks each of minimum 1000 ltr capacity, Electrical Panel having separate VFD drive for each pump, cabling, GI piping, automatic and manual operation of pumps with required sensors, controls, solenoid valves with sensors and NRV for filling up overhead tanks, control wiring etc as required. System shall be designed to distribute water at each outlet through hydro pneumatic supply system as well as through overhead tank.
2. Hydro pneumatic water supply system of suitably designed capacity pumping system for flushing/ordinary water with minimum 4 pump sets (each of minimum 16 CMH flow with residual pressure of 1.5 kgf/sq.cm at farthest point)) including 2 no. or 100% standby capacity with 2 nos. required pressure tanks minimum 1000 ltr capacity, Electrical Panel having separate VFD drive for each pump, cabling, GI piping, automatic and manual operation of pumps with required sensors, controls, solenoid valves with sensors and NRV for filling up overhead tanks, control wiring etc. as required. System shall be designed to distribute water at each outlet through hydro pneumatic supply system as well as through overhead tank.
3. Hydro pneumatic Pumping system (by providing minimum 2 pump sets (each of minimum 50 CMH flow with residual pressure of 1.5 kgf/sq.cm at farthest point)) including one no. standby pump) for transfer/use of STP treated water for Horticulture purpose, Electrical Panel having VFD drive for each pump, cabling, GI piping, automatic and manual operation of pumps with required sensors, controls, control wiring etc. as required. Note: These pumps are in addition to pumps required for Horticulture Sprinkler system.
4. Dewatering submersible pumps(with automation) (each of minimum 20 CMH flow with residual pressure of 1.5 kgf/sq.cm at farthest point) as required for sumps in basement with minimum 100% standby pumps (i.e. in each sump 2 nos. pumps including one standby is required), Local Electrical Panel for each pump, cabling, GI piping, automatic and manual operation of pump with required sensors, controls, control wiring etc as required
5. **AMC of 5 years i/c replacement of all defective part. The main agency shall enter in MoU with OEM or his authorized service provider for carrying out AMC of “Pumps for water supply and Dewatering system” and shall submit to Engineer-in-charge.**

D10C.2 Specifications and Design concept:

1. **All pumps and motors shall be Super ECSBC compliant as per ECSBC 2024 as amended up to date.**
2. Type, Pressure, Head and discharge of the pumps, sizes and type of valve shall be designed by the contractor for proper service. Capacity of each water transfer pump shall be so designed that no pump is required to operate for more than 6 hours in a day. Capacity of each dewatering pump shall be designed as per good engineering practice to serve the intended purpose.
3. Impeller of pumps shall be bronze or Stainless steel.
4. All pumps (except dewatering pumps) shall have VFD drive instead of starter.

5. Complete system (consisting of pumps, VFD, control panel, suction and discharge headers, pressure tanks) shall be procured from OEM of pumps.
6. Layout drawing shall be prepared by contractor indicating dimension of each and every equipment, foundation, hanging arrangement etc and shall be submitted to the Department for the approval. Layout of pumps shall be prepared for easy maintenance.
7. Pumps are to be monitored, controlled and operated through Auto mode in normal case, hence the pumps panels starter should have potential free contacts for integration in auto mode. However, a local manual override facility shall be provided. All pumps shall be normally operated in Auto mode depending upon requirement/levels of water in various tanks, with manual override facility. Proper Automation scheme shall be made.
8. Complete system shall be IBMS compatible (for operation and monitoring), Electric panels, Gauges, Wiring and control wiring shall be designed and executed accordingly.

D10C.3 DRAWINGS FOR APPROVAL ON AWARD OF THE WORK

The contractor shall prepare and submit three sets of hard copy of following drawings and 2 sets in soft copy and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved drawings and agreement.

- a. Layout drawings of pump rooms along with Layout of equipment's to be installed.
- b. Data sheet of pumps with selection point
- c. Head and discharge calculations of required pump
- d. Foundation drawings and pipe Support details
- e. Any other drawings relevant to the work.

D10C.4 DRAWINGS AFTER COMPLETION OF WORK

The contractor shall submit Three sets of as-built drawings on white paper and 2 sets in soft copy to the owner/ Engineer-In-Charge after completion of the work. In addition, following shall also be provided:

- a. Test Certificates
- b. Warrantee Certificates
- c. O&M Manuals of Equipments

Any other information the Engineer-In-Charge may demand.

D-11 ROOF TOP SOLAR PV POWER PLANT

D11.1 SCOPE OF WORK:

Scope of this sub head covers planning, designing, supply, installation, testing and commissioning of roof top grid interactive solar photo voltaic plant system as per state-of-the-art technology which includes not only the items exclusively defined hereunder but also any other item required to commission and complete the work as per site requirement in this sub head or as per good engineering practice or as required under the codes or by local/statutory authorities/MNRE guidelines.

Capacities of various equipments mentioned hereunder are minimum. EPC contractor shall do detailed design and calculations and provide the capacity of equipments accordingly, subject to **minimum** capacities mentioned hereunder:

1. **To achieve net zero building Minimum 300 KWp, grid interactive Ground mount (on vehicle parking shed at scattered places)/ Roof Top of Blocks, photo voltaic solar plant.** High efficiency PV cells with high efficiency invertors shall be used. Minimum power output guarantee offered for the **SPV Module shall not be less than 25 years.**
2. Inverters/Power conditioning unit (PCU suitable for mains as well as DG supply) as required, however capacity of each inverter minimum 30 KWp.
3. AC collection Panel with metering to monitor generation and AC cabling from Panel to receiving switch.
4. Tap off boxes with 4 pole 63A/ 100A MCCB for receiving solar power in Essential bus trunking or whatever required by local electric supply company.
5. Measuring devices i/c net metering, indication devices, protection devices, switching devices, all necessary wiring, DC and AC cabling including feeding power to essential supply Bus trunking by providing necessary tap off boxes
6. Mounting structure on ground of the vehicle parking area, protection of system for external / internal causes and from all kind of surges etc.
7. Earthing and Lightning protection of Solar system
8. Approval of scheme before start of work from local electric supply company.
9. Including installation of net metering local electric supply company.

S. No.	Description	Details	Remarks
1.	Scope of Solar PV Power Plant describing the inclusion of Solar PV modules, DC and AC cabling, Inverter, mounting arrangement/ MS structure of required capacity, Earthing, Lightning Protection, Metering arrangement etc. as required.	YES, with Net metering	
2.	Details of available ground area, location	In Parking Area & Roof Top area of Blocks and other locations as approved by Engineer-in-charge	
3.	Requirement of clearances from Local supply agency, provision of net metering, applicable fees etc.	In the scope of EPC contractor	

D11.2 DESIGN BASIS FOR ROOF TOP GRID INTERACTIVE SOLAR PHOTO VOLTAIC PLANT

1. Arrangement of mounting structure and array of solar panel shall be submitted along with structural analysis and design (STAAD) vetted by structural engineer.
2. The capacity of plant shall be derived as per electric load calculation of the Buildings as per substation sub head to make the building **Net Zero.**
3. The Inverters/ PCU shall be installed inside the minimum IP65 close enclosure near/ below PV module areas.
4. The ACDB panel shall be installed in the IP 65 Closed enclosure near / below PV Modules area.

5. Array shall be designed considering the following:
 - a. sufficient pathway shall be provided within array for the purpose of maintenance
 - b. At least 1 water tap shall be provided near each solar panel installation for cleaning of solar panel.
 - c. shall have an optimum angle for mounting of solar PV modules to achieve near maximum all day power output,
 - d. The drawings along with detailed design and equipment data sheet shall be submitted for approval before starting the work. The work will be carried out as per designs approved by the Engineer-in-charge.
 - e. The agency shall get designed suitable GRID on vehicle shed and Roof top Solar structure, for design wind speed of that area as per codes and provide the same. Such structure/grid shall be certified by structural consultant. An indicative layout of solar panel structure is shown below for guidance of EPC contractor.



- f. The solar power generation shall be done at different locations. connection and feeding of solar power generation to substation at one place i.e. sub-station through suitable size of cable, panel, IP 66 bus trunking etc. shall be in the scope of work.
6. **Guarantee Regarding Generated Output:**
 Agency shall give an undertaking that after the warranty period of 6 years, Generated output shall not deteriorate by more than 2% per year during its additional useful life of 20 years. Minimum Guaranteed Generated output (units/year) for 300 KWp system for first 5 years have been calculated as under:
 - a. Minimum capacity of Roof Top Solar System: 300 KWp
 - b. Minimum guaranteed Generation required = 6,00,000 units/year.
7. **Ambient Condition & Solar Insolation**
 Agency will seek from relevant database / source, all the data pertaining to the ambient conditions like temperature, humidity, wind load, rain, weather condition and historical solar radiation etc., pertaining to the site location and optimize the design accordingly. All design calculations and installation details shall be submitted for approval after the award of work.

D11.3 SPECIFICATIONS AND DESIGN

1. Module mounting structure

- a. The indicative layout of array structure is shown above for the guidance of EPC contractor.

The array structure shall consist hot dip galvanized MS angles, columns, girders, MS sheet of required size as per requirement. The minimum thickness of galvanized shall be at least 70 microns. All nuts & bolts shall be made of good quality steel (SS 304). The mounting structure of the array shall be vetted by structure consultant as mentioned above.

- b. The work should be completed with supply, fitting fixing of clamps, saddles, nut & bolts etc. While quoting the rate, the bidder may mention the design & type of structure offered. All nuts & bolts shall be made of very good quality steel.
- c. The structure shall be designed to allow easy replacement of any module and shall be in line with site requirements.
- d. The structure shall be designed for simple mechanical and electrical installation. It shall support SPV modules at a given orientation, absorb and transfer the mechanical loads to the ground properly. There shall be no requirement of welding or complex machinery at site.
- e. The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels & shall withstand heavy winds.
- f. The supplier / manufacturer shall specify installation details of the PV modules and the support structures with appropriate diagrams and drawings.

2. Solar PV Module (Electrical Features)

- (a) Solar PV module array will be made by utilizing BIS certified mono/poly crystalline high efficiency Silicon Solar PV cells. Minimum power output guarantee offered for the SPV Module shall not be less than 25 years. Each Solar PV module offered shall meet following min. requirement.
 - (i) Efficiency of cell, $E_{f,c}$ - $>21\%$
 - (ii) Efficiency of module, $E_{f,m}$ - $>21\%$
- (b) I-V curve of each PV module with Sl. Nos. should be submitted along with modules.
- (c) Solar PV modules shall conform to IEC/IS standard i.e. IEC-61215/IS14286, IEC61853-Part-I/ IS 16170-Part I, IEC 61730 Part-1 & Part 2 and IEC 62804 (PID) standards For the PV modules to be used in a highly corrosive atmosphere throughout their lifetime, they must conform to IEC 61701/IS 61701. Documentary evidence/ for all above certification shall be submitted. Minimum following parameters should be provided.
 - (i) Maximum Power, P_{max}
 - (ii) Minimum Power, P_{min}
 - (iii) Open Circuit Voltage, V_{oc}
 - (iv) Short Circuit Current, I_{sc}
 - (v) Voltage at Max Power V_{mp}
 - (vi) Current at Max power I_{mp}
 - (vii) Fill Factor, FF
 - (viii) Efficiency of cell, $E_{f,c}$
 - (ix) Efficiency of module, $E_{f,m}$
 - (x) The rated power of solar PV module shall have maximum tolerance up to $\pm 3\%$.
 - (xi) Solar PV modules of capacity 540 Wp or better to be used.

3. Solar PV Module (Mechanical Features)

Solar PV Module design will conform to following Mechanical requirement

- (i) Toughened, anti-reflective, low iron content, high transmissivity front glass. Anodized Aluminum Frame.
- (ii) Ethyl Vinyl Acetate (EVA) encapsulant
- (i) Silicon edge sealant around laminate
- (ii) Tedlar / Polyester trilaminate back surface

- (iii) IP 67 rated ABS plastic terminal box for the module output termination with gasket to prevent water moisture.
- (iv) IP 68 rating for water abrasion, hail impact, humidity & other environment factor for the worst situation at site.
- (v) Bypass diode.

4. Junction Boxes

The junction boxes shall be dust, vermin and waterproof and made of Thermo Plastic polycarbonate with minimum IP65 rating. The terminals shall be connected to copper bus bar arrangement of proper size. The junction boxes shall have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables. Suitable marking shall be provided on the bus bar for easy identification and cable ferrules shall be fitted at the cable termination points for identification. The junction boxes shall have suitable arrangement for the following:

- (i) Combine groups of modules into independent charging sub-arrays that shall be wired to the controller.
- (ii) Provide arrangement for disconnection for each of the groups.
- (iii) Provide a test point for each sub-group for quick fault location.
 - a. To provide group array isolation.
 - b. The rating of the JB's shall be suitable with adequate safety factor to inter connect the Solar PV array.
 - c. Metal oxide varistors shall be provided inside the Array Junction Boxes.

5. DC distribution board/Array Junction Box

DC distribution board shall be provided in between solar array and PCU. The junction boxes shall be made of Thermo Plastic polycarbonate with impact resistant transparent cover, waterproof, dust free, vermin with IP65 protection. The terminals shall be connected to copper bus bar arrangement of proper sizes. The junction boxes shall have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables. Suitable markings shall be provided on the bus bar for easy identification and cable ferrules shall be fitted at the cable termination points for identification. Array junction box shall have suitable reverse blocking diodes of minimum DC blocking voltage of 800 V with suitable arrangement for its connecting. The array box shall also have suitable surge protection.

The junction boxes shall have suitable arrangement for the following:

- (i) Combine groups of modules into independent charging sub-arrays that shall be wired to the controller.
- (ii) Provide arrangement for disconnection for each of the groups.
- (iii) Provide a test point for each sub-group for quick fault location.
- (iv) Provide group array isolation.
- (iv) The rating of the JB's shall be suitable with adequate safety factor to inter connect the Solar PV array.
- (vi) By-pass Diode
- (vii) Fuses of suitable rating for Overloading protection of array section.

6. Power Conditioning Unit (PCU):

- a. The PCU is a combination of Solar Charger (MPPT), Inverter, AC Charger and data logger all housed in a single unit.
- b. Maximum power point tracker (MPPT) shall be integrated into the PCU to maximize energy drawn from the solar PV array. MPPT shall be microprocessor/micro controller based to minimize power losses and maximize energy utilization. The efficiency of MPPT shall not be less than 94%.
- c. PCU shall include self protective and self diagnostic features to protect itself and the PV array from damage in the event of PCU component failure.
- d. Power conditioning unit will comply the following requirements.
 - 1. 415V AC \pm 5% 50Hz, 3 Phase
 - 2. Overload capacity – 150% for 60sec.

3. Output wave shape: sine wave with <3% total harmonic distortion (THD).
 4. Adjust the Voltage and Frequency Levels to suit the Grid in normal case
 5. Adjust the Voltage and Frequency Levels to suit the nearest Rising Mains
- e. Agency has to provide all safeguard needed for power transfer to GRID . The situation case of supply GRID failure shall also be taken into account and if required, necessary modifications shall be made in Transformer Marshalling Box also.
 - f. The power conditioner must be entirely self-managing and stable in operation. A self diagnostic system check should occur on start up. Functions should include a test of key parameters on start up.

7. Surge protection system

- (a) The DIN channel mountable pluggable surge protection shall be installed in a network configuration, consisting of a single block MOV (Metal Oxide Varistor) based surge arrester having nominal surge handling capacity of 15 KA 8/20 μ s & maximum surge handling capacity of 30 KA 8/20 μ s to provide protection between (L+, L-, earth). All surge arresters in these network configurations shall be of same manufacturer.
- (b) The Protection unit shall be based on Single block High Capacity Metal Oxide Varistors (MOV), capable of handling 15 KA 8/20 μ s surges and shall be able to give an indication in the event module failure and shall be pluggable to facilitate the onsite replacement without disturbing the lines.
- (c) One extra set of replacement protective device shall be furnished to the job site.
- (d) Protection shall be manufactured to withstand a maximum continuous operating voltage of not less than 115% of normal RMS system voltage

8. AC Distribution Board (ACDB)

AC DB shall be provided in between PCU and loads.

9. Earthing And Protection

The array structure of the PV yard shall be grounded properly using adequate number of earthing kits. All metal casing / shielding of the plant shall be thoroughly grounded to ensure safety of the power plant. Earthing shall be in line with IE rules and as per CPWD specification. The earthing & grounding shall also meet the requirement of PV module/cell manufacturer. Detailed specifications have been provided in the Earthing section.

10. Cable and accessories

All the interconnection wire shall be FRLS type copper conductor as per IS694:2010. All the cables shall be supplied conforming to IS7098 (Part-1)-1988 with upto date amendment (for LT cables) XLPE Insulated, Cores Laid Up, PVC Inner sheathed, Armoured and Extruded PVC Type ST2 Outer Sheathed shall be of 650 V/ 1.1 kV grade, copper conductor as per requirement. The size of the cables between array interconnections, array to junction boxes, junction boxes to DCDB, DCDB to PCU etc shall be so selected to keep the voltage drop and losses to the minimum. Type of DC cable shall be outdoor duty, UV protected and suitable for application.

The contractor are required to mention each size of cables used and should consider their resistance / impedance in the design optimization. Such calculation should be submitted.

The contractor shall supply all installation accessories, which are required to install and successfully commission the power plant.

11. Modes Of PCU

- a. **Standby Mode:** The control system shall continuously monitor the output of the solar power plant until pre-set value is exceeded and that value to be indicated.
- b. **Basic System Operation (Full Auto Mode):** The system shall automatically 'wake up' in the morning and begin to export power provided there is sufficient solar energy and the grid voltage and frequency is in range. It has to be designed for receiving Grid or DG supply.

- c. **System operation when no power supply in Rising Mains** : It shall switch off outgoing breaker to Grid .
- d. **DG set Power Supply in Rising Main Mode**: Rising mains is receiving either Supply company power or DG set power. In case it receives DG power and the total load requirement at LT panel in Sub Station level is less than Solar power output, DG sets need to be switched off. Necessary programming/logic shall be provided so that sum of DG set generation and Solar generation is not more than required/absorbed power.
- e. **Maximum Power Point Tracker (Mppt)**: MPPT control algorithm shall adjust the voltage of the SPV array to optimise solar energy fed into the grid. Necessary programming/logic shall be provided so that sum of DG set generation and solar generation is not more than required/absorbed power.
- f. **Sleep Mode**: Automatic 'sleep' mode shall be provided so that unnecessary losses are minimized at night. The power conditioner must also automatically re-enter standby mode when threshold of standby mode reached.

12. Inverter (On Grid System)

- a. The inverter output shall always follow the grid in terms of voltage and frequency. This shall be achieved by sensing the grid voltage and phase and feeding this information to the feedback loop of the inverter. Thus control variable then controls the output voltage and frequency of the inverter, so that inverter is always synchronized with the grid.
- b. Parameters of inverter:

Sl. No.	Description	Parameters
1.	Efficiency	$\geq 97\%$
2.	Output frequency	50Hz inverter to follow grid frequency upto ± 2 Hz of the nominal output frequency during normal operation
3.	Output voltage	$420 \pm 20\%$. This to be synchronizing automatically and then fed to Grid LT supply
4.	THD (at point of connection)	Less than $\pm 3\%$ (of rated power)
5.	Ambient temperature	-20 to 50 deg C without any derating in nominal inverter Rating and 60 deg C with derating
6.	Humidity	100 % non- condensing
7.	Input DC Range	360 to 800 volt
8.	Reactive Power Capability	0.8 (leading) and 0.8 (lagging)
9.	Maximum Permissible Voltage	1000 V
10.	Enclosure	IP 65 (Outdoor rated)
11.	Capacity	Min. 30 KWp.

- c. The Inverter shall have following features:
 - i. Auxilary power consumption shall be $< 0.5\%$ of rated power and maximum loss in sleep mode shall be less than 0.02%

- ii. Sinusoidal current modulation with excellent dynamic response.
 - iii. Unit wise & integrated Data logging.
 - iv. Dedicated Ethernet for networking
- d. The Inverter shall have Protection against:
- i. Over-under current
 - ii. Over voltage & under voltage,
 - iii. Over and under frequency
 - iv. Sync loss
 - v. Over temp
 - vi. Line to line fault
 - vii. Short circuit
 - viii. Protection against lightning
 - ix. Surge voltage induced at output due to external source
 - x. Set point pre-selection for VAR control
 - xi. Remote control via telephone modem or mini web server
 - xii. Integrated protection in the DC and three phase system
 - xiii. Insulation monitoring of the PV array
 - xiv. Ground fault detector – which is essential for large PV generators in view of appreciable discharge current with respect to ground.
 - xv. Over voltage protection against atmospheric lightning discharge to the PV array is required.

13. Computer Aided Data Acquisition System

- a. The plant shall be automatically monitored by data acquisition system. There shall be simultaneous data logging (5 minutes Intervals), recording and display system for continuous monitoring of data for different parameters of different sub systems, power supply of the power plant at DC side and AC side.
- b. An integrated data acquisition system shall be supplied which should be capable of communicating with all inverters and provide information of the entire Solar PV power plant.
- c. Computer Aided Data Acquisition Unit in the form of personal computer (PC) Supporting with competent internal hardware and software shall be a separate & individual system comprising of different transducers to read the different variable parameters, A/D converter, Multiplexer, Demultiplexer, 16 Interfacing Hardware & Software, Industrial Type PC, which will be robust & rugged suitable to operate in the Control Room Environment. Reliable sensors for Solar Radiation, Temperature & other Electrical Parameters are to be supplied with the data logger unit.
- d. System shall provide measurement and recording along with instantaneous of 5 minute daily, monthly and annual average of following parameters:
 - (i) Power at grid terminal
 - (ii) Ambient temperature near array field.
 - (iii) Wind Speed
 - (iv) AC and DC side Power of each inverter
 - (v) Solar irradiation/isolation
 - (vi) Voltage at inverter
 - (vii) Exported Energy to grid.
 - (viii) Energy of each inverter
 - (ix) Solar Radiation
 - (x) Temperature.
 - (xi) Any other parameter considered necessary by supplier based on current prudent practice.
- e. All data shall be recorded chronologically date wise. The data file should be MS Excel compatible. The data logger shall have internal reliable battery backup and data storage capacity to record all sorts of data simultaneously round the clock. All data shall be stored

- in a common work sheet chronologically. Representation of monitored data in graphics mode or in tabulation form. All instantaneous data can be shown in the Computer Screen.
- f. The applicant shall provide compatible software and hardware so data can be transmitted via standard modem must be compatible with Modbus or TCP/IP protocol for communication.
 - g. Provision shall be available in the PCU for remote monitoring of following parameters:
 - (i) DC power input
 - (ii) DC input voltage
 - (iii) DC current
 - (iv) AC power output
 - (v) AC voltage (all the 3 phases and line)
 - (vi) AC current (all the 3 phases and line)
 - (vii) Power factor
 - (viii) In addition to the above, energy values to be displayed the number of PCUs is indicative only. The agency may design the system to extract maximum efficiency with inbuilt redundancy.
 - h. **Data Logging and Instrumentation** : The solar power plant shall be provided with Data logging system using PLC. The PLC shall be also used for string monitoring. The PLC used for data logging shall be computer conversant to monitor the data over internet and on computer using software and Ethernet cable.

14. Solar Power Plant Data Monitoring System

- a. Computer Aided Data Acquisition Unit shall have features for simultaneous monitoring and recording of various parameters of different sub-systems, power supply of the power plant at the AC side.
- b. Computer Aided data Acquisition Unit shall be a separate & individual system comprising of different transducers to read the different variable parameters, Interfacing Hardware & Software, Industrial type PC, which will be robust & rugged suitable to operate in the Control Room Environment.
- c. The PC shall of Industrial type, rugged & robust in nature of operate in an hostile environment. the PV have minimum Intel Core 2 Duo processor having 2 x 150 GB HDD with 2 GB RAM. The PC shall also have minimum 25 inches Colour monitor, DVD Drive with writer, multimedia kit and UPS backup. The printer shall be of industrial type rugged & robust in nature. The printer shall be equipped for printing.
- d. The data acquisition system shall perform but not limited to the following operations and Measurement and continuous recording of
 - Inverter Output.
 - System Frequency.
 - Energy Delivered to the GRID in KWH.
 - Generated Output In KWH
- e. The data file should be MS excel compatible. All data shall be stored in a common work sheet chronologically. Representation of monitored data in graphics mode or in tabulation form. All instantaneous data can be shown in the Computer Screen.
 - a) The Bill of Materials associated with the equipment must clearly indicate especially the details about the PC, Modems. etc.
 - b) Communication interface the entire system can be operated and monitored via several interfaces (RS232/RS485/ MPI/ Profibus/ Telephone modem/Ethernet) to have compatibility.

15. Space For Solar Array And Control Room

The agency shall give the details of array layout and control room layout before execution for approval.

16. Type Tests

Type test reports of all major equipment's (Solar module, battery & PCU) shall be submitted to the department. The type test report shall be within 5 years from bid opening date, in absence of which fresh type test shall be done without any cost to department.

17. Installation And Commissioning

Detailed project execution program shall be submitted along with the offer. The contractor will be responsible for arranging all tools & plants for installation and commissioning the complete system.

The contractor will also submit the erection, testing & commissioning procedure for approval to the owner. These procedures will form integral part of the acceptance report for successful erection and commissioning the system. These reports will be prepared and signed by contractor's representative & the owner concerned with project.

18. Training & After Sales Service

Training and after sales service is an important component of supply. The terms and conditions for training and after sales supply and service are to be presented clearly in the proposal and the extent and duration of after sales support clearly defined. An explanation of preventative maintenance schedule, plan of operation, scope and implementation of the after sales service is to be defined.

Three sets of installation manual / user manual shall be supplied along with each power plant. The manual shall include complete system details such as array layout, schematic of the system, inverter details, working principle etc. Step by step maintenance and troubleshooting procedures shall be given in the manual. Contractor shall supply three sets of soft copies (in Pen Drive/ CD form) of all documents including drawings and user manual.

D-12 : SPLIT/ CASSETTE AC

D12.1 SCOPE OF WORK

Scope of this sub head covers planning, designing, supply, installation, testing and commissioning of Split/ Cassette AC as per requirement of various rooms & buildings as specified Work includes not only the items exclusively defined hereunder but also any other item required to commission and complete the work as per site requirement in this sub head as per CPWD General Specification for Heating, Ventilation & Air Conditioning 2024 & Super ECSBC 2024 as amended upto date.

D12.2 SPECIFICATION

Split Air Conditioner Units

- i) Air-cooled split air conditioner Unit comprising of an Indoor unit and outdoor Unit. Indoor unit shall be Hi-wall, Cassette type.
- ii) Must be Energy Efficient & refrigerant used should be CFC free & low, preferably zero ODP.
- iii) Refrigerant piping and fittings interconnecting compressor condenser shall be all copper and valves shall be brass / gun metal construction.
- iv) Fan motor shall be suitable for $415 \pm 10\%$ volts or $230 \pm 10\%$ volts, 50 Hz, A.C. Supply, Single phase, motors shall be provided with permanent capacitor. Motors shall be especially designed for quite operation and motor speed shall not exceed 1440rpm.
- v) Fan speed shall not exceed 1000 rpm and maximum fan outlet velocity shall be 550 meters per minute.
- vi) Cooling coils shall be of fin and tube type having aluminium fins firmly bonded to copper tubes assembled in zinc coated steel frame / Multichannel.
- vii) Inverter Driven Compressor Air Conditioner depending upon suitability and applicability. Inverter driven AC must conform to minimum 5 Star Rating.

Description	
Compressor	Rotary / R32
Fan Speed (No. of Steps)	5
Air Flow (IDU)	≥ 530 CFM
Rated Power Supply	Single Phase, 230V, 50 Hz
Compressor Warranty	(10 Years)
Controller (PCB) Warranty	(5 Years)
Rated ISEER	≥ 5
Evaporator & Condenser Coil Material	Copper
Remote for Control	Yes
Noise level	≤ 37 dB

Tentative Inventory of Split AC (Hi-wall/ Cassette type)

Sl. No.	Location	1.5 TR Split AC	2 TR Split AC (Hi-wall/ Cassette type)
A	Training & Capacity		
	Ground Floor		
(i)	Library	-	6
(ii)	H.O.D		3
(iii)	Meetings Room (14 seats)	2	-
(iv)	Smart Class Room (108 Seats)	-	6
	First Floor		
(i)	Incubation Centre	-	6
(ii)	Cabin	2	-

Sl. No.	Location	1.5 TR Split AC	2 TR Split AC (Hi-wall/ Cassette type)
(iii)	Pedagogy expert	2	-
(iv)	Wild Life (SME)	2	-
(v)	Trainer	2	-
(vi)	Work Station	-	4
	Total (A)	10	25
B	Informatic and Analytic & Network and outreach unit		
	Ground Floor		
(i)	Statistician	1	-
(ii)	GIS Expert	1	-
(iii)	Screen & Server	2	-
(iv)	HOD Informatics and analytics	-	2
(v)	Research Associates and Data Analysts (14 Nos.)	3	-
(vi)	Meeting Room (12 Seats)	2	-
(vii)	IT Expert	1	-
(viii)	M&E Expert	1	-
	1st Floor		
(i)	RRT	1	-
(ii)	Regional Centre Coordination unit and workspace & Discussion area	-	2
(iii)	H.O.D. (Network and Outreach)	2	-
(iv)	Workstation	1	2
(v)	Meeting Room	2	-
(vi)	Policy	1	-
(vii)	Media	1	-
	Total (B)	19	6
C	Wildlife Health Management and Disease Investigation and Surveillance		
	Ground Floor		
(i)	Research Associates (28 Nos.)	-	6
(ii)	Wild Life Biologist	-	1
(iii)	Extra	-	1
(iv)	Immunologist	2	-
(v)	Micro biologist	2	-
(vi)	Animal Nutritionist	2	-
(vii)	HOD Wildlife Disease Investigation and Surveillance	4	-
(viii)	Meeting Room (14 Seats)	3	-
(ix)	Chemist	-	1
(x)	Jr. Veterinary Doctor	-	1
(xi)	Sr. Veterinary Doctor	-	1
(xii)	Operation Theatre	-	3
(xiii)	Instrument Room	-	2
(xiv)	Treatment Room	-	2
(xv)	Animal Treatment ward	-	2
	1st Floor		
(i)	Histopathology Lab	3	-
(ii)	Pathology Lab + Cabin	-	3
(iii)	Bio Informatics Lab + Cabin	3	-

Sl. No.	Location	1.5 TR Split AC	2 TR Split AC (Hi-wall/ Cassette type)
(iv)	Biotechnology Lab	2	1
(v)	Bio Statisticians	2	-
(vi)	Room	2	-
(vii)	Room	2	-
(viii)	Epidemiologist	-	1
(ix)	Pathologist	-	1
(x)	Toxicologist	-	1
(xi)	Vaccinologist	2	-
(xii)	Molecular Biologist	-	1
(xiii)	BSI Lab 1 + Cabin	2	-
(xiv)	BSI Lab 2 + Cabin	-	2
(xv)	Virology Lab + Cabin	-	2
(xvi)	Toxicology Lab + Cabin	-	2
(xvii)	Microbiology Lab	3	-
(xviii)	Biotechnologist	-	1
(xix)	Bioinformatic Expert	2	-
	Total (C)	36	35
D	Administrative Department		
	Ground Floor		
(i)	Deputy Directors Room	2	-
(ii)	Technical Assistant	4	-
(iii)	Directors room	-	2
(iv)	Vice Chairman Room	4	-
(v)	PA + Technical Assistant + Waiting Area	2	-
(vi)	Chairmans Room	2	-
(vii)	Board Room (32 + 32 Seat)	-	5
	1st Floor		
(i)	Admin Work Station	-	5
(ii)	Procurement office	2	-
(iii)	Audit office	2	-
(iv)	External Audit	2	-
(v)	Legal Expert	2	-
(vi)	Finance H.O.D. + PA + Waiting Area	-	3
(vii)	Meeting Room	2	-
(viii)	Admi H.O.D. + PA+ Waiting Area	-	3
(ix)	Admin Office	2	-
(x)	Establishment office	2	-
	Total (D)	28	18
	Grand Total (A+B+C+D)	93	84

D12.3 Outside Conditions

- a. Outdoor Design Conditions for Junagarh are based on ISHRAE-Indian Weather data-2017 & NBC-2016.

D13.3.1. Inside Conditions: As per NBC 2016 or special required if any.

D13.3.2. Lighting Load: As per ECBC

D13.3.3. Equipment Load: As per Actual & NABH, ASHRAE etc.

The EPC contractor has to submit heat load design data for selection of Split AC.

D12.4 SAMPLE

The contractor shall bring sample of materials for approval of the Engineer-in-charge. (For Equipments Model and makes shall be got approved) . Sample of approved materials must be kept at site for inspection/comparison with materials to be used in work by senior officers. All materials shall be delivered with manufactures test certificates and technical catalogues, instructions manuals, wiring diagram etc. as required.

D12.5 DRAWINGS FOR APPROVAL ON AWARD OF THE WORK

The contractor shall prepare and submit two sets of hard copy of following drawings and 2 sets in soft copy and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved drawings and agreement.

- (i) Layout drawings of the various system along with Layout of equipment's to be installed.
- (ii) SLD's
- (iii) Any other drawings relevant to the work.

D12.6 DRAWINGS AFTER COMPLETION OF WORK

The contractor shall submit Two sets of as-built drawings on white paper and 2 sets in soft copy to the owner/ Engineer-In-Charge after completion of the work. In addition, the following shall also be provided:

- a. Test Certificates
- b. Warrantee Certificates
- c. O&M Manuals of Equipments
- d. Any other information the Engineer-In-Charge may deem fit.

D-13 : AUDIO – VIDEO WORK (SMART CLASS ROOM):-

D13.1 SCOPE OF WORK

Scope of this sub head covers planning, designing, supply, installation, testing and commissioning of Audio-Video work as per requirement of **108 seated Smart Class Room** in Training & Capacity Block as specified Work includes not only the items exclusively defined hereunder but also any other item required to commission and complete the work as per site requirement in this sub head.

D13.2 SPECIFICATION

LED Video Wall/ Active LED:

LED Indoor Video wall with 1.5 mm - 1.6 mm Pixel pitch, size of minimum 2870 x 1625 mm (approx.), aspect ratio 16:9, Brightness: 600 Nits or better, Pixel Configuration: 3in1 SMD or better, Pixel density: 4,00,000 pixels/m² or better, Contrast Ratio: 5000:1 or better, 4 Trillion Colours or better, LED lifespan: 100,000 hrs or better, 14/16-bit processing or better, Brightness Uniformity 97% or better, Viewing angle 160° both horizontal and vertical or better, Refresh rate 3840Hz or better, IP 20 rating, 100% front serviceable, Average Power consumption <225 W/m². Should have redundant inbuilt power. (Certification: CE/UL/BIS)

Video Wall Controller

Should be supplied with video wall controller/processor. Should be certified/complied with provided LED wall proposed make. The Video Wall controller should have minimum 4xHDMI inputs , 2xHDMI scaled outputs supporting resolution upto 4K@60Hz, aspect ratio 16:9 or better. The video wall controller should have capability to provide Picture In Picture, Picture by Picture on the video wall etc complete as required.

The LED Video wall should be supplied with minimum 6% spares at site. Should be supplied with mounts and interconnecting cables and other installation accessories as required.

(With 5 year on site warranty for complete item)

LED Display:

75" or Higher, LED Back Lit Panel, Panel Technology -(IPS/ VA), Native Resolution- 3840 x 2160 (UHD), Brightness -440cd/m² or better, Contrast Ratio- 1000 : 1 or better, Dynamic CR- 400,000 : 1 or better, Operating System- WebOS/ Tizen/ Android, Orientation -Portrait & Landscape, Viewing Angle(H x V) -178 x 178, Response Time- 8 ms or better, Operation Hours- 24 Hrs , Connectivity - Input Ports -Digital HDMI(3), Display Port(1), External Control RS232C(1), RJ45(1), IR(1, Internal), USB -1, Output Ports- Audio Out-1, AUDIO -Audio Power 20W(10W x 2), Additional feature Inbuilt : Internal Memory 8 GB or better, Wi-Fi, Screen Sharing feature with all devices, Media Player, SNMP Support, Temperature Sensor, Auto Brightness Sensor, Local Key Operation, USB Plug & Play, Fail over, Wake on LAN, Media Player, Picture in Picture (Optional), Environment Conditions , Operation Temperature- 0 °C to 40 °C or better, Operation Humidity - 10 % to 80 % or better, POWER - Power Supply 100-240V~, 50/60Hz, Power Type- Built-In Power, Speakers - 20W(10W x 2) , Power Supply 100 – 240 V, 50/60 Hz, Certifications UL/BIS, Wall mount accessories as per site requirement, Remote control, Standard cable.

(With 5 year on site warranty)

Ceiling Speaker:

Full Range, Ceiling-mount loudspeaker. Frequency range - 80 Hz to 16 kHz or better, Rated RMS Power - 16 Watts or better, Sensitivity-86 dB SPL or better, Coverage Angle-130° conical or better, Maximum SPL Continuous/Peak- 99dB/105dB or better, Rated Impedance - 8/16 Ohms. Transformer Tapping - 70V/100V. Transducer - 4-inch or better, with steel/ Al. Back can. Mounting rails and C-Ring etc. for ceiling tile included / as required.

(With 5 year on site warranty)

Amplifier:

Dual Channel Class-D amplifier. Per Channel Power 200W @8Ω/4Ω/70V/100V or better. Power

Sharing or Bridge/Parallel modes for better power distribution. Frequency Response- 20 Hz – 20 kHz or better. Signal to Noise ratio -> 100 dB or better, Input impedance - >10k, balanced or unbalanced or better, LED indicators for Power, signal (per channel), limit / mute / protect etc. or better. Better to have Remote standby and Power saving features - Auto-standby.
(With 5 year on site warranty).

Digital Signal Processor:

Digital Signal Processor with minimum 12 Mic/Line inputs and 8 Line outputs. Shall support phantom power on each microphone input. AEC channels - 12 or more with 300ms tail length or better. Minimum 8x8 Dante channels or more and support for 32x32 Network or more audio channels via Dante /AES67 or similar protocol. POTS and SIP Softphone integration for Audio conferencing. USB-B port supporting AV USB Bridging for software or web-based conferencing applications emulating USB Audio (Speakerphone) and USB Video (Camera) driver. 16x16 GPIO ports for Microphone look at me integration. 24 bit-A/D-D/A converters or better, 48 kHz Sample rate or better, Input frequency response of 20 Hz to 20 kHz or better, Input dynamic range > 109 or better. Ports - RS232, 2 or More LAN ports for Redundancy. **(With 5 year on site warranty).** The DSP should have features like conference room routers, input equalizers, router, band pass filter, output equalizer, delay, limiters, gates, source selectors etc.

Note : Required hardware / perpetual software should be added to match the compliance. All items should be from the same OEM as of Digital Signal Processor for compatibility etc. complete as required.

Wireless Handheld Microphone:

Digital Wireless UHF handheld microphone set with Rack receiver having 56 MHz or higher of switching bandwidth and equidistant spacing enables up to 90 channels or more along with 2,240 selectable frequencies for fine-tuning. It should have auto scan feature for efficient connections to reduce time and effort. It should have a minimum 100 meter transmission range. It should have a Cardioid pick-up pattern, Sound pressure level (SPL) : 150 dB or more, System Latency : 1.9 ms, Dynamic range: 130 dB and frequency response: 20Hz- 20000 Hz. The microphone system can be controlled through ios / Android applications via Bluetooth. It should have 12 hours of operation life and more.

(With 5 year on site warranty)

Wireless Lapel Microphone:

Wireless Lapel Microphone Set. Frequency Response - 50 to 15,000 Hz or better, Polar Pattern - Omnidirectional, Channels – Upto 48 simultaneous Channels across all bands or more, Range – 300 ft or more, Frequency Auto Scan Functionality, Power Requirements : 2 X AA batteries, 1.5 V, alkaline or similar, Battery Life : Should be more than 12 hours (alkaline) .

Note: All required hardware / perpetual software should be added to meet the requirement and match the compliance. All hardware / software should be from the same OEM for interoperability.

(With 5 year on site warranty)

Digital Podium:

Digital Interactive Podium in Metallic Frame with option of Tilting of the Interactive Panel, provision to install Gooseneck Microphone, Keyboard Tray and space to store AV equipment. Top connectivity plate with Min. 1 No. HDMI, USB x 2, VGA + Audio and Power socket for external Laptop connectivity. OPS should be from the same OEM as kiosk /podium 12gen Core i5 Processor, 8GB RAM and 256GB SSD Storage complete as required at site. PCAP Interactive LED display should be full HD resolution of 1920x1080, the toughened front protection glass on the display should be of 7H hardness with Anti finger mark plasma coating , 24/7 commercial grade , 70000hours life of the display , Brightness min. 450 cd/m2 Interactive PCAP IPS LED.

(With 5 year on site warranty)

Network Video Endpoint:

4K60 4:4:4 Network Video Endpoint, software configurable as **Encoder or Decoder**. Minimum 3 HDMI 2.0 Inputs & Minimum 2 HDMI 2.0 Outputs. Resolution Support upto 4K60 4:4:4. HDCP

1.4 and 2.2 compliant. USB-B port for Web Conference integration, delivering video feeds from PTZ-IP conference cameras and audio feeds from host PC for web conference applications. Audio Inputs: 1 x Mic/line input on a 3.5 mm TRS connector for PC-Level audio input from a microphone or media player. Analog Audio Output: 1 x Line output on a 3.5 mm TRS connector. Simultaneous streaming capabilities from all Inputs. Control: RS-232 & GPIO ports with 3 Pin euroblock terminal for control of third-party devices. Power - PoE 802.3bt Type 4 and 48 V DC Nominal, 1.5 A on 2-pin Euro connector. Should include all mounting accessories.

(With 5 year on site warranty)

4K Video conference Camera:

4K Network PTZ Conference camera with minimum 20X optical zoom & 60-degree horizontal coverage. Low Noise CMOS 4K image sensor with User-configurable resolution and quality for IP streams (up to 1080p). HDMI resolutions up to 4K30 or better and SDI-3G resolution up to 1080p60 or better. Image rotation controls to allow for inverted mounting using ceiling bracket. Minimum Illumination - 0.5 Lux @ (F1.8, AGC ON) or better, Horizontal Rotation Range - $\pm 170^\circ$, Vertical Rotation Range - -30° to $+90^\circ$ or better, White Balance controls- Auto, indoor, outdoor, one-push, manual, specified color temperature or better. Camera should be able to transmit video via network to USB endpoint connected for video conferencing. Power – PoE & AUX. Shall include wall mounting bracket included.

(With 5 year on site warranty).

Control System:

AV Hardware or Software based control system with required Ports to control the devices mentioned in BOQ with perpetual licenses to connect Wall/Table mount touch screen controllers and iOS and Windows devices as wireless touch controller.

Note : Required hardware / perpetual software should be added to match the compliance and achieve the functionality. All the items should be from the same OEM as of the control system.

Touch Panel:

High Definition, Multi-touch Touch Screen Controller with 24-bit color display. Viewable Screen Dimensions (diagonal) – 7-inch / 8 inch, Resolution - 1280 × 800, Brightness - 350 Nits or better, Aspect ratio – 16:10, Power – PoE, Mounting – Wall and Tabletop, Orientation - Vertical / horizontal. Configurable LEDs on both sides. Ambient Light Sensor, Proximity Detection.

(With 5 year on site warranty).

Network Switch:

16 port L2 Gigabit POE+ Network Switch. PoE Budget - 480W or better. Multicast support with IGMP V1/V2 or better, QoS support, IPV4/IPV6 Support, Switching Capacity in Gigabits per Second, 1 Gbps Non-blocking ports with standard accessories.

Equipment Rack:

18/ 19U Equipment Rack with standard accessories.

HDMI Cable:

Gold Plated, Rust free 18Gbps 6/15-feet HDMI Cable.

Speaker Cable:

2/ 4 core 1.5 sq.mm PVC Sheathed loudspeaker cable.

Microphone Cable:

2 core shielded balanced microphone cable.

CAT-6/ 6A Cables:

Cat-6/ 6A Cable for AV Network connectivity

USB A-B & C Cable:

6" High speed USB A-B 3.0 Cables & 6" High speed USB-C cables with Thunderbolt Video

and 65W charging Support.

Recording and Streaming Media Processor:

Recording and Streaming Media Processor. HDMI Inputs - 3 or more / SDI/HD-SDI Inputs - 2 or more. Outputs - 1x HDMI or more. Analog Audio Inputs and Outputs, Simultaneously Record and Stream, Dual channel recording and streaming with confidence stream, Internal Storage - 400GB or more, Ethernet Port for Control and Management.

(With 5 year on site warranty)

UPS:

5 KVA Online UPS.

D13.3 TENTATIVE INVENTORY

Sl. No.	Description of Item	Minimum Quantity
1	LED Video Wall/ Active LED (size of minimum 2870 x 1625 mm (approx.))	1 No.
2	LED Display: 75” or Higher	2 Nos.
3	Ceiling Speaker: 16 Watts or better	12 Nos.
4	Amplifier	1 No.
5	Digital Signal Processor	1 No.
6	Wireless Handheld Microphone	4 Nos.
7	Wireless Lapel Microphone	2 No.
8	Digital Podium complete set	1 No.
9	Network Video Endpoint	1 No.
10	4K Video conference Camera	1 No.
11	Control System	1 No.
12	Touch Panel	1 No.
13	Network Switch: 16 port or Higher	1 No.
14	Equipment Rack: 18/ 19U	1 No.
15	Recording and Streaming Media Processor	1 No.
16	HDMI Cable	1 Lot
17	Speaker Cable	1 Lot
18	Microphone Cable	1 Lot
19	CAT-6/ 6A Cables	1 Lot
20	USB A-B &C Cable	1 Lot
21	UPS: 5 KVA online	1 No.

D13.4 SAMPLE

The contractor shall bring sample of materials for approval of the Engineer-in-charge. (For Equipments Model and makes shall be got approved) . Sample of approved materials must be kept at site for inspection/comparison with materials to be used in work by senior officers. All materials shall be delivered with manufactures test certificates and technical catalogues, instructions manuals, wiring diagram etc. as required.

D13.5 DRAWINGS FOR APPROVAL ON AWARD OF THE WORK

The contractor shall prepare and submit two sets of hard copy of following drawings and 2 sets in soft copy and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved drawings and agreement.

- (i) Layout drawings of the various system along with Layout of equipment’s to be installed.
- (ii) SLD’s
- (iii) Any other drawings relevant to the work.

D13.6 DRAWINGS AFTER COMPLETION OF WORK

The contractor shall submit Two sets of as-built drawings on white paper and 2 sets in soft copy to the owner/ Engineer-In-Charge after completion of the work. In addition, the following shall also be provided:

- a. Test Certificates
- b. Warrantee Certificates
- c. O&M Manuals of Equipments
- d. Any other information the Engineer-In-Charge may deem fit.

**LIST OF PREFERRED MAKE / MANUFACTURERS FOR DIFFERENT MATERIALS TO BE USED
IN THIS WORK / PROJECT FOR ELECTRICAL WORKS**

SL. NO.	ITEMS	MAKES
	ELECTRICAL INSTALLATIONS & GENERAL	
1	PVC INSULATED FRLS COPPER CONDUCTOR SINGLE CORE CABLE	POLYCAB/ KEI/ HAVELLS/ RR KABEL/ FINOLEX
2	MS CONDUIT AND ITS ACCESSORIES	AKG/BEC / NIC
3	PVC CONDUIT AND ITS ACCESSORIES	AKG/BEC/ PRECISION
4	G.I. RACE WAY	LEGRAND/ MK (HONEY WELL)/ OBO
5	MODULAR SWITCH & SOCKET/ USB CHARGER/ TELEPHONE SOCKET / TV SOCKET / FAN REGULATOR	MK -ORNA / PANASONIC (EUROPA) / HAVELLS (CRABTREE MURANO)
6	ANCHOR FASTENER	HILTI/ 3M/ FISCHER
8	1.1 KV GRADE XLPE POWER CABLE/ FIRE SURVIVAL CABLE/ 11 KV GRADE XLPE POWER CABLE/ CABLES (CONTROL, SIGNAL & COMMUNICATION, COAXIAL SYSTEM CABLE)/ FAS & PA SIGNAL & COMMUNICATION CABLE (INDIGENOUS)	POLYCAB/ KEI/ HAVELLS/ RR KABEL/ FINOLEX
9	CABLE LUGS AND GLAND	GRIPWEL / DOWELL/ COMET
10	CAT-6 UTP/CAT-6A, UTP/ UTP PATCH CORD/CAT 6 I/O/JACK PANEL/LIU/FACE PLATE /FIBER CABLES, STP CABLE, FIBRE OPTICS CABLE	LEGRAND/ COMMSCOPE/ PANDUIT/ BELDON
11	GI PERFORATED CABLE TRAY	INDIANA / AKG/BEC
12	UPVC/ HDPE PIPE/DWC	DURALINE/ REX/ TIRUPATI
13	RACK (EPABX/ AUDIO VIDEO/ CCTV etc.)	PANDUIT/ APW/ HP/ POWERIDE/ PROTECTION ENGINEERING/VALRACK
14	PAINT, PRIMER	ASIAN PAINT/ NEROLAC / BERGER/ ICICI
15	ANTI-VIBRATING MOUNTING PADS	DUNLOP/ RESISTOFLEX/ EASYFLEX/ FLEXIONICS
16	MS PIPE, GI PIPE	SAIL/ TATA/ JINDAL (HISSAR)
17	SEALING COMPOUND	HILTI/3M/ M-SEAL
	<u>DG SET</u>	
1	DIESEL ENGINE	CUMMINS / CATERPILLER/ PERKINS/ KIRLOSKAR OIL ENGINE LTD.
2	ALTERNATOR	STAMFORD/ CROMPTON/ LEROY SOMER/ KIRLOSKAR ELECTRIC
3	PROTECTION RELAYS & CT'S	AS PER MAIN EQUIPMENT MANUFACTURES STANDARD, L&T/ SIEMENS/ SCHNEIDER ELECTRIC
4	BATTERY	EXIDE / AMARON/ TATA GREEN/ PANASONIC
5	DG SET - ACOUSTIC ENCLOSURE & ASSEMBLER	AS PER OEM

SL. NO.	ITEMS	MAKES
6	AMF CONTROLLER	AS PER OEM
7	POWER/ AUXILLARY CONTACTOR/ CAPACITOR DUTY CONTACTOR / METERS INCLUDING DIGITAL METERS / INDICATING LAMP (LED TYPE) / PUSH BUTTON / STARTERS /OVERLOAD RELAY / TIMER	L&T/ SIEMENS/ SCHNIEDER ELECTRIC/ ABB
8	BRASS COMPRESSION GLAND (HEAVY DUTY)	COMMEX/ GRIPWELL/ DOWELL
	<u>SUB-STATION</u>	
1	11 KV VCB PANEL (NO CHANNEL PARTNERS ARE ALLOWED)	ABB / SCHNEIDER ELECTRIC/ SIEMENS/ KIRLOSKAR
2	DRY TYPE (CAST RESING TYPE)/ OIL TYPE TRANSFORMER (11KV/433 VOLT)	KIRLOSKAR/ VOLTAMP/ CROMPTON GREEVES
3	ACB	SCHNEIDER ELECTRIC – MASTERPACT NW (6.0A)/ L&T - U POWER OMEGA (MTX3.5)/ SIEMENS 3WL (ETU 45B)/ ABB EMAX (PR122)
4	MCCB	SCHNEIDER – COMPACT NSX/ L&T DU/ ABB TMAX
5	MCB/ RCCB/ ISOLATOR	SCHNEIDER - ACTI9/ HAGER-H3/ SIEMENS BETA GUARD 10KA/ ABB SB200M
6	MCB DB	HAGER / SIEMENS (BETAGARD) /SCHNEIDER (ACTI-9)/ABB (ITUS)
7	MAIN LT PANEL/ SUB LT PANELS/ CAPACITOR PANEL/ SYNCHRONIZING PANEL WITH ACCESSORIES/ METER PANEL/ STARTER PANEL	NEPTUNE/ ADVANCE PANELS & SWITCHGEAR (P) LTD / ADLEC / TRICOLITE
8	BUS DUCT, AIR INSULATED COMPACT RISING MAINS, END FEED UNIT, TAP-OFF BOX (PLUG-IN TYPE)	SCHNEIDER ELECTRIC/ RR BUS DUCT/ L&T
9	HT, LT JOINTING KIT & TERMINATION KIT	REYCHEM/ 3M/ M SEAL/ ABB
10	SOFT STARTERS	SIEMENS/ SCHNEIDER/ ABB / L&T
11	CT, PT	ADVANCE / KAPPA / AE
	<u>UPS</u>	
1	UPS	SCHNEIDER (APC)/ EATON/ EMERSON (VERTIV)/ PEGASUS/ ABB
	<u>LIGHTING, FIXTURES & FANS</u>	
1	CEILING FAN / EXHAUST FAN / KITCHEN FRESH AIR/ WALL FAN	HAVELLS/ CROMPTON/ USHA /BAJAJ
2	LED EXIT SIGNAGE	MR. LITE/ PROLITE/ REGENT/ ADVERT ELECT.
3	LED INDOOR LUMINAIRES/ LED DECORATIVE LIGHT LUMINAIRES	PHILIPS/ REGENT/ LIGHTING TECHNOLOGY
4	LED STREET LIGHT/ OUTDOOR FITTINGS	REGENT/ LIGHTING TECHNOLOGY
5	MS DECORATIVE POLE	PHILIPS/ BAJAJ / HILITE/ TWINKLE LUXMAX/ HAVELLS/ LUSTER
6	BOLLARDS	PHILIPS/ REGENT/ LIGHTING TECHNOLOGY/

SL. NO.	ITEMS	MAKES
7	POLYCARBONATE JUNCTION BOX WITH CONNECTOR	HENSEL / RITTAL/ SCHNIEDER/ GE POWER
8	SENSORS FOR LIGHT CONTROL	PHILIPS /ABB /HONEY WELL / SCHNEIDER ELECTRIC/ PANASONIC
9	TIMER FOR LIGHTING CONTROL	PHILIPS /ABB /HONEY WELL / SCHNEIDER ELECTRIC/ SIEMENS/ L&T
	<u>EPABX</u>	
1	IP-PBX SYSTEM / IP PHONE	CISCO/ POLYCOM/ MYTEL/ AVAYA
2	SERVER	DELL / HP/ IBM / LENOVO
3	WI- FI SYSTEM	CISCO/ JUNIPER/ ARISTA / NETGEAR
4	CALLER ID PHONE	BEETEL/ CORAL TELECOM
5	JELLY FILED TELEPHONE CABLE	HAVELLS/ POLYCAB/ KEI
	<u>FIRE ALARM SYSTEM</u>	
1	ADDRESSABLE FIRE ALARM CONTROL PANEL	EDWARDS / NOTIFIER (HONEYWELL) / SIEMENS /PANASONIC
2	ADDRESSABLE DETECTORS, GRAPHIC USER INTERFACE SOFTWARE, SOUNDER CONTROL MODULE /MONITORING MODULE, RESPONSE INDICATORS, MANUAL CALL BOXES, INPUT /OUTPUT DEVICES	EDWARDS / NOTIFIER (HONEYWELL)/ SIEMENS/PANASONIC
3	MANUAL CALL POINT, HOOTER	SIEMENS / NOTIFIER (HONEYWELL) / PANASONIC
4	MAIN CONTROL PANEL	EDWARDS / NOTIFIER (HONEYWELL)/ SIEMENS / PANASONIC
5	OPERATING STATION	DELL/ HP/ LENOVO
6	COLOR MONITOR	SAMSUNG/ PANASONIC/ SONY
	<u>PUBLIC ADDRESS SYSTEM</u>	
1	PUBLIC ADDRESS SYSTEM CONSOLE AND ALL ACCESSORIES	BOSCH/ BIAMP/ HONEYWELL
2	P.A. SPEAKERS/ HORNS/ AMPLIFIERS	BOSCH/ BIAMP/ HONEYWELL
	<u>FIRE FIGHTING SYSTEM</u>	
1	2-WAY/4-WAY FBC, AIR RELEASE VALVE, DOUBLE/SINGLE HEADED LANDING VALVE	SAFEX/ NEWAGE/ LIFE GAURD
2	DIESEL ENGINE (FIRE-FIGHTING)	CUMMINS/ KIRLOSKAR/ ASHOK LEYLAND/ GREAVES / CATER PILLER
3	DIESEL ENGINE ALTERNATOR	SIEMENS/ KIRLOSKAR/ ABB/ CROMPTON
4	FIRE EXTINGUISHERS	SAFEX/ CEASEFIRE/ MINIMAX/ LIFE GUARD/ FIRE SHIELD
5	FIRE HOSE	CRC/ NEWAGE / MINIMAX/ LIFEGUARD/ SAFEX
6	FIRE MAN AXE	CRC/ NEWAGE/ MINIMAX/ LIFEGUARD/ SAFEX
7	FIRST AID HOSE REEL AND DRUM	FIREX /LIFEGUARD/ SAFEX/ EVERS SAFE/ NEWAGE
8	FLEXIBLE COUPLINGS	LIFE GUARD/ VICTAULIC/ TYCO/ GRIDNELL/ RAPID DROP
9	FLEXIBLE DROP	LIFE GUARD/ VICTAULIC/ TYCO/ GRIDNELL/ RAPID DROP
10	HOSE BOX (EXTERNAL) STAINLESS STEEL	MANUFACTURERS OF PANELS

SL. NO.	ITEMS	MAKES
11	INSTALLATION CONTROL VALVE/ DELUGE VALVE	SAFEX/ TYCO/ HD/ VICTAULIC/ LIFEGUARD
12	SPRINKLER HEADS	TYCO/HD/ VICTAULIC/RAPID DROP/ LIFE GUARD/ VIKNG
13	SPRINKLER PANEL, CURTAIN SYSTEM PANEL	TYCO/ HONEYWELL/ HD/ VIKING/ NOTIFIRE
14	STAINLESS STEEL BRANCH PIPE	SAFEX/ LIFE GUARD / NEW WAGE
15	FIRE WATER JOCKEY/ MAIN PUMP SET- HYDRANT SYSTEM, SPRINKLER SYSTEM, WATER CURTAIN SYSTEM	ARMSTRONG/ GRUNDFOSS// WILO/ MATHER PLATT/ XYLEM
16	ELECTRICAL MOTOR	ABB/ BHARAT BIJLEE/ KIRLOSKAR ELECTRIC CO./ SIEMENS INDIA LTD/ CROMPTON GREAVES LTD
17	THERMAL INSULATION FOR EXHAUST PIPE	UPTWIGA/ LLOYD INSULATION/ OWENS CORNING/ KIMMCO
18	M.S. FITTINGS	UNCO/ UNIK/ NEW/ HB/ BHARAT FORGE
19	WELDING RODS	ADANI/ L&T/ ESAB/ MARGLAM
20	STRUCTURAL STEEL	TATA/ SAIL/ JINDAL HISSAR APL-APOLLO
21	BUTTERFLY (MANUAL, GEAR OPERATED) VALVES, NON-RETURN VALVES, SLUICE VALVES	AUDCO/ ADVANCE/ ZOLOTO/ SANT/ HONEYWELL/ KIRLOSKAR
22	TAMPER SWITCH FOR BUTTERFLY VALVE	HONEYWELL/ POTTER/ RAPID CONTROL/ SYSTEM SENSOR/ PACIFIC FIRE
23	BALL VALVES, GLOBE VALVE, AIR RELEASE VALVE	ZOLOTO/ SANT/ HAWA/ HONEYWELL/ CASTLE
24	FOOT VALVE WITH STRAINER	KIRLOSKAR/ NORMEX/ CASTLE/ AUDCO
25	Y-TYPE STRAINER	ZOLOTO/ HONEYWELL/ EMERALD/ SANT/ KARTAR/ DRP
26	AIR VESSEL	NEMA/ ZENITH/ AS PER CPWD SPECIFICATIONS TESTED UPTO 25KG/SQRMTR /LIFE GUARD
27	PRESSURE RELEASE VALVE	NEWAGE (MUMBAI)/ CLA-VAL/ TYCO/ VIKING/ H-GURU
28	PRESSURE SWITCH	DANFOSS/ INDFOS/ VIKING/ DELTA CONTROL
29	PRESSURE GAUGE	FEIBIG/ H. GURU/ EMERALD/ WAAREE
30	FLOW TEST METER	VIKING/ NEWAGE (MUMBAI)/ GLOBAL VISION/ EUREKA FORBES/ FABRI-TEK EQUIPMENTS PVT LTD./ GERAND
31	HYDRANT VALVE, BRANCH PIPE WITH NOZZLE	SAFEX/ MINIMAX/ EVERS SAFE/ LIFE GUARD
32	HOSE COUPLING	SAFEX/ MINIMAX/ EVERS SAFE/ LIFE GUARD
33	FIRE BRIGADE CONNECTION	NEWAGE (MUMBAI)/ EVERS SAFE/ SHAH BHOGILAL/ NEWAGE (SURENDRANAGAR)/ GTECH/ SAFEGUARD
34	ZONE CONTROL VALVE (ZCV)	TYCO/ VIKING/ HD FIRE/ RELIABLE
	HVAC	
1	SPLIT TYPE AC	HITACHI/ MITUSBISHI/ O-GENERAL
2	REFRIGERANT PIPING	MANDEV / MEXFLOW / RR SHRMIK
3	CLOSED CELL NITRILE RUBBER INSULATION/ EPDM INSULATION	ARMAFLEX /AEROCELL / ALP
4	INLINE FANS	SYSTEMAIR/ KRUGER/ GREENHECK/ HUMIDIN/ NICOTRAAIR

SL. NO.	ITEMS	MAKES
5	M.S. SHEETS	SAIL/ TATA/ JINDAL
6	CO2 SENSOR	SCHNEIDER/ HONEYWELL/ SIEMENS/ OMICRON
	<u>LIFT</u>	
1	LIFT	KONE ELEVATORS INDIA PVT. LTD./ MITSUBISHI / SCHINDLER/ OTIS ELEVATOR/ JHONSON
	<u>PUMPS</u>	
1	WATER SUPPLY, STP, DRAINAGE, SUBMERSIBLE	KIRLOSKAR /KSB/ GRUNDFOSS/ WILO/ XYLEM/ ARMSTRONG
	<u>LAN</u>	
1	NETWORK SWITCH /MEDIA CONVERTOR	NETGEAR/ JUNIPER/ CISCO/ EXTREME/ ARISTA
2	PORT MANAGED POE ETHERNET SWITCH	CISCO/ JUNIPER/ NETGEAR/ EXTREME/ ARISTA
3	WI- FI SYSTEM	CISCO/ JUNIPER/ ARISTA / NETGEAR
	<u>SOLAR POWER</u>	
1	POWER CONDITIONING UNIT (PCU)	SMA(GERMANY)/DELTA/SCHNEIDER ELECTRIC/ABB/PANASONIC
2	SOLAR PV PANEL	TATA SOLAR/ BHEL/ EXIDE/ HAVELLS/ WAAREE ENERGY/ UTL SOLAR/PANASONIC
3	INVERTER PANELS FOR SOLAR POWER SYSTEM	TRICOLITE / ADVANCE POWER CONTROL LTD. /NEPTUNE
4	SOLAR INVERTERS	DELTA/ SMA/ ABB
5	DATA LOGGER	COMPATIBLE TO INVERTER
6	INDUSTRIAL PC FOR DATA MONITORING	HP/ DELL/ LENOVO/ IBM
	<u>ETP</u>	
1	ETP PLANT MANUFACTURER	GRANNUS WATER AND ENVIRONMENTAL SOLUTIONS PVT. LTD./ CIMERA ENGINEERS/ SPECTRUM ENGINEERING TECH PVT. LTD.
2	AIR BLOWER	EVEREST / BETA / AKASH /INGERSOLE
3	AIR DIFFUSERS	REHAU / WELBRICK / MM AQUA
4	RAW SEWERAGE TRANSFER PUMP/ SLUDGE RECYCLE PUMP/ FILTER FEED PUMP/ NON CLOG HORIZONTAL CENTRIFUGAL PUMP/ DE WATERING PUMP	ARMSTRONG/ XYLEM/ GRUNDFOS/ KIRLOSKAR / WILO
5	DOSING PUMP/ SBR FEED PUMP/ FILTER FEED PUMP/ SLUDGE PUMP/ CHLORINE DOSING PUMP	ARMSTRONG/ XYLEM/ GRUNDFOS/ KIRLOSKAR / WILO
6	FILTER PRESS	SACHINFILTECH / PHARMATECH
7	TUBE SETTLER MEDIA /MBBR MEDIA	WELBRICK / PHARMATECH / MM AQUA
8	M.S. FILTER	WELBRICK / ION EXCHANGE / ASTHA / THERMAX
9	OZONATOR	CREATIVE/ OZONICS/ ORAPL
10	NON CLOGG HORIZONTAL SCREW TYPE FILTER PRESS PUMP	ROTO/ POSITIVE/ ROTAMAC/ TUSHACO
11	CENTRIFUGE	APOLLO / WELBRICK / GWSPL / PHARMATECH
12	PRESSURE GAUGE	H GURU / FEIBIG / GLUCK

SL. NO.	ITEMS	MAKES
13	BUTTERFLY / DUAL PLATE CHECK VALVES	ZOLOTO / ADVANCE / CASTLE / SANT
14	MCB	LEGRAND/ SCHNEIDER/ L&T
15	METERING CT	KAPPA/ AE/
16	DIGITAL VOLTMETER	ENERCON/ L&T/ LEGRAND/ ABB/ SCHNEIDER
17	DIGITAL AMMETER	ENERCON/ L&T/ LEGRAND/ ABB/ SCHNEIDER
18	INDICATION LIGHT	L&T/ LEGRAND/ ABB/ SCHNEIDER
19	OVERLOAD RELAY	L&T/ LEGRAND/ ABB/ SCHNEIDER
20	POWER CONTACTOR	L&T/ LEGRAND/ ABB/ SCHNEIDER
21	PUSH BUTTON	L&T/ LEGRAND/ ABB/ SCHNEIDER
22	PLC	DELTA/ SIEMENS/ SCHNEIDER
23	SINGLE PHASE PREVENTER	L&T/ LEGRAND/ ABB/ SCHNEIDER
	<u>AUDIO-VIDEO</u>	
1	LED VIDEO WALL	CHIRSTIE / BARCO / SAMSUNG/LG/ PANASONIC
2	LED DISPLAY	CHIRSTIE/ SAMSUNG/ LG/ SONY/ PANASONIC
3	PROJECTOR	PANASONIC/ SONY/ CHRISTIE
4	WIRELESS HANDHELD MICROPHONE	SHURE/TELEVIC/SENNHEISER/ EARTHWORK/ TELEVIC
5	WIRELESS LAPEL MICROPHONE:	SHURE/TELEVIC/SENNHEISER/ EARTHWORK/ TELEVIC
6	DIGITAL PODIUM	AHA/ UNI/ GLOBUS
7	NETWORK VIDEO ENDPOINT	QSC/KRAMER/EXTRON/ LIGHTWARE/ CRESTRON/ LUMENS
8	FULL RANGE CEILING SPEAKERS	QSC/ BOSE/ QUEST/ ELECTROVOICE/ BIAMP
9	2 WAY SPEAKER – TYPE 1 & 2	QSC/ BOSE/ QUEST/ ELECTROVOICE
10	SUBWOOFER	QSC/ BOSE/ QUEST/ ELECTROVOICE
11	SURROUND SPEAKER	QSC/ BOSE/ QUEST/ ELECTROVOICE
12	PASSIVE COLUMN ARRAY LOUDSPEAKER – TYPE 1 & 2	QSC/ BOSE/ QUEST/ ELECTROVOICE
13	AMPLIFIER	QSC/ QUEST/ BOSE/ BIAMP/ ELECTROVOICE
14	DIGITAL SIGNAL PROCESSOR	QSC/ QUEST/ BOSE/ BIAMP/ ELECTROVOICE/ SYMETRIX
15	BOUNDARY MICROPHONE	SHURE/ QSC/ SENNHEISER
16	GOOSENECK MICROPHONE	SHURE/ DPA/ SENNHEISER/ TELEVIC
17	WIRELESS CHARGER FOR WIRELESS GOOSNECK MICEOPHONE	SHURE/ DPA/ SENNHEISER/ TELEVIC
18	ANTENNA	SHURE/ DPA/ SENNHEISER/ TELEVIC
19	ANTENNA SPLITTER/ COMBINER	SHURE/ DPA/ SENNHEISER/ TELEVIC
20	DIGITAL IP BASED CHAIRMAN UNIT	BOSCH/ SENNHEISER/ DIS(SHURE)/ TELVIC/ BRAHLER
21	DIGITAL IP BASED DELEGATE UNIT	BOSCH/ SENNHEISER/ DIS(SHURE)/ TELVIC/ BRAHLER
22	WIRELESS DELEGATE UNIT	BOSCH/ SENNHEISER/ DIS(SHURE)/ TELVIC/ BRAHLER
23	WIRELESS CHAIRMAN UNIT	BOSCH/ SENNHEISER/ DIS(SHURE)/ TELVIC/ BRAHLER
24	WIRELESS CONFERENCE CONTROLLER	BOSCH/ SENNHEISER/ DIS(SHURE)/ TELVIC/ BRAHLER
25	MATRIX SWITCHER, DISTRIBUTION AMPLIFER, TRANSMITTER & RECEIVER	KRAMER/ LIGHTWARE/ EXTRON/ CRESTRON/ CYPRESS.

SL. NO.	ITEMS	MAKES
26	TABLE MOUNT ENCLOSURE	KRAMER/CRESTRON/ LEGRAND
27	PTZ CAMERAS	SONY/ LUMENS/ QSC/ PANASONIC
28	RECORDER & STREAMING SYSTEM	LUMENS/ MEDIA POINTE/ PANASONIC/ SONY
29	CONTROL TOUCH PANEL AND CONTROL SYSTEM	CRESTRON/QSC/KRAMER
30	NETWORK SWITCH	NETGEAR/CISCO/DELL/JUNIPER
31	SPEAKER & MICROPHONE CABLE	KRAMER/ CRESTRON/ EXTRON/ LIGHTWARE
32	HDMI CABLE/ VGA CABLE, PATCH CABLES, CONTROL CABLE/ ACTIVE USB CABLE	KRAMER/ CRESTRON/ EXTRON/ LIGHTWARE
33	VIDEO CONFERENCE SYSTEM	CISCO/ POLYCOM/ CRESTRON
34	MATRIX SWITCHER	EXTRON/ AMX/ LIGHTWARE/ CRESTRON/ CYPRESS
35	VIDEO CONTROLLER	EXTRON/ AMX/ LIGHTWARE/ CRESTRON
36	CONFERENCE CABLE	BOSCH/ SENNHEISER/ DIS (SHURE)/ TELVIC
37	SPEAKER CABLE	BELDEN/ EXTRON/ CRESTRON
38	MICROPHONE CABLE	BELDEN/ SOMMER/ EXTRON/ CTRESTRON
39	VIDEO & CONTROL CABLES	EXTRON/ CRESTRON/ BELDEN/ CRESTRON
	<u>CCTV</u>	
1	PTZ, BULLET, DOOM CCTV CAMERA	BOSCH/ PANASONIC/ AXIS/ HONEYWELL ENTERPRISES/ MOBOTIX
2	NVR	BOSCH/ PANASONIC/ AXIS/ HONEYWELL ENTERPRISES/ MOBOTIX
3	4K DISPLAY	PANASONIC/ SAMSUNG/ SONY
4	NETWORK SWITCH /MEDIA CONVERTOR	NETGEAR/ JUNIPER/ CISCO/ EXTREME/ ARISTA /PANASONIC
5	PORT MANAGED POE ETHERNET SWITCH	CISCO/ JUNIPER/ NETGEAR/ EXTREME/ ARISTA /PANASONIC
6	CAT 6 UTP CABLE/UTP PATCH CORD/CAT 6 /I/O/JACK PANEL/LIU/FACE PLATE /FIBER CABLES	LEGRAND/ COMMSCOPE/ PANDUIT
7	WORKSTATION	DELL/ HP/ LENOVO (WITH LATEST SERIES)

Note: -

- The articles / materials which are not mentioned in the above said list shall be approved by the Engineer-in-Charge before execution of work with the approval of NIT approving authority.**
- Only BIS Mark materials in the list shall be used in the work, non-BSI Mark materials may be provided by the Engineer-in-charge when BSI Mark materials are not manufactured.**

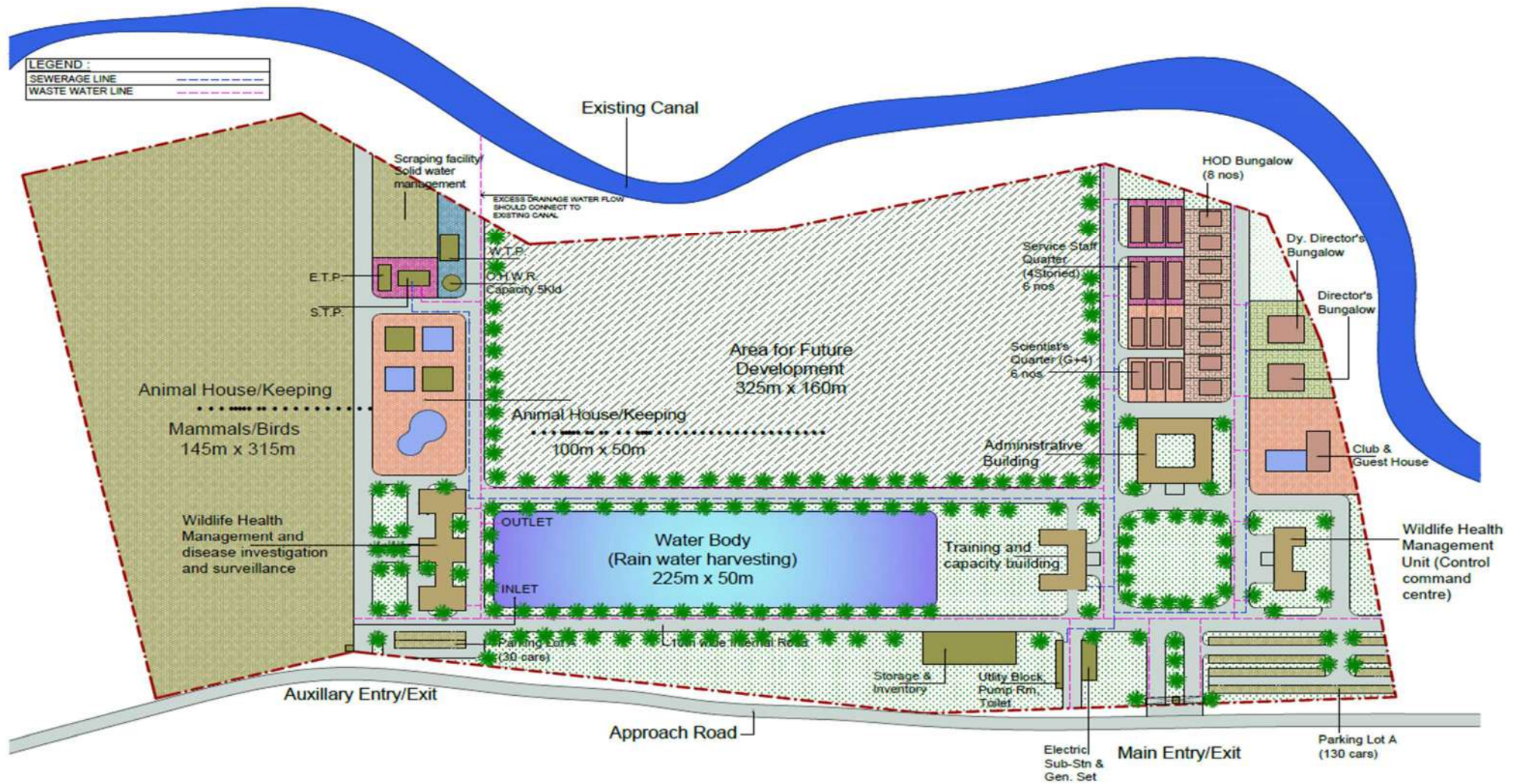
FINANCIAL SCHEDULE

CIVIL CONSTRUCTION UNIT					
NIT No: 2/2024-25/CE/CCU/CED1/JUNAGARH					
SCHEDULE OF QUANTITY					
Name of the Contractor					
Sl. No.	Description	Estimated cost (Rs.)	Percentage above or below the estimated cost	% in Figures	Total Cost (Rs.)
1	2	3	4	5	6
1	Design and Development of Civil Infrastructure for National Referral Centre-Wildlife at Junagarh, Gujarat (Phase-1) on EPC Mode. The scope of work also covers external development works and other allied works within controlled architectural parameters.	52,58,00,000	*	*	*
	Total	52,58,00,000			

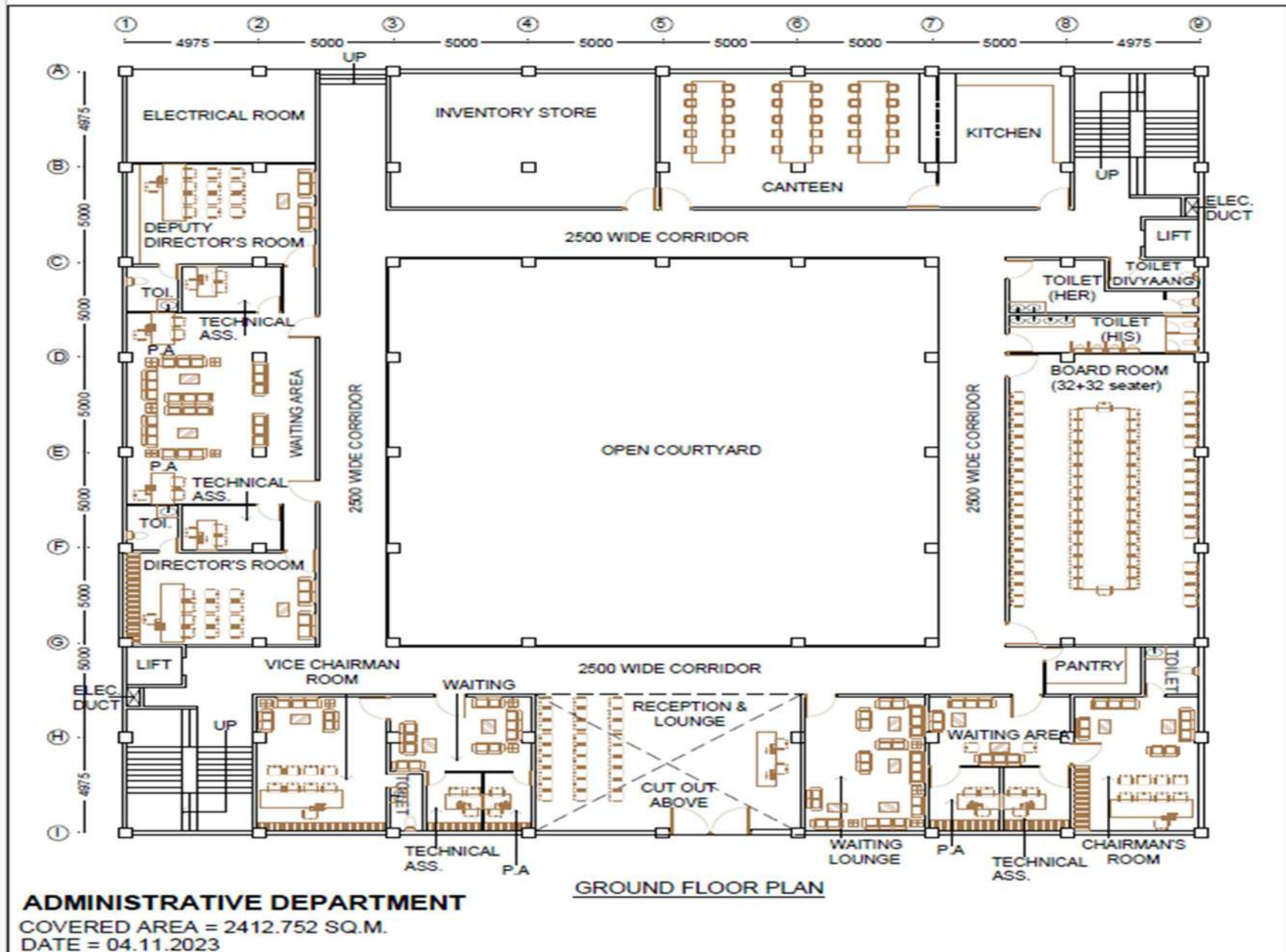
.*- To be filled online in bid document.

- 1) The Column Nos. 4 & 5 are mandatory to be filled by the bidders / tenderers. If these columns are left blank, the tender become invalid.
- 2) The amount in figures in column No.6 shall appear automatically corresponding to the percentage quoted in column No.4 & 5.
- 3) The tenderer is required to quote the percentage only above or below or at par with the estimated cost to cover all the rates of item covered under the respective packages.
- 4) The percentage shall be written in 2 (two) place of decimal.
- 5) If the percentage selection in column No 4 is "At Par", by default the percentage will be considered as "Zero" only. In other words, if "At par" is selected in column No.4, then no need to fill column No. 5

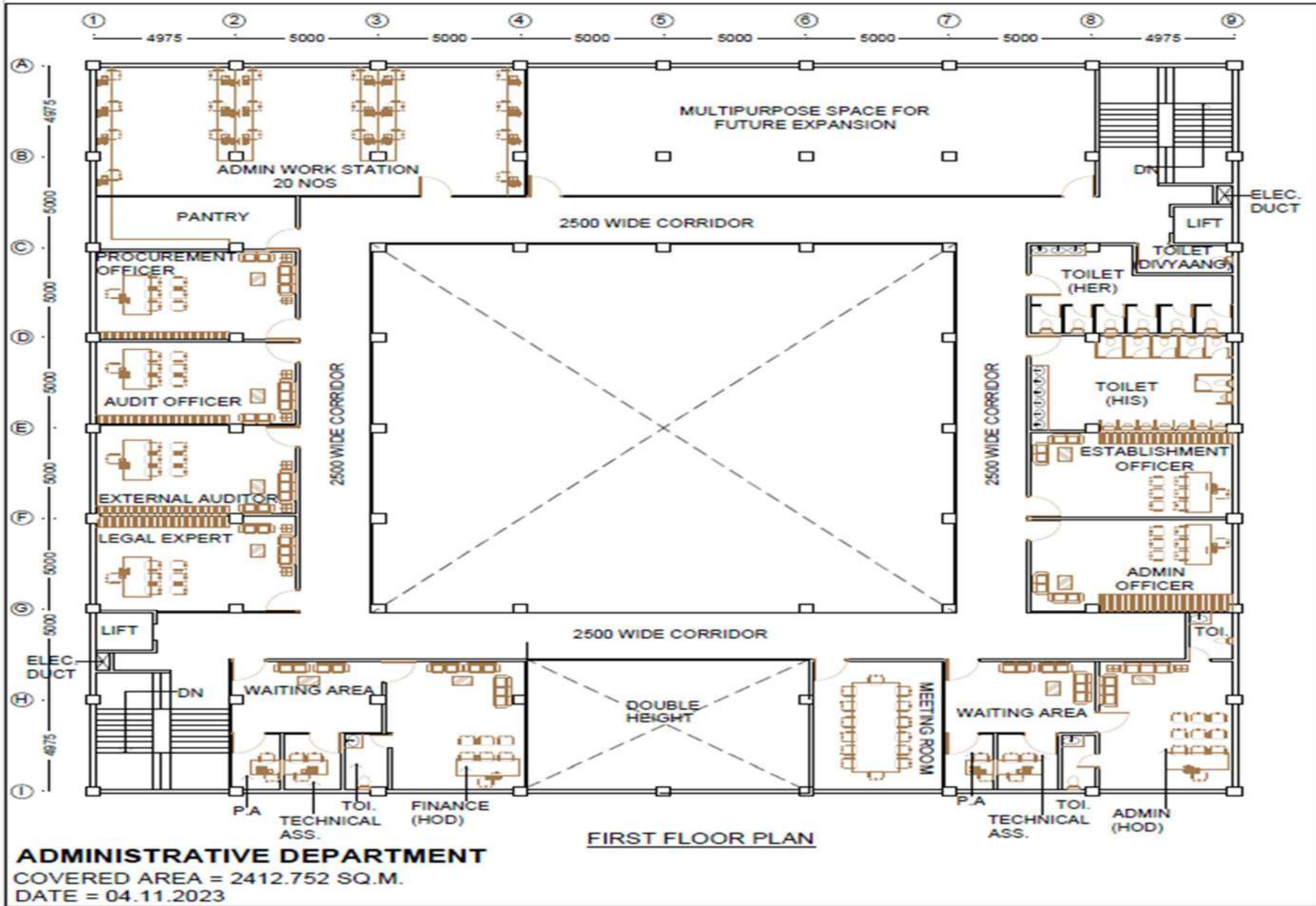
Master Plan of Proposed Development



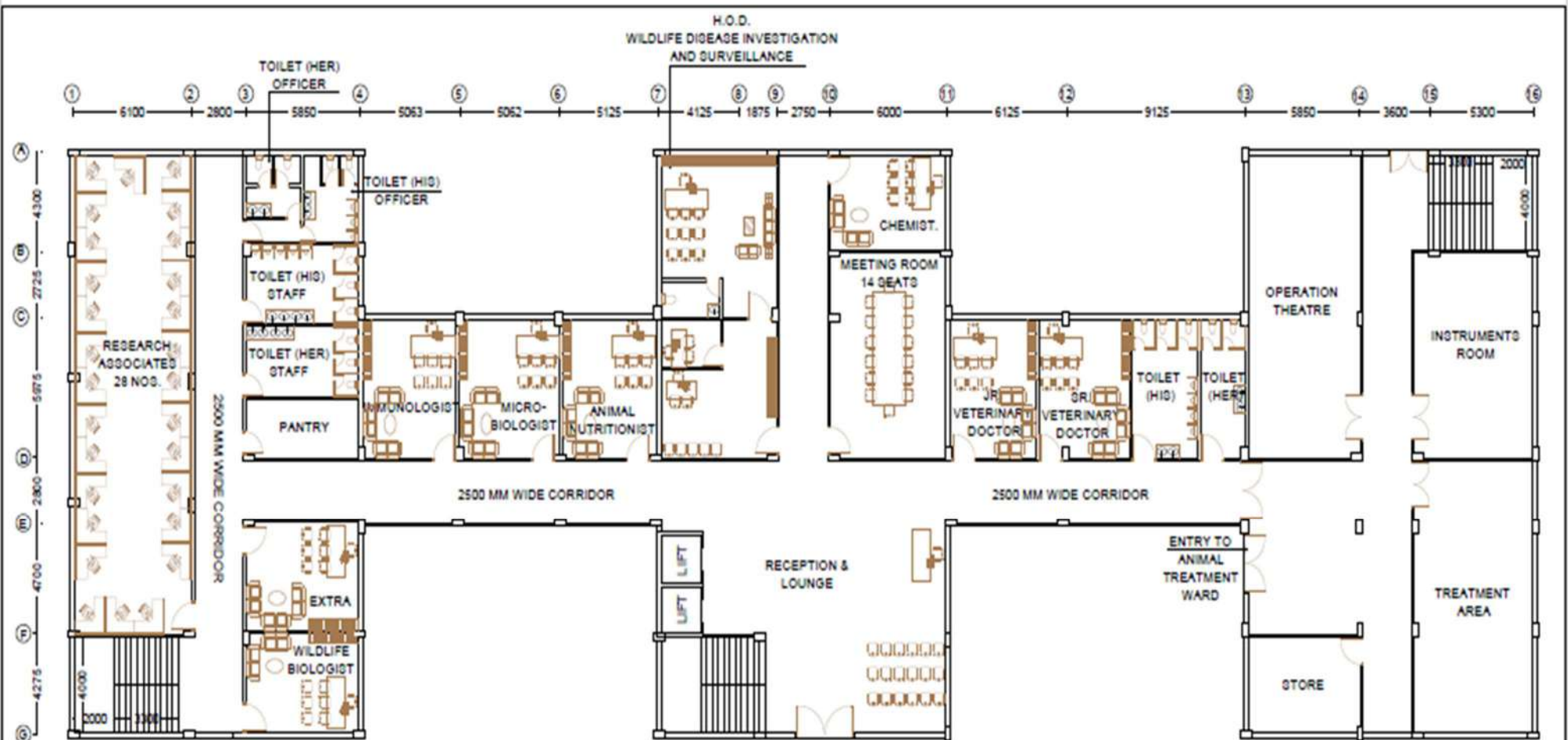
ADMINISTRATIVE DEPARTMENT GROUND FLOOR PLAN



ADMINISTRATIVE DEPARTMENT FIRST FLOOR PLAN



**WILDLIFE HEALTH MANAGEMENT AND DISEASE INVESTIGATION AND SURVEILLANCE
GROUND FLOOR PLAN**

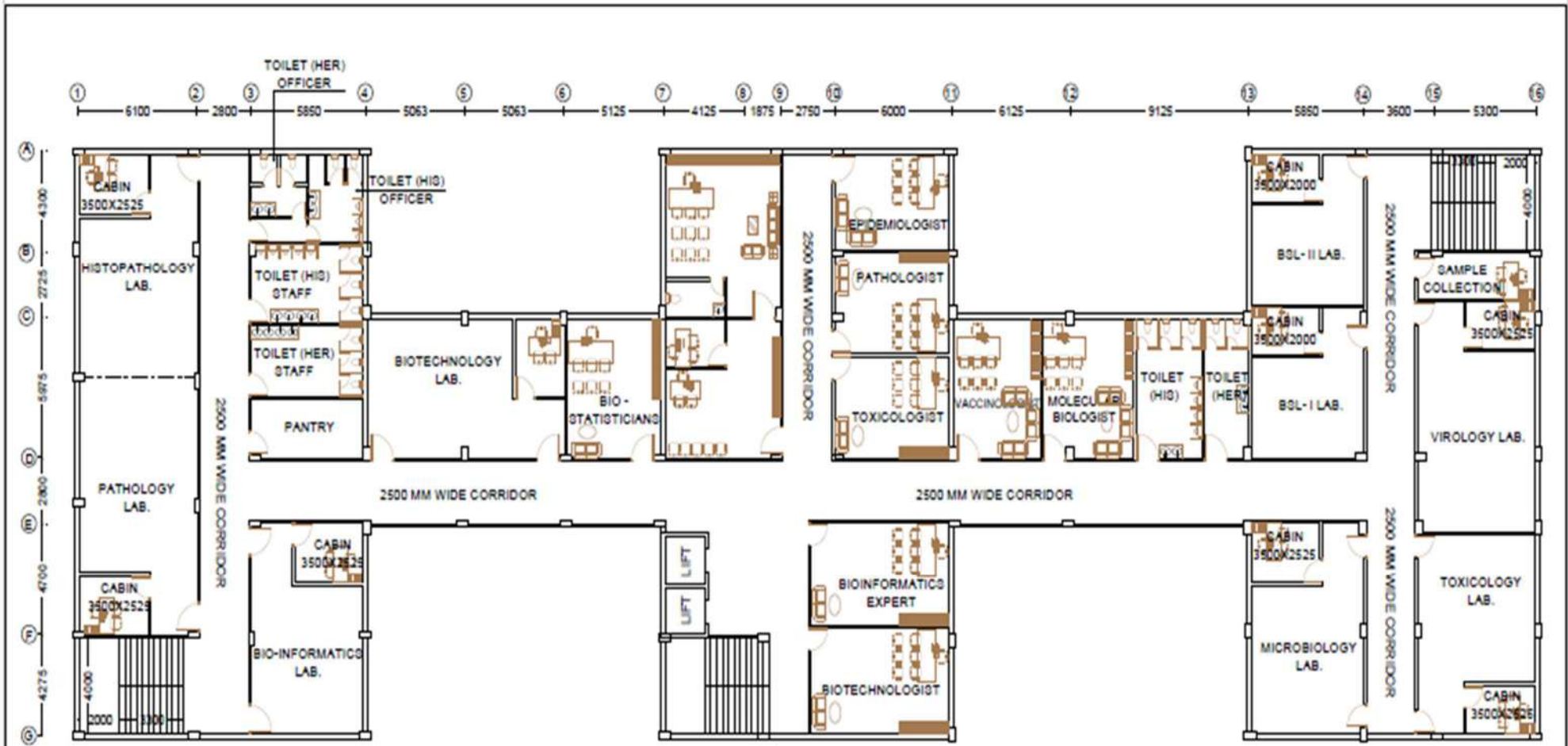


WILDLIFE HEALTH MANAGEMENT AND DISEASE INVESTIGATION AND SURVEILLANCE

COVERED AREA = 2794.588 SQ.M.
DATE = 04.11.2023

GROUND FLOOR PLAN

**WILDLIFE HEALTH MANAGEMENT AND DISEASE INVESTIGATION AND SURVEILLANCE
FIRST FLOOR PLAN**

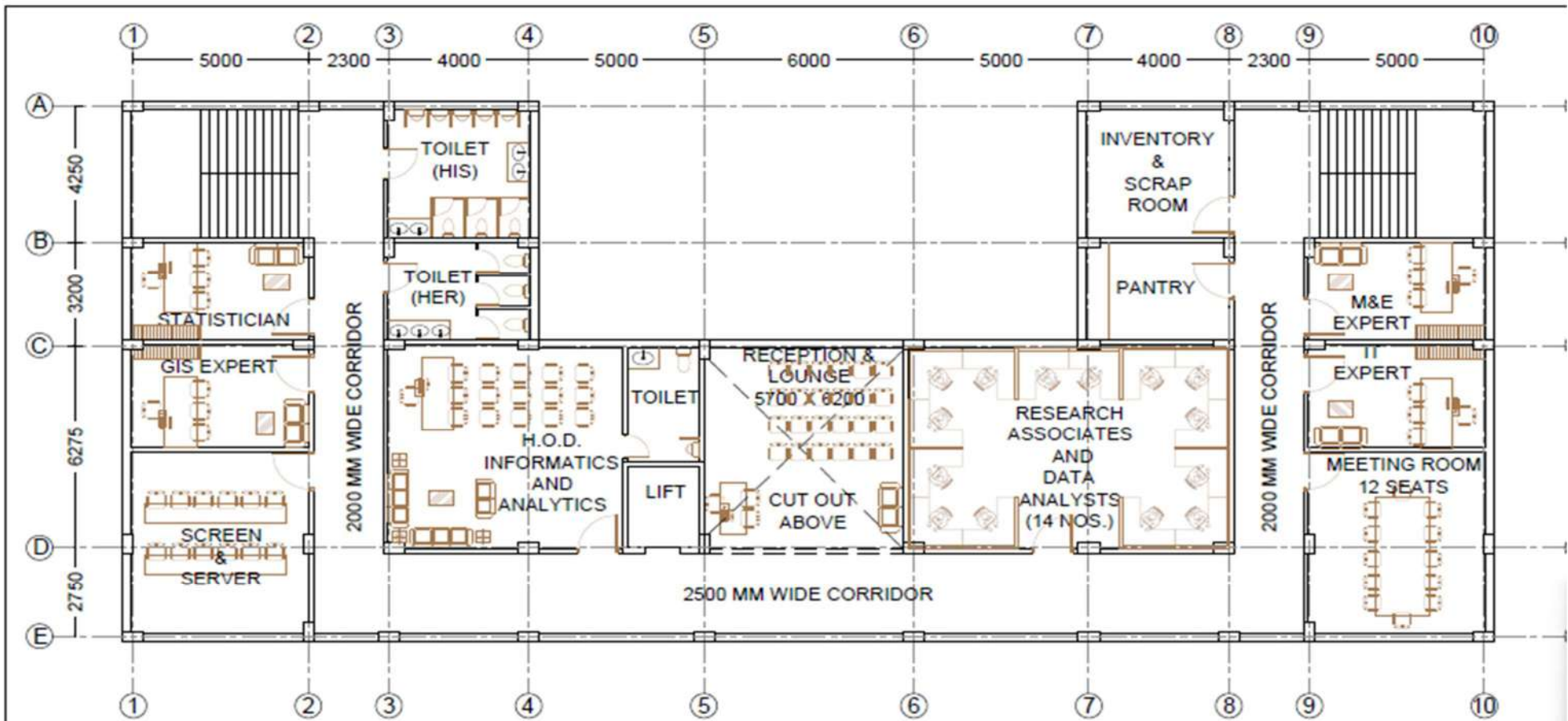


WILDLIFE HEALTH MANAGEMENT AND DISEASE INVESTIGATION AND SURVEILLANCE

COVERED AREA = 2794.588 SQ.M.
DATE = 04.11.2023

FIRST FLOOR PLAN

INFORMATICS AND ANALYTICS & NETWORK AND OUTREACH UNIT
GROUND FLOOR PLAN

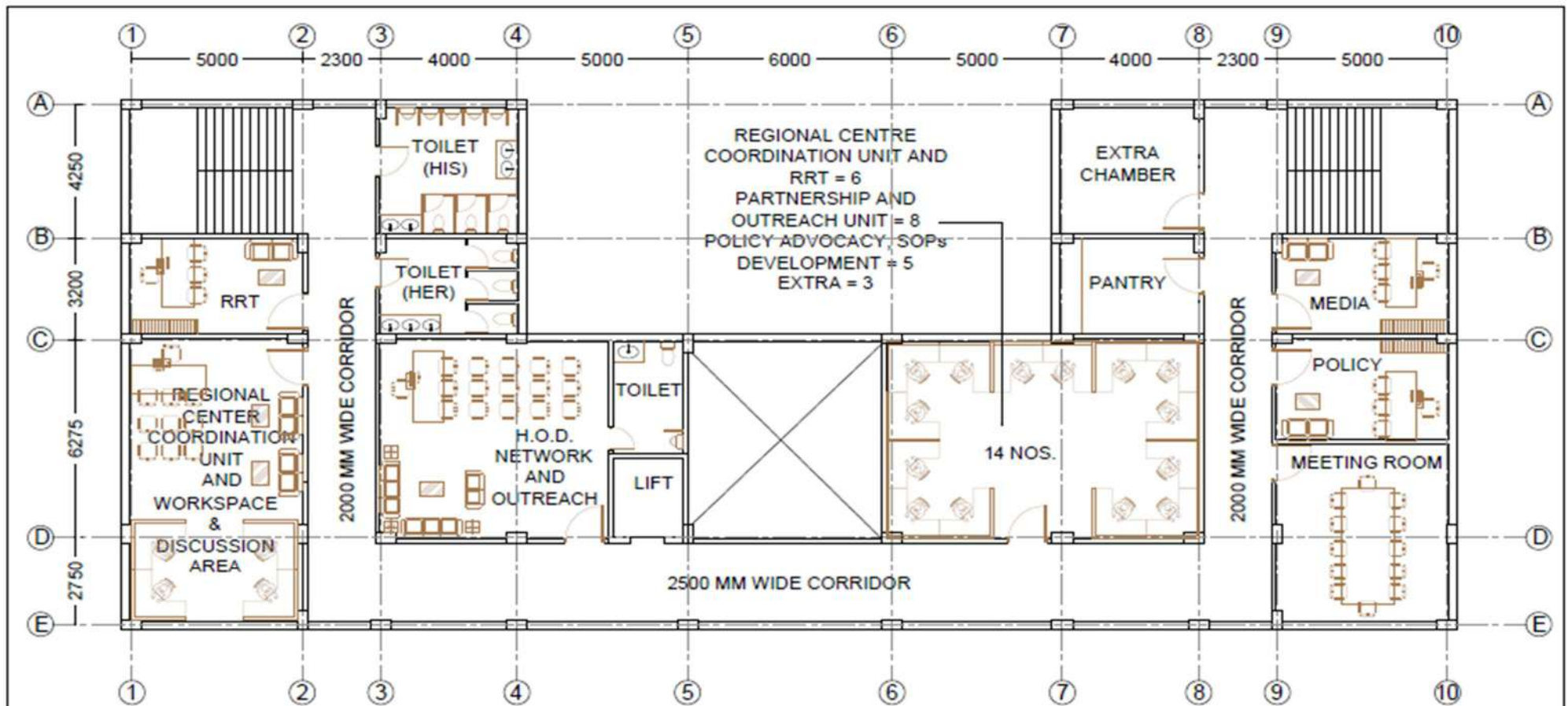


INFORMATICS AND ANALYTICS & NETWORK AND OUTREACH UNIT (GROUND FLOOR)

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DATE = 06.11.2023

INFORMATICS AND ANALYTICS & NETWORK AND OUTREACH UNIT
FIRST FLOOR PLAN

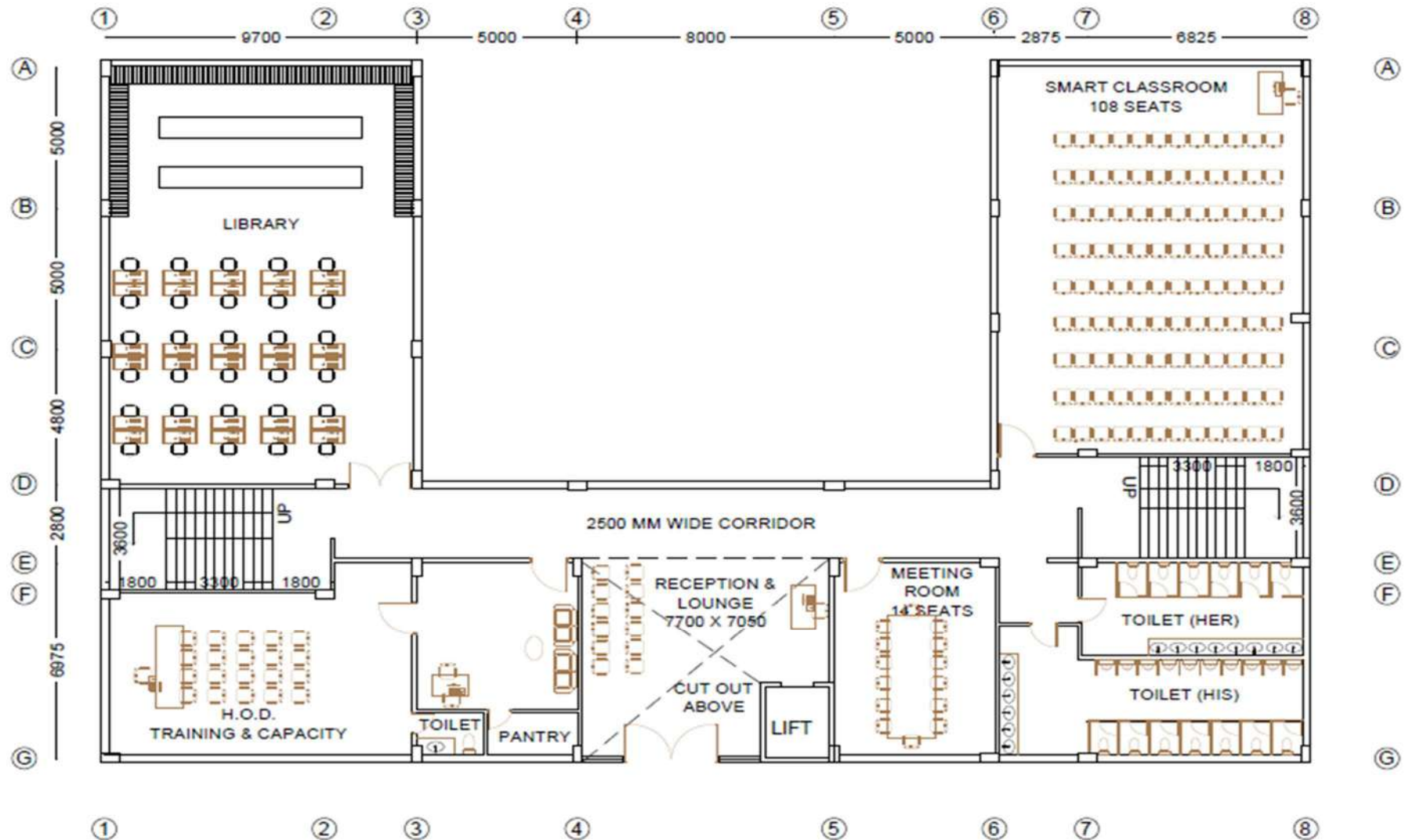


INFORMATICS AND ANALYTICS & NETWORK AND OUTREACH UNIT (FIRST FLOOR)

COVERED AREA = 542.85 SQ.M.

DATE = 06.11.2023

TRAINING AND CAPACITY GROUND FLOOR BUILDING_GROUND FLOOR PLAN

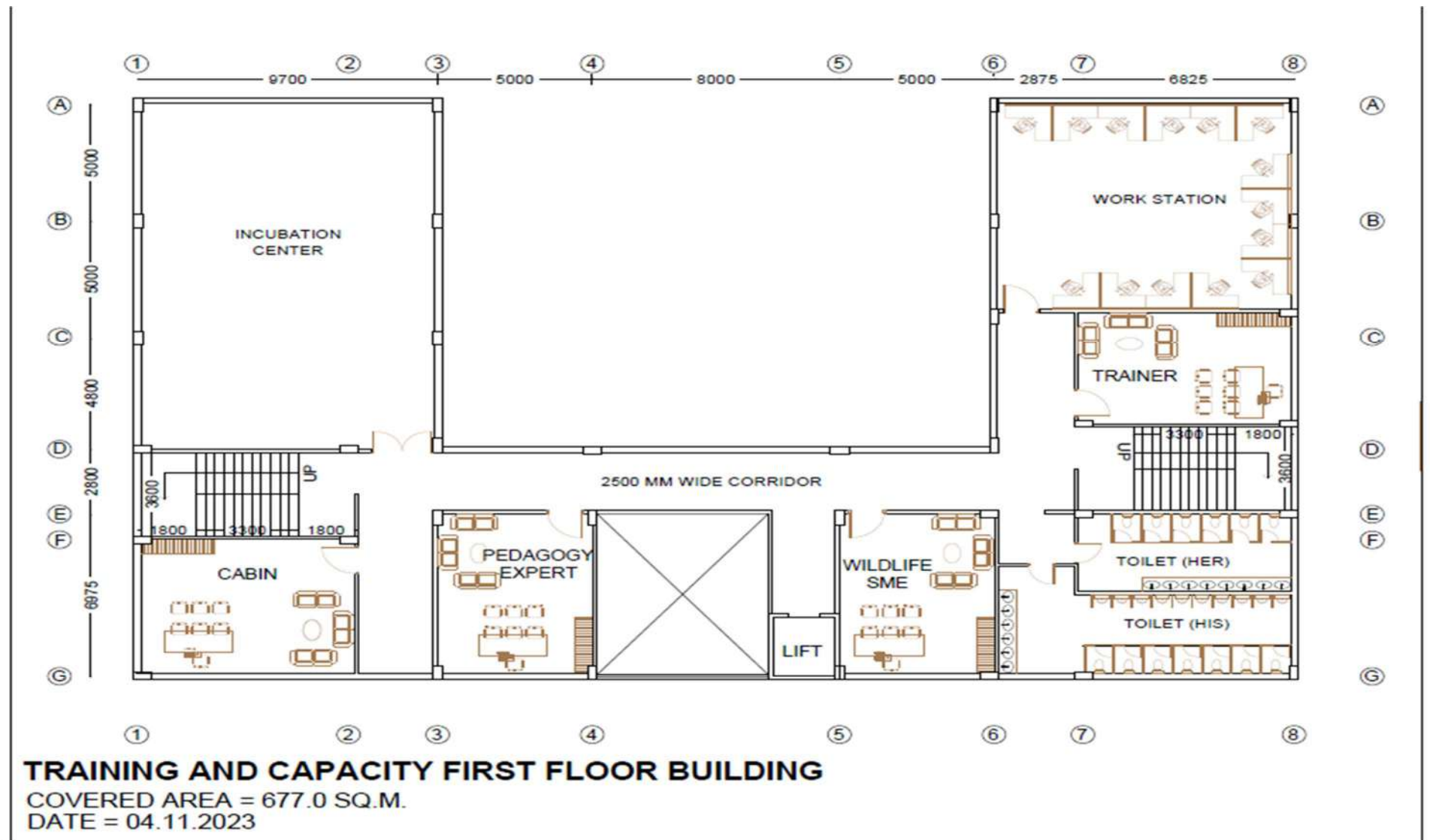


TRAINING AND CAPACITY GROUND FLOOR BUILDING

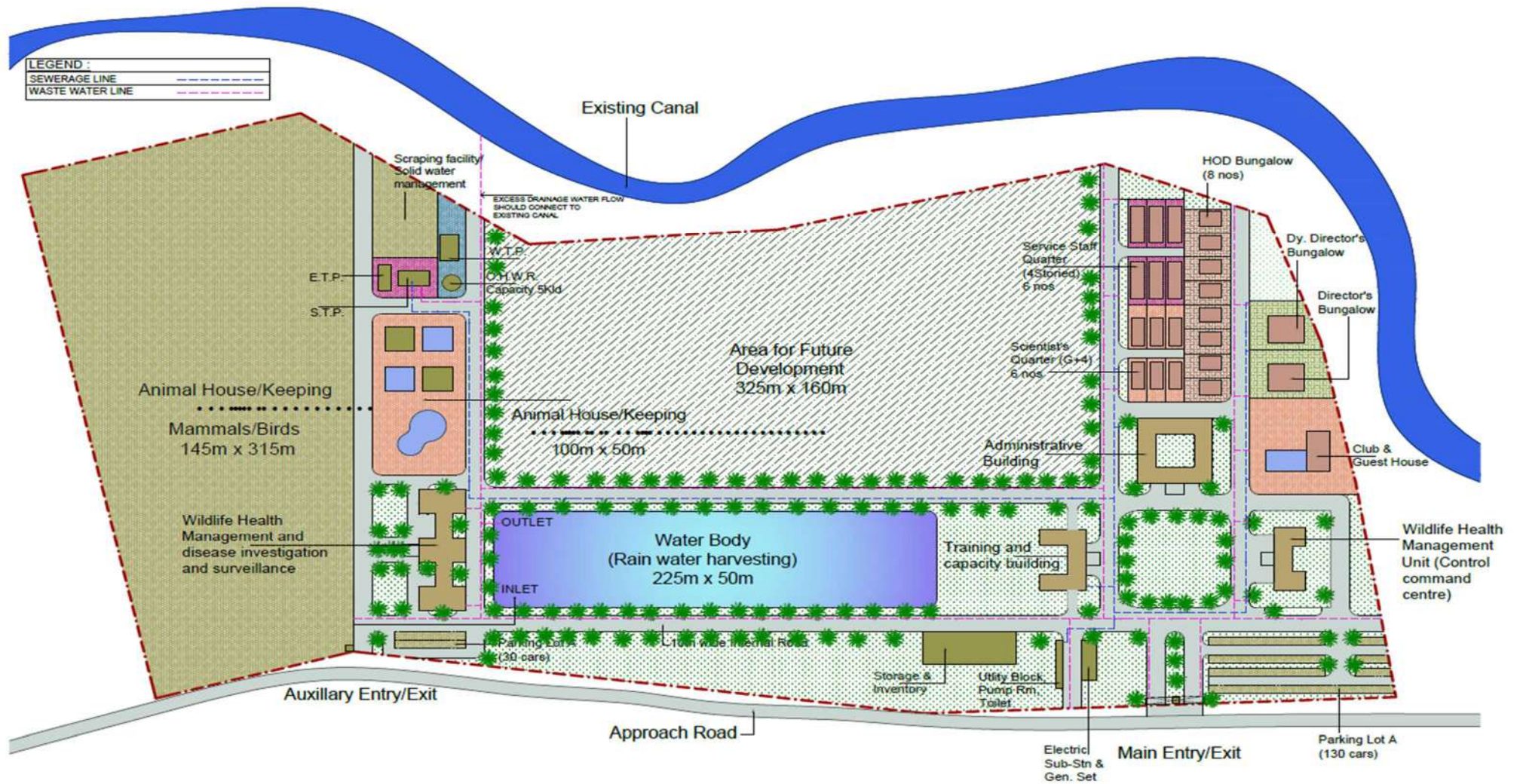
COVERED AREA = 677.0 SQ.M.

DATE = 04.11.2023

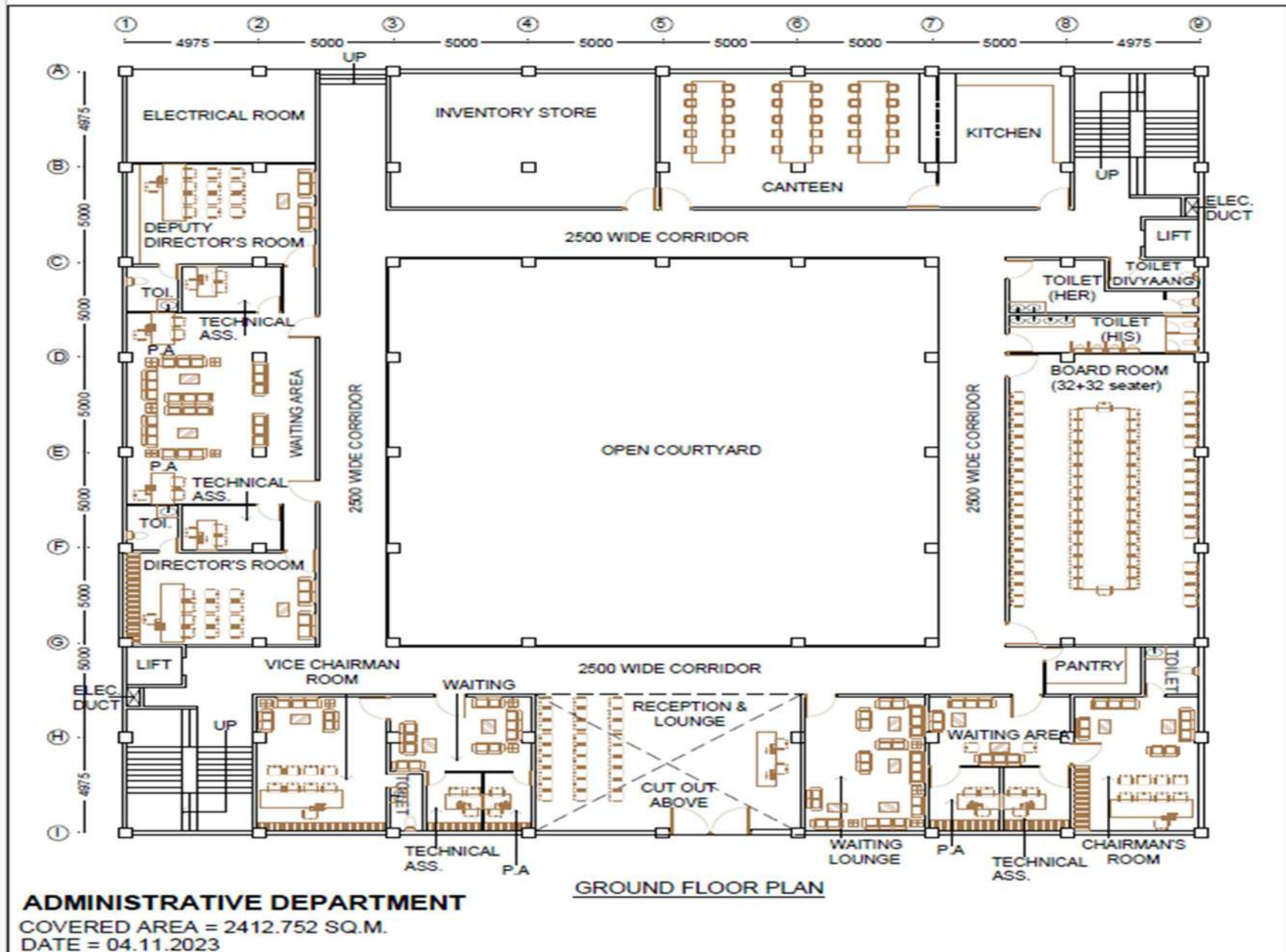
TRAINING AND CAPACITY FIRST FLOOR BUILDING GROUND FLOOR PLAN



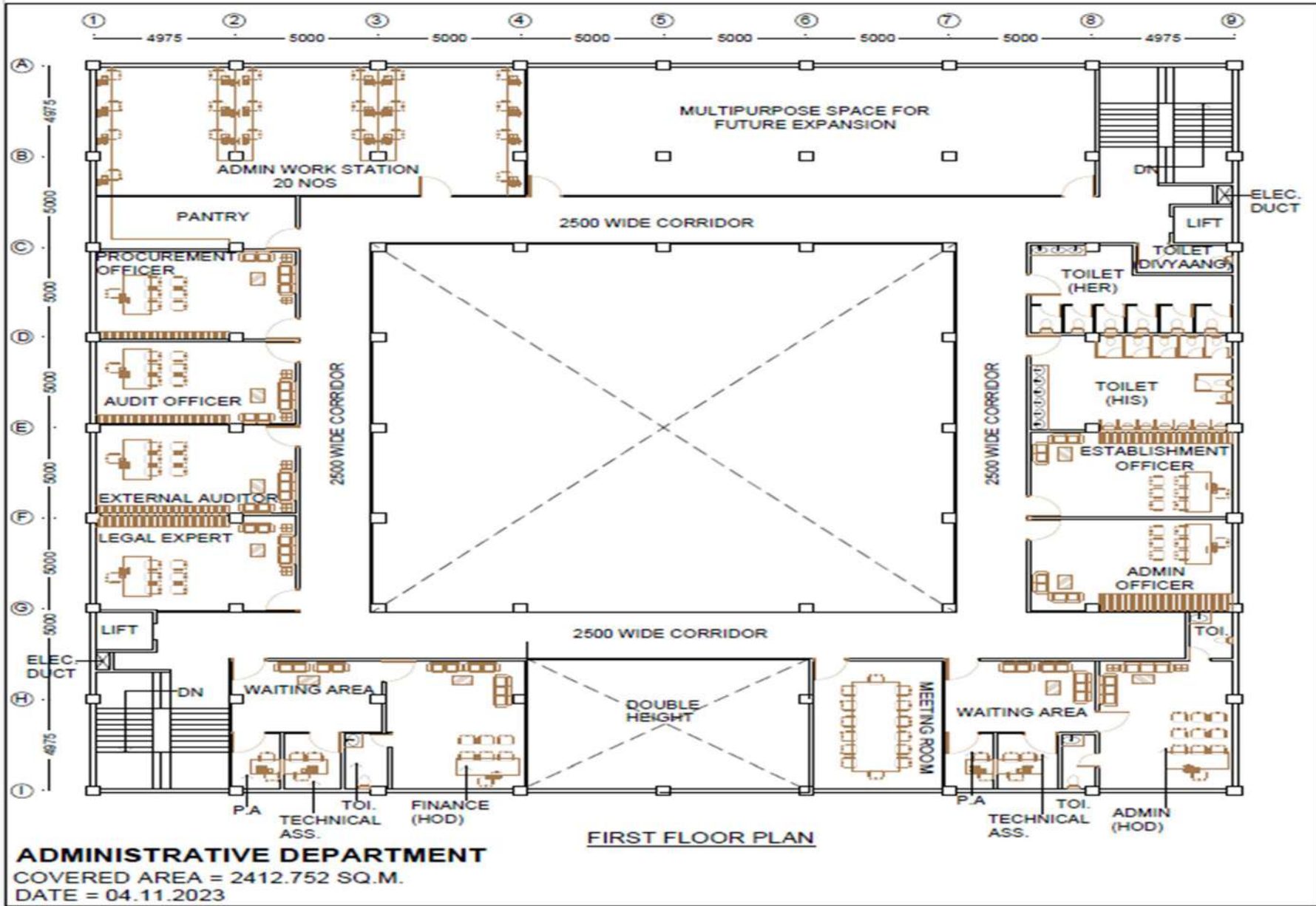
Master Plan of Proposed Development



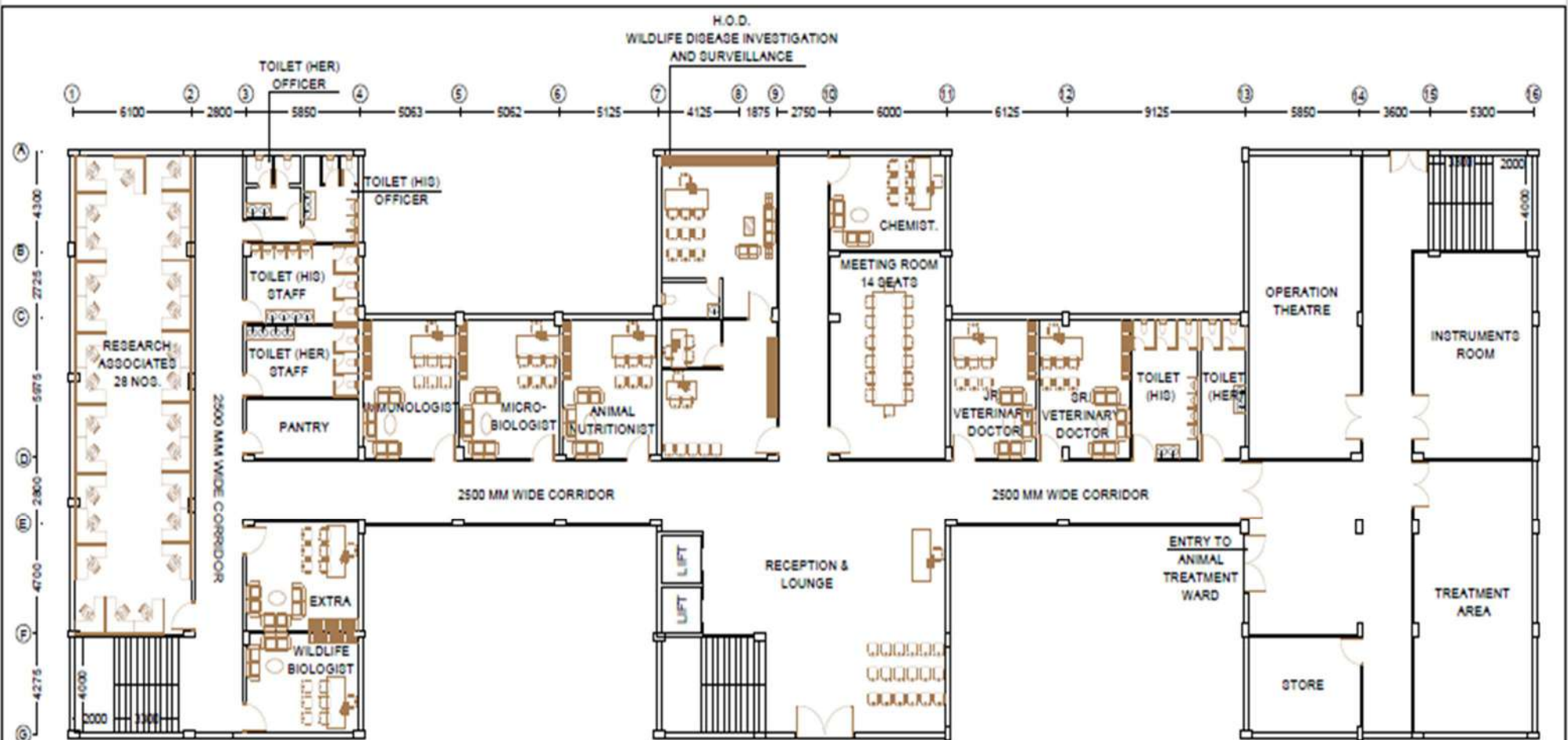
ADMINISTRATIVE DEPARTMENT GROUND FLOOR PLAN



ADMINISTRATIVE DEPARTMENT FIRST FLOOR PLAN



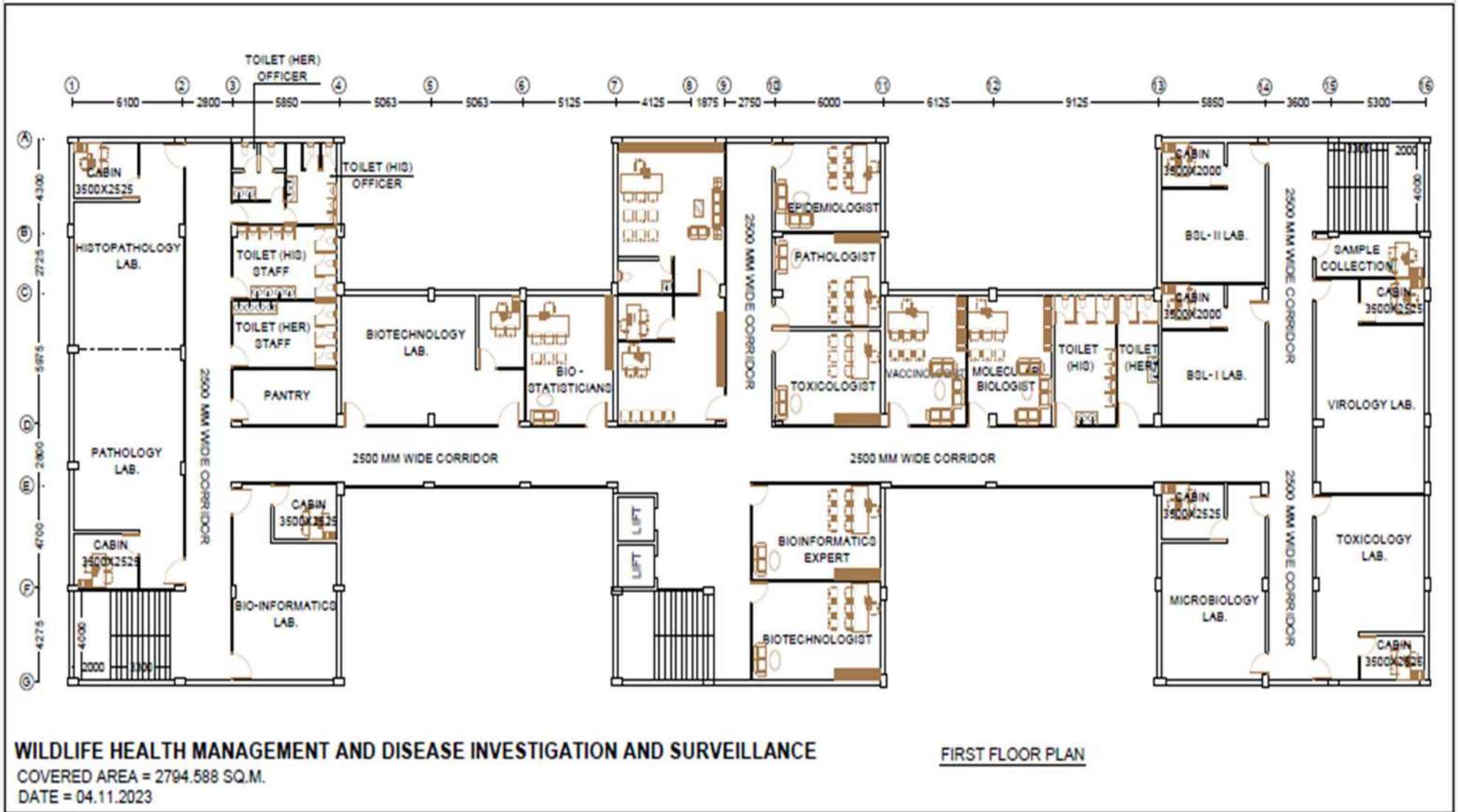
**WILDLIFE HEALTH MANAGEMENT AND DISEASE INVESTIGATION AND SURVEILLANCE
GROUND FLOOR PLAN**



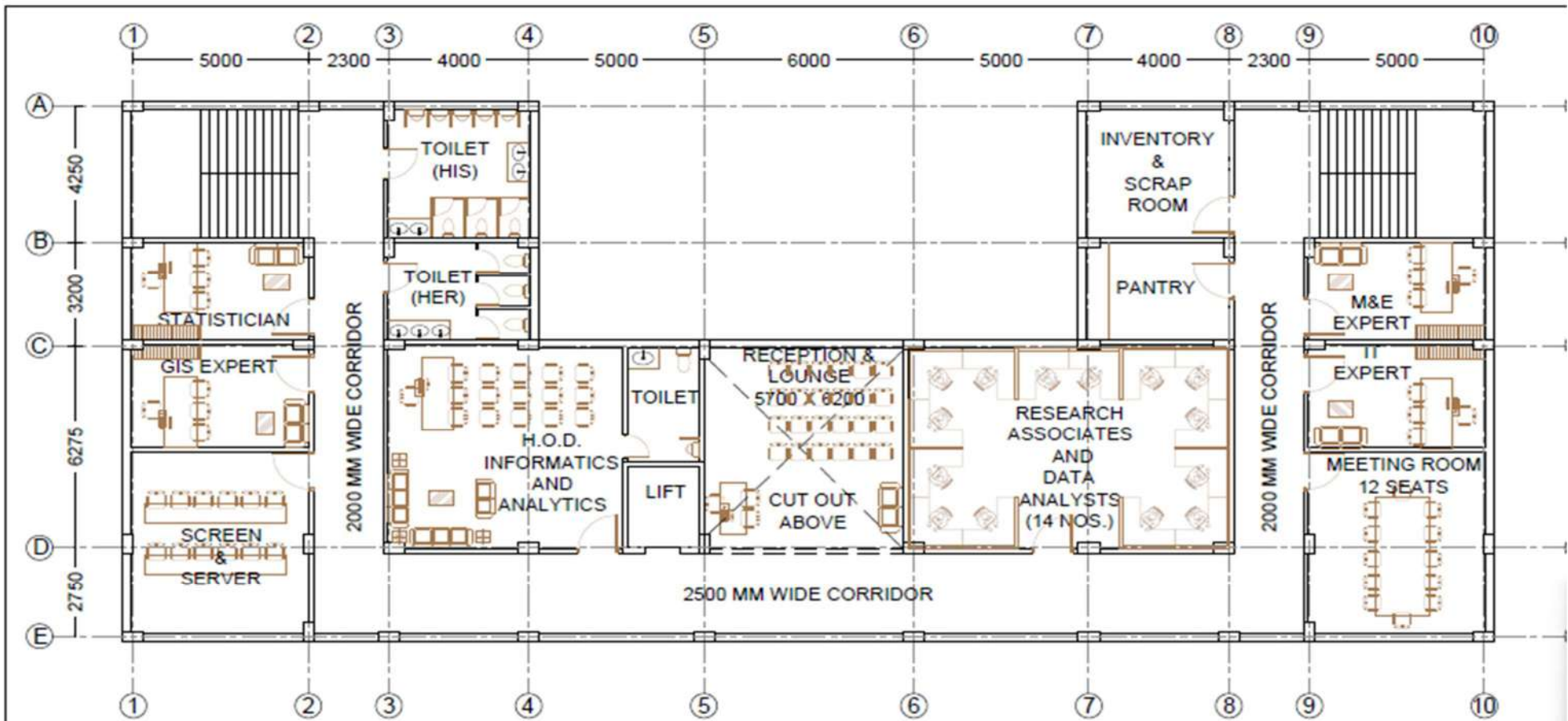
WILDLIFE HEALTH MANAGEMENT AND DISEASE INVESTIGATION AND SURVEILLANCE
COVERED AREA = 2794.588 SQ.M.
DATE = 04.11.2023

GROUND FLOOR PLAN

**WILDLIFE HEALTH MANAGEMENT AND DISEASE INVESTIGATION AND SURVEILLANCE
FIRST FLOOR PLAN**



INFORMATICS AND ANALYTICS & NETWORK AND OUTREACH UNIT
GROUND FLOOR PLAN

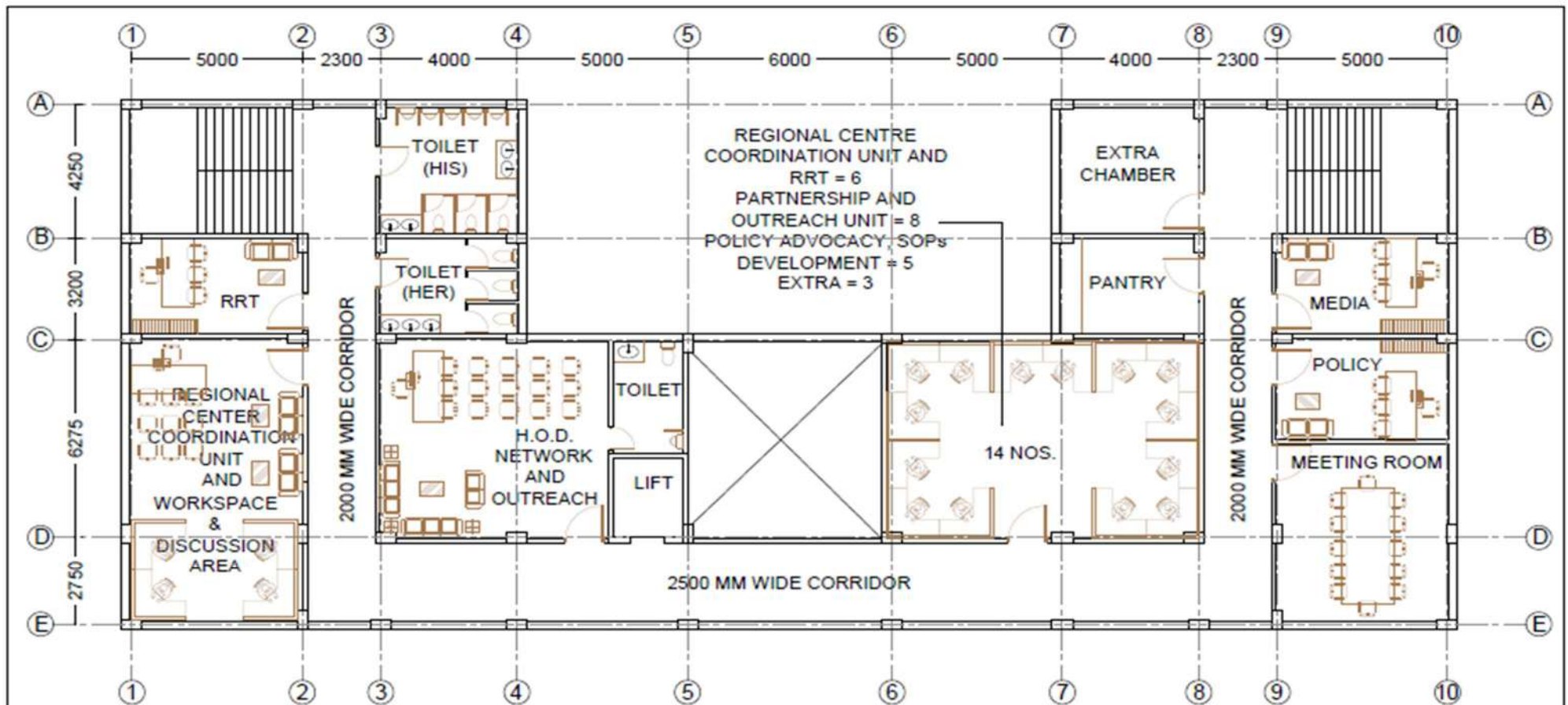


INFORMATICS AND ANALYTICS & NETWORK AND OUTREACH UNIT (GROUND FLOOR)

COVERED AREA = 542.85 SQ.M.

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INFORMATICS AND ANALYTICS & NETWORK AND OUTREACH UNIT
FIRST FLOOR PLAN

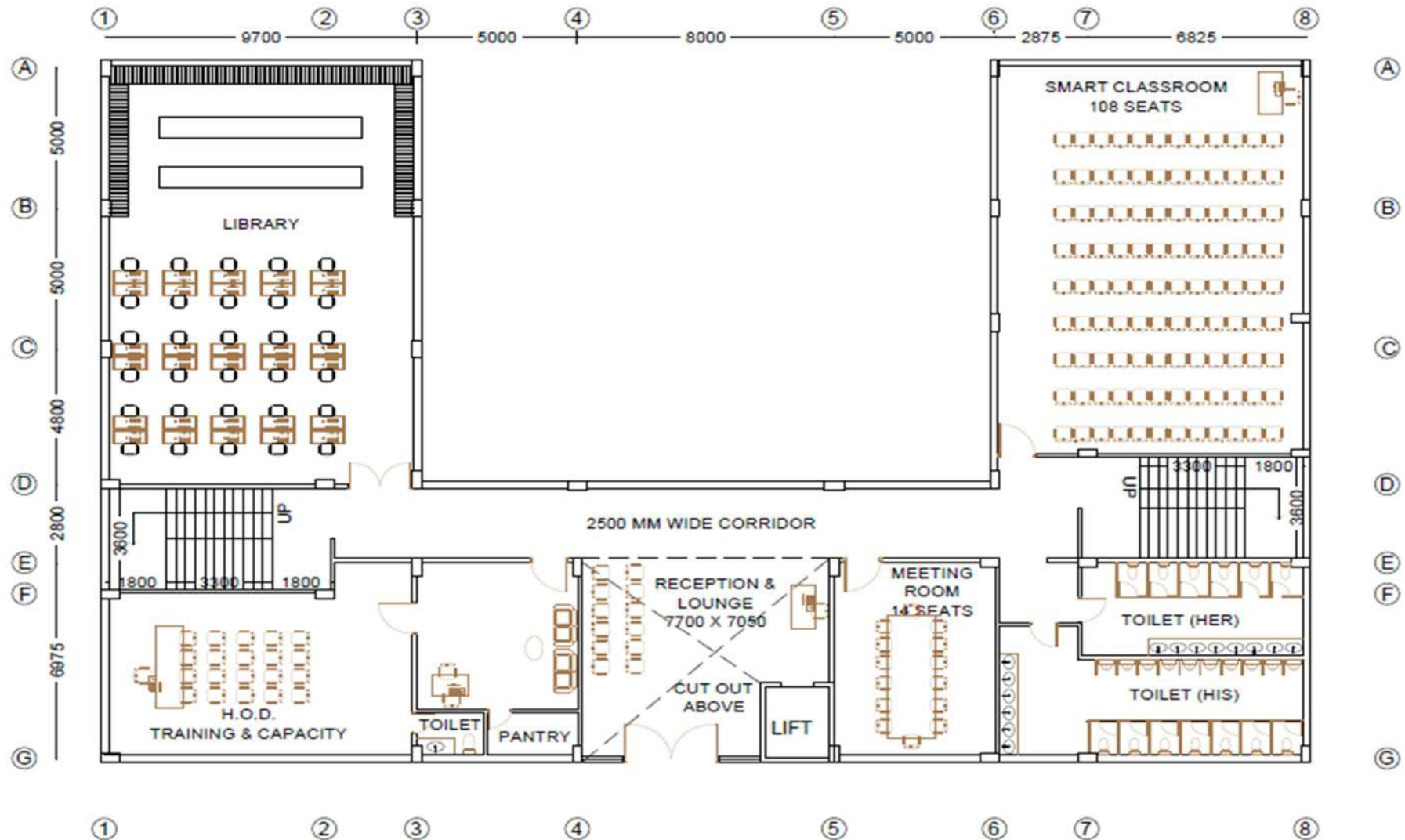


INFORMATICS AND ANALYTICS & NETWORK AND OUTREACH UNIT (FIRST FLOOR)

COVERED AREA = 542.85 SQ.M.

DATE = 06.11.2023

TRAINING AND CAPACITY GROUND FLOOR BUILDING GROUND FLOOR PLAN



TRAINING AND CAPACITY GROUND FLOOR BUILDING

COVERED AREA = 677.0 SQ.M.

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TRAINING AND CAPACITY FIRST FLOOR BUILDING GROUND FLOOR PLAN

