



Government Of India

Ministry Of Housing & Urban Affairs



Central Public Works Department

Excellence in Public Works

Tender Published

Current Tender Details

Tender ID	169449	NIT/RFP NO	06/2026-27/CE/CCU/CED-I/New Delhi (Recall)
Name of Work	Modernisation of the Entrance Plaza of National Zoological Park at New Delhi, India on EPC mode-1. (Cancel Tender ID No.: 165558)		
Procurement Type	Works	Bid Type	EPC Percentage
Tender Type	OPEN	Estimated Cost	₹ 57,96,25,394 (Fifty Seven Crore Ninety Six Lakh Twenty Five Thousand Three Hundred and Ninety Four Rupees)
Bid Submission Closing Date	24/09/2026 15:00	Competitive Bidding Type	NCB

Tender Published Successfully.

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Enquiry Particulars

Regional Office	EE - CED - I	Office Inviting Bids	Chandigarh - CE - E and F - EE - CED - I
Tender ID	169449	NIT/RFP NO	06/2026-27/CE/CCU/CED-I/New Delhi (Recall)
Name of Work	Modernisation of the Entrance Plaza of National Zoological Park at New Delhi, India on EPC mode-1. (Cancel Tender ID No.: 165558)	Subwork/Packages	
Time Allowed	15 months	Tender Type	OPEN
Procurement Type	WORKS	Bid Type	EPC Percentage
Type of Work	Civil Works - Buildings	Category of Tender	COMPOSITE
Estimated Cost(INR)	₹ 57,96,25,394	Competitive Bidding Type	NCB
Reasons for Exemption Doc	Authorization.pdf	Reasons	Due to urgency of work, Competent Authority has approved the call of this tender at short notice.

Bid Submission Dates

Last Date & Time of receipt of Pre-Bid Queries	24/09/2026 14:30	Receipt of Queries through	Email
Email	eeced1ccu-mef@nic.in		
Bid Submission Closing Date & Time	24/09/2026 15:00	Bid Validity Period (In Days)	75 After Technical cum Eligibility Bid Opening
Bid Validity Expiry Date	08/12/2026 15:30	Tender Notice Type	Short Notice Tender

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 Delh	Contact Details	9969617538
Email	eeced1ccu-mef@nic.in		

EMD Details

EMD (INR)	EMD in favour of	Mode of Payment
₹ 67,96,254	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
SANJAY KUMAR MEENA	EE - CED - I	9969617538	aecivilcpd@gmail.com	Executive Engineer	5b89003586e5	07/10/2027 01:07
Rakesh Kumar Jain	EE - CED - I	9971999755	eebrpd1@gmail.com	Executive Engineer	18f0167	01/08/2027 02:03

Tender Documents

S.No	File Name	File Description	File Size (in Bytes)	Uploaded Date
1	NIT Part A.pdf	NIT Part A	1230805	18/09/2026 13:06
2	NIT Part B.pdf	NIT Part B	26283128	18/09/2026 13:06
3	NIT Part C.pdf	NIT Part C	1969900	18/09/2026 13:07
4	Financial Bid.pdf	Financial Bid	300372	18/09/2026 13:07
5	soil investigation.pdf	Soil Investigation	3792770	18/09/2026 13:07
6	Eligibility.pdf	Eligibility	343573	18/09/2026 13:08

Mandatory Documents Details

S.No	Documents Required from Vendor	Document Type
1	For CPWD enlisted Contractors	Mandatory
2	i) Copy of enlistment order in appropriate class and category issued by CPWD	Mandatory
3	ii) Copy of original EMD in proper form.	Mandatory
4	iii) Copy of receipt for deposition of original EMD to division office of any EE CPWD and CCU.	Mandatory
5	iv) 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 under taking along with bid documents	Mandatory
6	v) Letter of transmittal.	Mandatory
7	vi) Certificate of Financial Turnover from CA (Form A) for calculation bidding capacity.	Mandatory
8	vii) List of eligible similar nature of completed works in Form C	Mandatory
9	viii) List of projects under execution in Form C-1 for calculation bidding capacity.	Mandatory
10	ix) Performance report of works (mentioned in Form C) in Form D	Mandatory
11	x) Bidding Capacity as per Form- C-2 based on the details of works mentioned in Form C-1	Mandatory
12	xi) Affidavit for non-execution of eligible similar work (s) through another contractor on backto-back basis or subletting basis furnished on Rs.100/- non-judicial stamp paper attested by Notary. Undertaking for similar works in Form- H	Mandatory
13	xii) Undertaking on structural stability and soundness of already completed building and infrastructure projects. Form- I	Mandatory
14	xiii) Affidavit for Non-Black Listing should be furnished on Rs.100/- non-Judicial stamp paper attested by Notary in Form-J	Mandatory
15	xiv) Any other document as specified in NIT/bid document.	Mandatory
16	For Non-CPWD Registered Contractors	Mandatory
17	i) Copy of original EMD in proper form.	Mandatory
18	ii) Copy of receipt for deposition of original EMD to division office of any EE, CPWD/CCU.	Mandatory
19	iii) Letter of transmittal	Mandatory
20	iv) 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 under taking along with bid documents	Mandatory
21	v) Certificate of Financial Turnover from CA (Form A)	Mandatory
22	vi) Bankers certificate or Networth certificate (Form B or B-1)	Mandatory
23	vii) List of eligible similar nature of completed works in Form-C	Mandatory
24	viii) List of projects under execution in Form C-1	Mandatory
25	ix) Bidding Capacity as per Form C-2 based on the details of works mentioned in Form C-1	Mandatory
26	x) Performance report of completed works (mentioned in Form-C) in Form D	Mandatory
27	xi) Performance report of works (mentioned in Form C-1) in Form D1	Mandatory
28	xii) Structure and Organisation (Form E)	Mandatory
29	xiii) Undertaking on structural stability and soundness of already completed building and infrastructure projects. (Form- I)	Mandatory
30	xiv) Affidavit for non-execution of eligible similar work(s) through another contractor on backto-back basis or subletting basis furnished on Rs.100/- non-judicial stamp paper attested by Notary. Undertaking for similar works in Form- H	Mandatory
31	xv) Affidavit for Non-Black Listing should be furnished on Rs.100/- non-Judicial stamp paper attested by Notary in Form- J	Mandatory
32	xvi) 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	24/09/2026 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

Financial Bid

S.No	File Name	File Size(in Bytes)
1	169449-PercentageComposite1.xls	64000

Done

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Certified that this NIT contains Pages 1 to 508.

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, Civil Engineering Division-I, Civil Construction Unit (CCU), Ministry of Environment, Forest & Climate Change (MoEF&CC), 7th Floor, CGO Complex, Lodhi Road, New Delhi-110003 ([email- eeecd1ccu-mef@nic.in](mailto:eeecd1ccu-mef@nic.in)) on behalf of President of India invites online Percentage rate bids in two bid system from CPWD enlisted contractors of appropriate class in Buildings & Roads (erstwhile composite /Building/ Infrastructure) category and Non-CPWD enlisted firms/contractors of repute in EPC **Mode-I (Design & Build) Turn key basis** for the following work :

NIT No.	06/2026-27/CE/CCU/CED-I/New Delhi (Recall)
Name of Work	Modernisation of the Entrance Plaza of National Zoological Park at New Delhi, India on EPC mode-1.
Location	National Zoological Park, New Delhi
Estimated cost put to bid (Rs.)	Rs. 57,96,25,394/-
Earnest Money (Rs.)	Rs. 67,96,254/-
Stipulated Period of Completion of work (in months)	15 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/Bid document	03:00 PM on 24.09.2026
Time date of opening of technical bid	03:30 PM on 24.09.2026
Pre Bid Conference	Pre bid conference shall be held onatwith 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. Contractors who fulfil the following requirements shall be eligible to apply [1(b), 1(c) & 1(d) are applicable for non-CPWD contractors but not applicable for CPWD enlisted contractors of appropriate class. 1(a) and 1(e) are applicable for both CPWD enlisted contractors as well as non-CPWD contractors.]:
 - 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. 23.18 Crores** or two similar works each costing not less than **Rs. 34.77 Crores** or one similar work costing not less than **Rs. 46.37 Crores**.
- (ii) In case, the eligible work has been executed by a Joint Venture through one or more individual firm(s), then cost of completed work shall be distributed among the individual firm(s) in proportion to their share in Joint Venture and that will be considered as work experience for individual firm(s) for pre-qualification in bidding.

“Similar Work” shall mean construction of RCC framed structure building and/or composite structure building or completing balance Construction work of RCC framed structure building and/or composite structure building.

Note-1: Components of work executed other than those included in definition of similar work shall be deducted while calculating cost of similar work.

Note-2: For the purpose, “Cost of work” shall mean gross value of the completed work including the cost of materials supplied by the Government/User department, 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. **17.39 Crores** on construction works during the last three years ending 31st March 2025 (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 2025.
- d)** Should have a Banker's Certificate from a commercial Bank for **Rs. 23.18 Crores** or Net Worth certificate from CA with Unique Document Identification Number (UDIN) of minimum amount of **Rs. 5.80 crores**. (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 annual turnover 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:

- i) The bidder should submit bidding capacity as per Form 'C-2'.
- ii) Bidding capacity is applicable for all the contractors including CPWD enlisted contractors.
- iii) Bidding capacity formula, for CPWD contractors who are enlisted based on rule 6.1.7 Of Rules For Enlistment Of Contractors In CPWD, 2026 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.

- iv) Bidding capacity, for CPWD contractors who are enlisted based on rules 9.6.3 & 9.6.4 of Rules for Enlistment of Contractors in CPWD, 2026 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/directions 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 for Enlistment of Contractors in CPWD, 2026 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 annual turnover 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.

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** 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 7 years ending 31st March 2025 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 atwith 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. **List of Documents to be filled in by the tenderers in various forms, to be scanned and uploaded in JPG/PDF format within the period of bid submission:**

For CPWD enlisted Contractors

- i) Copy of enlistment order 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) 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 under taking along with bid documents.

"If work is awarded to me, I/we shall obtain GST registration certificate, as applicable (of the state where site is located), 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".
- v) Letter of transmittal.
- vi) Certificate of Financial Turnover from CA (Form 'A') **for calculation bidding capacity.**
- vii) List of eligible similar nature of completed works in Form – 'C'.
- viii) List of projects under execution in Form 'C-1' for calculation bidding capacity.
- ix) Performance report of works (mentioned in Form-C) in Form – 'D'.

- x) Bidding Capacity as per Form- 'C-2' based on the details of works mentioned in Form 'C-1'
- xi) 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'.
- xii) Undertaking on structural stability and soundness of already completed building and infrastructure projects. (Form- 'I').
- xiii) Affidavit for Non-Black Listing should be furnished on Rs.100/- non-Judicial stamp paper attested by Notary in Form- 'J'.
- xiv) Any other document as specified in NIT/bid document.

For Non-CPWD Registered Contractors –

- i) Copy of original EMD in proper form.
- ii) Copy of receipt for deposition of original EMD to division office of any EE, CPWD/CCU.
- iii) Letter of transmittal
- iv) 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 (of the state where site is located), 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".
- v) Certificate of Financial Turnover from CA (Form 'A').
- vi) Banker's certificate or Networth certificate (Form 'B' or 'B-1').
- vii) List of eligible similar nature of completed works in Form – 'C'.
- viii) List of projects under execution in Form 'C-1'.
- ix) Bidding Capacity as per Form- 'C-2' based on the details of works mentioned in Form 'C-1'
- x) Performance report of completed works (mentioned in Form-C) in Form – 'D'.
- xi) Performance report of works (mentioned in Form 'C-1') in Form – 'D1'.
- xii) Structure & Organisation (Form 'E').
- xiii) Undertaking on structural stability and soundness of already completed building and infrastructure projects. (Form- 'I').

- xiv) 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'.
- xv) Affidavit for Non-Black Listing should be furnished on Rs.100/- non-Judicial stamp paper attested by Notary in Form- 'J'.
- xvi) Any other Document as specified in the bid documents.

If any requisite document as mentioned in bid document, is not scanned and uploaded while submitting the bid, the submitted bid shall become invalid and will not be considered in e-Tendering process further. The submitted bid shall summarily be rejected without giving any notice in this regard.

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:

Name of work: “Modernisation of the Entrance Plaza of National Zoological Park at New Delhi, India in EPC mode-I.”.

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. 57,96,25,394/-** This estimate, however, is given merely as a rough guide.
- 1.2. Intending bidders is 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: -

[1.2.2, 1.2.3 & 1.2.4 are applicable for non-CPWD contractors only but not applicable for CPWD enlisted contractors in appropriate class while 1.2.1 and 1.2.5 are applicable for both CPWD enlisted contractors as well as non-CPWD contractors]

- 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. 23.18 Crores** or two similar works each costing not less than **Rs. 34.77 Crores** or one similar work costing not less than **Rs. 46.37 Crores**.
- (ii) In case, the eligible work has been executed by a Joint Venture through one or more individual firm(s), then cost of completed work shall be distributed among the individual firm(s) in proportion to their share in Joint Venture and that will be considered as work experience for individual firm(s) for pre-qualification in bidding.

“Similar Work” shall mean construction of RCC framed structure building and/or composite structure building or completing balance Construction work of RCC framed structure building and/or composite structure building.

Note-1: Components of work executed other than those included in definition of similar work shall be deducted while calculating cost of similar work.

Note-2: For the purpose, “Cost of work” shall mean gross value of the completed work including the cost of materials supplied by the Government/User department, 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 the last date of submission of bid.

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. 17.39** Crores on construction works during the last three years ending 31st March 2025 (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 2025.
- 1.2.4. Should have a Banker's Certificate from a commercial Bank for **Rs. 23.18** Crores or Net Worth certificate from CA with Unique Document Identification Number (UDIN) of minimum **Rs. 5.80** Crores (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 annual turnover 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:

- a) The bidder should submit bidding capacity as per Form 'C-2'.
- b) Bidding capacity is applicable for all the contractors including CPWD enlisted contractors.
- c) Bidding capacity formula, for CPWD contractors who are enlisted based on rule 6.1.7 of Rules for Enlistment of Contractors in CPWD, 2026 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.

- d) Bidding capacity, for CPWD contractors who are enlisted based on rules 9.6.3 & 9.6.4 of Rules for Enlistment of Contractors in CPWD, 2026 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/directions 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 for Enlistment of Contractors in CPWD, 2026 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 annual turnover 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.

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 **15 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 considering the prevailing site conditions and other relevant parameters.**
5. The working architectural, structural, and services drawings shall be prepared by the contractor. The architectural and structural drawings for the work shall be made available in phased manner, as per requirement of the same as per approved programme of completion submitted by the contractor after award of work.
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 free of cost.
7. After submission of the bid the contractor can re-submit revised bid any number of times **or withdraw it** before last date and time of submission of bid as notified. **No post-tender modification is allowed by the tenderers except through negotiations, if required. In case, any tenderer does so, the tender will be rejected and the tenderer will be debarred for future tendering in CCU/CPWD for two years by the concerned enlisting authority (in case of CPWD enlisted contractor) and by the concerned CE/SE (in case of non-enlisted contractor).**
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 of (a) 5% of tendered value or Estimated Cost Put to Tender (ECPT) (whichever is higher) performance Guarantee shall remain valid for a minimum period of six months beyond the date of completion of all contractual obligations. (b) Where the tendered amount is less than eighty percent (80%) of the Estimated Cost Put to Tender (ECPT), the Performance Guarantee, in addition to the requirement under (a) above, shall be increased by an amount equal to the difference between eighty percent (80%) of the ECPT and the tendered value 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 of any Commercial Bank. 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 be 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 sub-contractors, if any engaged by the contractor for the said work within the period specified in Schedule F.

12. Intending contractors 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. The contractor shall be deemed to have full knowledge of the site whether he/she inspects it or not and no extra payment consequent on any misunderstanding or otherwise shall be allowed. The contractor shall be responsible for arranging and maintaining at their 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 contractor implies that they have read this notice and all other contract documents and have made themselves aware of the scope and specifications of the work to be done 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 Civil Construction Unit 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 **75 days** from the date of opening of technical bids. Further,

- i) If any tenderer withdraws his tender within 7 days after last date **and time (24 hours basis)** 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 **and time (24 hours basis)** 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) **Withdrawal of the tender, by the tenderer, shall only be made through e-tender portal. Any other method i.e. through letter/ e-mail etc. shall not be considered.**
- iv) 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 onat 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. The bidders must associate with himself, with agencies as per NIT conditions.
22. **Specialized Agencies for specialized works:** The contractor must associate himself with agencies of the appropriate eligibility for each of specialized nature of items mention in bid document. The works of specialized nature shall be got executed only through OEMs/associated agencies specialized in these fields. **However, the work of lifts shall be carried out by OEMs only.** 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. The value of executed works shall be brought to current costing level by enhancing the actual value of work done at simple rate of 7% per annum calculated from the date of completion to the last date of submission of bids. The contractor has to submit MOU with associated contractor (in case electrical contractor is associated), engineers name, credential, email address & mobile no. before start of work. The main agency should possess a valid electrical contractor license for executing EI works otherwise they have to associates contractor having valid electrical contractor license. It shall be the responsibility of contractor to sort out any dispute / litigation with the Specialized Agencies without any time & cost overrun to the Department. The 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. The 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 proposal of associate agency along with proposed MoU for all specialized agencies (for Civil and E& M works as specified in the bid documents) shall be submitted by the contractor within 03 months of the date of start/commencement of the work. In case of non-submission or incomplete or part submission of the proposals, **deduction @ Rs.500/-** per day per proposal of specialized agency shall be made from any amount payable to the contractor.
25. The 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 them.

26. 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.

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

TECHNICAL BIDS

SECTION-I

BRIEF SCOPE OF WORK

The scope of work is indicative and not exhaustive. The architectural drawings provided in this bid document are conceptual drawings which are indicative and meant for guiding purpose only. The contractor shall have to develop these drawings as per the scope of work for completing and handing over of the project. Additionally, the contractor shall execute all necessary items for Civil, Electrical and other works to make building fully complete functional/operational and habitable of the **Planning, designing and Modernisation of the Entrance Plaza of National Zoological Park at New Delhi, India on EPC Mode- I** making the project functional, habitable and ready for occupation in accordance with duly approved drawings by the Engineer-in charge, to be developed by the contractor on basis of attached drawings with the bid documents.

The Architectural drawings attached with tender documents are conceptual not exhaustive meant for guiding purpose only. The Layout Plan, drawings and **Soil Test Report**, forming part of this NIT are indicative only. There can be changes in the scope of work as per requirements of Local body, Fire Services etc. Contractor shall carryout such changes which occur due to Building byelaws or statutory requirements.

Bidders shall assess & evaluate the same before bidding and quote the rates accordingly. Any aspects left out in the drawings to make the all buildings, development works and services (Civil + E&M with bulk services) functional, habitable, and ready for occupation to meet the requisite criteria, National Building Construction Standards (NBCS) 2026 regulations, CPWD Manual on Accessible Built Environment, Harmonized Guidelines and Space Standards for Barrier-Free Built Environment for Persons with Disability and Elderly Persons issued by Ministry of Urban Development, Govt. of India, etc. are to be incorporated by the contractor during execution within the same cost as quoted by the Bidder. This shall not be considered as “Enhancement/Variation/Change in scope of work” and nothing extra shall be paid on this account.

The scope of work includes all Construction works for the Food Court, Information Centre & Souvenir Shop, Entry gate, Entry Forecourt, Extension of old footover bridge along with its landscaping at Mathura road to enter in Zoo, bus dropoff shelter, four-wheeler dropoff shelter, development of green areas, surface parking, landscape fountain, paved forecourt, internal roads and footpaths, entry for parking area, demolition of existing boundary wall at Mathura Road to facilitate entry and exit of the vehicles at Zoo, construction of new boundary wall at several new location and at the location of demolishing of existing boundary wall and where ever required as per mentioned in tender drawings in bid document at all such locations to **entire project area of entrance plaza** the zoo campus, external development works around the buildings and services and complete site development etc. and Civil, E & M Works, MEP works associated with all these structures and services are to be carried out at the site. MEP work includes Wet riser system of Fire Fighting System with sprinkler, Illuminated Signages & fire extinguisher, Automatic Fire alarm system and Public Address system, Internal Electrical Installations, External Electrical Service Connections, compound lighting, Entry gate lighting, Power Wiring and Plugs, Lightning Conductors, Telephone Conduits, Electrical Substation, Diesel Generating Sets (DG sets), UPS, 2 numbers Passenger Escalators, Baggage Scanner, Door Frame Metal Detector, HVAC (VRV/ VRF Air Conditioning System), Solar Photo Voltaic

Power Generation Plant, IP Based CCTV Surveillance System and Allied equipment, Automated Flap Barrier System, Sewage Treatment Plant (STP), Rain water harvesting system, Horticulture work Hydro pneumatic System including hydro pneumatic pumps.

1. The project will be executed on **EPC Mode-I (Design & Build) Turn key basis**. This includes obtaining all necessary local body, statutory and other approvals / clearances, conducting soil testing, hiring expert consultants for the development of architectural designs & drawings, preparing detailed working drawings, structural designs & drawings, all services designs and drawings, development of Building Information Models (BIM), preparation of schedule of quantities as per applicable DSR and executing the works as per the contract documents. Additionally, preparation and submission of completion plan for buildings and services are required.
2. The scope of work **entire project area of entrance plaza** all activities / works from the given concept to completion.
3. **The campus shall be designed and constructed to achieve minimum 4-star GRIHA rating. The responsibility of Investigations, Designing, Detailed Planning, Procurement, Construction, Safety, quality, and risk of Engineering lies with the contractor. Contractor takes the full responsibility for the design and execution.**
4. The scope of work includes planning, designing, construction and commissioning of buildings / structures as stipulated at locations indicated in the layout plan. The buildings should be designed and executed as per the conceptual plans for various buildings / structures enclosed with the tender document, and design & execution of all services and obtaining all Statutory Approvals from Local Authorities / Central Authorities / Defence Authority / Airport Authority / Chief Fire Officer / Pollution Control Board / Ministry of Environment, Forest & Climate Change / Height NOC from aviation authorities/ Water and sewer department/ State PWD/ Municipal Corporation/ Village panchayat & other Statutory Authorities from inception to completion and occupation.
5. The work includes Civil, E&M, MEP Services and all other development works including Horticulture. Works. All safety aspects and any other activities necessary for the satisfactory construction and completion of the project in all respects to the best satisfaction of the Engineer in Charge are included in the scope of work.
6. The responsibility of investigations, planning and design, procurement, construction, safety, quality, and engineering risk entirely lies with the contractor.
7. All works have to be executed as per Approved Architectural Drawings, User requirements, and Detailed Specifications provided in the bid document, CPWD Specifications, and National **Building Codes Standards 2026** (in case of difference, the stringent / higher specification of the two shall be followed). Nothing extra shall be paid on this account.

8. The Architectural drawings attached with tender documents are conceptual not exhaustive meant for guiding purpose only. The Layout Plan, designs and soil test report, forming part of this NIT are indicative only. There can be changes in the scope of work as per requirements of Local body, Fire Services etc. Contractor shall carryout such changes which occur due to Building byelaws or statutory requirements. Bidders shall assess & evaluate the same before bidding and quote the rates accordingly. Any aspects left out in the drawings to make the all buildings, development works and services (Civil + E&M with bulk services) functional, habitable, and ready for occupation to meet the requisite criteria, National Building Construction Standards (NBCS) 2026 regulations, CPWD Manual on Accessible Built Environment, Harmonized Guidelines and Space Standards for Barrier-Free Built Environment for Persons with Disability and Elderly Persons issued by Ministry of Urban Development, Govt. of India, etc. are to be incorporated by the contractor during execution within the same cost as quoted by the Bidder. This shall not be considered as “Enhancement/Variation/Change in scope of work” and nothing extra shall be paid on this account.
9. Any change, modification / revision in design/drawing required to be done by CCU, User department (National Zoological Park, New Delhi), Local Bodies, Proof Consultants, etc. will have to be done by the contractor as per applicable standards, and nothing extra shall be payable. The decision of the Engineer in Charge in the matter shall be final and binding. No claim whatsoever will be entertained on this account. However, if there is any variation in the plinth area as mentioned in the bid documents, the same shall be adjusted (paid/deducted) as per the terms and conditions of the contract.
10. Wherever the bid document specifies that the work shall be executed as per relevant CPWD specifications or other specified standards, it refers strictly to the technical work specifications outlined in the manuals or codes during execution.
11. The contractor shall take all necessary precautionary measures to prevent accidents involving their employees, construction workers, the public, and supervisory staff of CCU. This responsibility encompasses providing necessary safety equipment such as temporary roofs or canopies at entry and exit points of buildings under construction, as well as personal protective equipment like helmets, jackets and safety shoes required at the worksite. These safety measures are to be implemented by the contractor at no additional cost to the project.
12. It shall be deemed that the Contractor has satisfied himself with the nature and location of the work, general and local conditions, and particularly those pertaining to transport including restriction of movement of traffic / vehicles, handling, availability and storage of materials, availability of labour, weather conditions at site, and general ground / sub-soil conditions. Agencies are expected to quote their rates accordingly and nothing extra shall be payable for any reason/s whatsoever it may be. **CCU shall bear no responsibility for the lack of such knowledge and also the consequences thereof to the contractor. The information and site data shown in the drawings and mentioned in the tender documents are furnished for general information and guidance only. The Engineer in charge in no case shall be held responsible for the accuracy thereof or/and deductions, interpretations, or conclusions drawn therefrom by the contractor and no claim shall be entertained whatsoever on this account; if the site conditions / information is different or otherwise incorrect. It will be presumed that the contractor has satisfied himself for all possible contingencies, situations,**

bottlenecks, and acts of coordination which may be required between the different associate agencies by the main contractor.

13. The scope of work outlined here includes all costs associated with materials, manpower, equipment, tools and plants (T&P), fixtures, accessories, royalties, taxes, watch & ward, and all other essential elements necessary for the satisfactory completion of works as described. This comprehensive coverage extends to any changes, modifications, or revisions required in the drawings by User department, CCU, local bodies, proof-checking consultants, etc., in accordance with applicable standards, which shall be executed by the contractor at their own cost without any additional payment.
14. **Topographic Survey :**
 - 14.1 Before commencing the topographic survey, the entire campus, which is covered with vegetation and trees, shall be cleared. The contractor shall ensure that all necessary clearance, including removal of vegetation and trees, is completed prior to the commencement of the topographic survey. This clearance must be carried out in compliance with applicable environmental regulations and local body guidelines.
 - 14.2 Before commencing the topographic survey, the entire project area, which is covered with vegetation and trees, shall be cleared. The contractor shall ensure that all necessary clearance, including removal of vegetation and trees, is completed prior to the commencement of the topographic survey. This clearance must be carried out in compliance with applicable environmental regulations and local body guidelines.
 - 14.3 The EPC contractor shall perform a comprehensive topographical survey of the entire project area, which includes a Digital Survey and a contour survey. This is required as part of the scope of work and shall be carried out at the contractor's expense. The site is sloppy terrain, the inclusion of a topographical survey (contour plan) in the bid documents provides an initial understanding of the site's topography. The contractor may also need to conduct additional surveys necessary for the execution of the works / services.
 - 14.4 However, it is imperative for the contractor to independently verify the accuracy of the provided topographical survey, visit the site, and thoroughly acquaint themselves with the site's conditions. The contractor cannot claim compensation for unforeseen challenges such as difficult site conditions, additional transportation or handling requirements (load or lift), reduced labour productivity, or other unforeseen difficulties at a later date.
 - 14.5 The contour survey plan included in the bid document offers indicative site levels for reference only. The buildings are strategically placed at the most feasible sites according to preliminary conceptual plans, and the development of infrastructure such as roads, services, and utilities has been planned based on these placements.
 - 14.6 The EPC contractor shall perform a comprehensive topographical survey of the entire project area, which includes a Digital Survey and a contour survey. This is required as part of the

scope of work and shall be carried out at the contractor's expense. The site is sloppy terrain, the inclusion of a topographical survey (contour plan) in the bid documents provides an initial understanding of the site's topography. The contractor may also need to conduct additional surveys necessary for the execution of the works / services.

14.7 However, it is imperative for the contractor to independently verify the accuracy of the provided topographical survey, visit the site, and thoroughly acquaint themselves with the site's conditions. The contractor cannot claim compensation for unforeseen challenges such as difficult site conditions, additional transportation or handling requirements (lead or lift), reduced labour productivity, or other unforeseen difficulties at a later date.

14.8 The contour survey plan included in the bid document offers indicative site levels for reference only. The buildings are strategically placed at the most feasible sites according to preliminary conceptual plans, and the development of infrastructure such as roads, services, and utilities has been planned based on these placements.

15. Soil Investigation:

15.1 Soil investigation report attached with this bid document is indicative and for guidance purpose. The contractor is also required to conduct a detailed soil investigation at their own cost in accordance with relevant IS codes, National Building Construction Standards (NBCS) 2026, etc., through soil consultants with at least 15 years of professional experience and a proven track record of successfully conducting soil investigations for at least two similar projects and the same one set of test reports shall be submitted to the Engineer in Charge. The department may verify these results through independent soil consultants if necessary. Alternatively, the contractor may conduct the soil investigation through any recognized Government Engineering College, IIT, or NIT, with three sets of test reports also submitted to the Engineer in Charge. Nothing extra shall be paid for these activities.

15.2 Prospective bidders may conduct pre-soil tests at their discretion. An indicative soil investigation report is provided with the tender documents for general guidance and awareness, but this does not relieve bidders of their responsibility to independently verify soil properties through their investigations before bid submission. Necessary permissions will be granted to all agencies or prospective bidders who wish to conduct their own soil investigations prior to their bid submissions. It is essential for bidders to conduct detailed soil investigations through expert soil consultants for each specific land pocket, detecting any harmful chemicals that could affect the structural design and durability of each proposed building.

15.3 The contractor shall undertake a comprehensive Soil / Geotechnical investigation to determine the soil characteristics, including the Safe Bearing Capacity (SBC) for the foundation design of buildings, retaining walls, and other structures. This investigation should ideally extend to a required depth below the anticipated foundation level. It is essential for contractor to conduct detailed soil investigations for each specific land pocket, detecting any harmful chemicals that could affect the structural design and durability of each proposed building. **The SBC for structural design shall be the minimum value out of the SBC values given in the indicative soil investigation report attached with this bid document and the soil**

investigation to be carried out by the contractor. Nothing extra shall be payable on this account.

- 15.4 Key details for conducting the soil investigation include:
- Drilling boreholes at each site of construction, including building sites, blocks, UG sump and retaining wall locations etc. in consultation with the Engineer in Charge.
 - A minimum of five boreholes per building or similar structure is required.
 - The contractor shall conduct a California Bearing Ratio (CBR) test and other requisite tests for road design purposes.
- 15.5 If concerns arise about the soil's load-bearing capacity during excavation at the foundation level, the contractor is responsible for conducting a plate load test at their own expense to reassess the SBC. Any necessary modifications to the foundation design, based on test results, shall be implemented to maintain structural integrity. Nothing Extra shall be paid in this regard.
16. **Architectural Drawings**
- 16.1 The tender documents include the conceptual preliminary layout, conceptual architectural plans. These documents are to be further developed by expert consultants engaged by the contractor. Adhering to these drawings is mandatory; however, modifications are permissible with the written approval of the Engineer in Charge, in response to local body requirements, user department requests, or other specific needs.
- 16.2 In the event that the contractor proposes alternative architectural plans and elevations that meet functional requirements, local body regulations, and user department requests; while maintaining the same number of rooms and plinth area as specified, such proposals may be considered for execution. This is subject to the approval of the Engineer-in-Charge, CCU and the user department. Any approved alternative plans and elevations shall be executed without any additional cost to the department, and no claims for extra payment on account of these modifications shall be entertained.
- 16.3 The architect engaged by the EPC contractor shall ensure compliance with National Building Construction Standards (NBCS) 2026, local authority regulations, statutory requirements etc. while preparing the Architectural drawings. The following provisions are specifically brought to the kind notice of the contractor for compliance.
- 16.3.1 The proposed fire door shall have sufficient width at least one shutter leaf with a minimum width of 900mm to ensure wheelchair accessibility. Fire door openings towards the staircase landing shall be redesigned to prevent obstruction to the exit flow, either by altering the shutter leaf width or by shifting the door position backward.
- 16.3.2 The width of the toilet shaft shall be kept to meet National Building Construction Standards (NBCS) 2026 standards, ensuring ease of maintenance and proper access for serviceability. Adequate provisions shall be incorporated to allow proper maintenance access to the shaft.

- 16.3.3 A raised plinth level shall be provided in accordance with National Building Construction Standards (NBCS) 2026 requirements to facilitate proper site drainage and flood protection, ensuring the structural and functional integrity of the building.
- 16.3.4 Access to the fire pump room shall not be planned through the fire escape staircase to avoid confusion in exit routes and to ensure that emergency escape paths remain unobstructed at all times.
- 16.3.5 All final architectural drawings and Good for Construction (GFC) drawings shall be submitted for approval from the concerned local authorities and shall meet all statutory requirements before execution. The services provided in the lower ground floor and upper floors shall be checked for compliance with National Building Construction Standards (NBCS) 2026 and local authority regulations.
- 16.3.6 Any other modifications as proposed by the Engineer-in-Charge during execution shall be incorporated to ensure full compliance with applicable standards and project requirements.
- 16.3.7 The EPC Contractor shall obtain final approval from the User department Department and Engineer-in-Charge after incorporating all required modifications. The contractor shall submit the final drawings for approval after making necessary revisions to the conceptual drawings. Any modifications suggested by the User department or Engineer-in-Charge shall be duly incorporated and re-submitted for approval. Work shall commence strictly after obtaining all the local bodies approvals for the finally approved drawings by the User department/ Engineer-in-Charge. No claims for any additional payments or time extension shall be entertained due to these modifications, approvals, or re-submissions, as they are included within the scope of the work of contractor.

These provisions shall be binding on the EPC contractor and shall be strictly adhered to during the finalization and execution of architectural drawings.

- 16.4 Approval for all architectural drawings prepared by the architectural consultant of the contractor will be required from a committee composed of members from each discipline of the CCU and the representatives from the user department or owner department (user department). The architectural consultant appointed by the contractor shall be responsible for getting the architectural drawing approval from the committee through presentations. This committee shall take the view on the architectural drawings prepared by the architectural consultant of the contractor and release the drawings for obtaining local body approvals by the contractor. The project shall be executed based on these approved drawings.

17. **Structural Designs:**

- 17.1 The contractor is required to prepare complete structural designs, drawings on the basis of approved architectural drawings prepared by the consultant appointed by the contractor in accordance with the relevant BIS codes of practice.
- 17.2 Structural design and preparation of drawings will involve structural planning, framing, and preparation of a structural system, as well as structural analysis and design according to the

latest and updated editions of all relevant IS codes. Design calculations shall be submitted in both hard and soft copies. Dynamic analysis, if necessary, should be performed using the Response Spectrum method according to the design spectrum specified under the relevant clause of IS code 1893 (latest edition). The RCC building frame system shall be designed for ductile failure and comply with IS 4326 and IS 13920. In buildings with a Dual frame system, both the RC frame and shear walls shall be designed to exhibit ductile behavior in accordance with IS 4326 and IS 13920. The contractor shall also prepare and supply a minimum of six sets of Good for Construction (GFC) structural drawings, along with a design basis report and design calculations.

- 17.3 Structural design work shall be performed by a qualified structural designer to be appointed by the contractor.
- 17.4 Proof checking/vetting of the structural drawings shall be got done by the contractor from the reputed Government institutes like IIT's and NIT's or any other reputed Government Institutes approved by the Engineer in Charge.

However, the contractor shall obtain prior approval from the Engineer in Charge before appointing the Proof-Checking Institute. The fee for vetting/proof checking of structural drawings to Proof-Checking Institute shall be borne by the contractor.

- 17.5 Any modifications required in the design and structural drawings due to site conditions or as a result of proof checking shall be made by the contractor at their own cost. The Engineer in Charge's decisions regarding these modifications are final and binding, and no claims related to these modifications will be entertained. The contractor is responsible for all costs related to the designs.
- 17.6 The contractor is also responsible for submitting drawings, liaising with, and meeting with officials from the concerned institute. If the department requires changes to vetted drawings, the contractor shall resubmit the corrected vetted drawings to the Engineer in Charge at no extra cost. All correspondence between the institute and the contractor regarding proof checking and payment receipts shall be submitted to the Engineer in Charge.

18. MEP Design (Internal & External):

- 18.1 The MEP design for both internal and external components is a comprehensive task that involves multiple expert consultants under the direction of the architectural consultant appointed by the contractor.
- 18.2 The consultant's role includes providing an extensive range of consultancy services as specified in the project requirements. Although the description of services are provisional and indicative, the consultant may need to extend beyond the defined scope to ensure full compliance with project requirements. This includes planning and executing shop drawings for all services, aligning with the details specified in the civil and electrical works sections of the bid documents. The EPC contractor is expected to ensure comprehensive service delivery during the execution phase, either directly or through the consultant. If the consultant lacks the

necessary in-house expertise, the appointment of specialized consultants shall be done by the contractor without any extra cost.

- 18.3 The scope of MEP consultancy encompasses a wide range of components, with specific focus on both civil and MEP services. For the civil component, the scope includes the planning, designing, and execution of both internal and external services. These services cover water supply, sanitary, stormwater drainage, sewerage systems, sewage treatment plants (STP), rainwater harvesting systems, RCC retaining walls, CC Toe walls, CC roads, footpaths, Tube wells and Horticulture work. Additionally, the scope includes the design and installation of electrical and mechanical services

In particular, the civil scope involves the detailed design and laying of water supply & sanitary lines as well as the planning of plumbing systems. Furthermore, the consultancy includes the design of recycled water supply systems intended for horticultural use and for flushing purposes, ensuring that sustainable and efficient water management practices are integrated into the project.

- 18.4 **The scope extends to designing stormwater drainage systems, rainwater harvesting systems, and ensuring the planning of sewer, stormwater drainage, and water supply systems aligns with existing levels and connectivity points.** For the E&M components, the consultant is tasked with the comprehensive planning, design, and preparation of detailed drawings for all Electrical, Mechanical, and Plumbing (MEP) services required in the Food Court, Souviner Shop & information centre, Entry gate, Entry Forecourt, Extension of old footover bridge along with its landscaping at Mathura Road to enter in Zoo, internal road and footpath work. This includes the strategic placement of MEP equipment and fixtures, ensuring functional efficiency, safety, and accessibility. The consultant is expected to provide all necessary details to ensure a cohesive integration of all systems within the building.
- 18.5 Special attention is required for the design of interior spaces with appropriate acoustical treatments, comprehensive signage systems throughout the building, and firefighting systems that comply with local fire safety regulations. Moreover, the contractor shall plan and design specialized systems like internal electrical installations, external lighting, service connections, substations, and power distribution networks, along with network architecture for LAN, CCTV, and IPBAX systems.
- 18.6 Proof checking of MEP drawings is crucial and shall be performed by recognized institutions such as IITs or NITs or Government institutions of repute with prior approval from the Engineer in Charge. The contractor is responsible for ensuring that the MEP drawings are proof checked by the agreed institute and any modifications required due to site conditions or results from proof checking shall be addressed at no additional cost. This includes the management of all associated costs and liaising with the concerned institute officials. If the department requires changes to vetted drawings, the contractor is responsible for the resubmission of corrected drawings without any extra costs.
- 18.7 The contractor shall obtain prior approval from the Engineer-in Charge before appointing the proof-checking institute, and the fee for this service shall be borne by the contractor.

19. **BIM Consultant for Architectural, Structural, and MEP Services**
- 19.1 The BIM Consultant, working under the guidance of the architectural consultancy appointed by the contractor, is required to hold a master's degree or equivalent in a relevant field of engineering or architecture. Additionally, they shall have experience in BIM modelling for similar projects. Documentation that validates these qualifications shall be submitted to the Department for approval at the specified time.
- 19.2 The project shall be executed using Building Information Model (BIM) of minimum LOD 350. The BIM model shall be used for architectural, structural, MEP services and other design and services. The Building Information Model (BIM) will be approved by CCU at different stages.
- 19.3 The agency shall provide a Building Information Model (BIM) at a minimum Level of Development (LOD) 350 during the planning and construction phases. This model will serve as a crucial tool for the integration and coordination of various services such as plumbing systems, sanitary installations, internal electrical installations, firefighting systems, fire alarm systems, HVAC systems, low voltage services, and the design of horticulture and landscaping. Additionally, the agency is tasked with preparing and submitting a Work Breakdown Structure (WBS) for all buildings to ensure clear scheduling and phasing of the construction activities.
- 19.4 The consultancy charges are inclusive of services for the development of the BIM model and the WBS. Therefore, no additional payments will be made for these deliverables.
- 19.5 The consultant's responsibilities encompass comprehensive BIM consultancy services for Architectural, Structural, and MEP services. These responsibilities include:
- 19.5.1 BIM Modelling: Developing and managing BIM models for all architectural, structural, and MEP services according to project specifications, ensuring integration of all models to facilitate coordination and clash detection.
- 19.5.2 Architectural Services: Creating detailed BIM models for all architectural elements such as building layout, space planning, and interior finishes, ensuring the models reflect the design intent and meet user department requirements.
- 19.5.3 Structural Services: Developing BIM models for structural components including foundations, superstructures, and load-bearing elements, ensuring compliance with IS codes and relevant standards.
- 19.5.4 MEP Services: Modelling both internal and external MEP systems such as water supply, plumbing, stormwater drainage, sewerage, STP, HVAC, electrical systems, and firefighting systems, coordinating these with architectural and structural models.

- 19.5.5 Quantity Surveying Services: Providing BIM-based quantity take-offs and cost estimation for all project components, ensuring accuracy and alignment with project specifications.
 - 19.5.6 Green Building Design: Modelling building systems to achieve minimum **4-Star GRIHA** rating green building rating, adhering to the guidelines of the Green Rating Manual.
 - 19.5.7 Civil Components: Planning, modelling, and executing internal and external services as per attached drawings and project specifications.
 - 19.5.8 E&M Components: Modelling electrical, mechanical, and plumbing systems including internal installations, external lighting, service connections, substations, power distribution, and network architecture, accommodating specialized works such as HVAC systems, lifts, fire alarms, PA systems, lightning conductors, and DG-sets.
 - 19.5.9 Coordination and Collaboration: Ensuring effective coordination between architectural, structural, and MEP models and collaborating with other specialists to resolve conflicts or issues identified through clash detection and model reviews.
 - 19.5.10 Documentation and Submission: Providing comprehensive BIM documentation including design basis reports, model validation reports, and coordination reports, and submitting both hard and soft copies of all relevant documents and models as required.
 - 19.5.11 Additional Services: Performing any other services necessary to meet the full project requirements and ensure user department satisfaction, even if not explicitly mentioned in the contract documents.
- 19.6 The BIM Consultant is tasked with thorough planning, design, and execution, adhering to all relevant norms and user department requirements to ensure a successful project outcome.
- 20 **Green Rating Consultant for GRIHA Rating:**
- 20.1 The buildings are to be designed and constructed conforming to Green Building norms to achieve minimum **4-Star GRIHA** rating. The contractor is required to achieve the necessary rating based on the scope of work of this tender document and any additional items required. If any additional items are necessary to obtain the required Green Rating, the contractor will execute these at their own expense, with no additional payments. This shall be deemed to be inclusive in the quoted rates by the contractor.
 - 20.2 The responsibility for the documentation required to obtain the green building rating rests with the agency, which will also establish liaison with the concerned authorities and manage all arrangements for Green Rating team visits by GRIHA/user department department/Engineer-in charge, bearing all associated costs. No extra payment for these expenses will be made to the contractor.

- 20.3 The Green building consultant hired by the contractor shall hold a master's degree or equivalent in a relevant field and have at least 10 years of experience in green building design and certification. Documentation verifying these qualifications shall be presented to the Department for approval at the designated time.
- 20.4 The consultant's responsibilities include providing comprehensive consultancy services to achieve the required Green Rating for the project. These responsibilities encompass:
- 20.4.1 Initial Assessment: Conduct an initial review of the project's design and construction plans to pinpoint potential improvements and strategies that meet the required Green Rating criteria.
 - 20.4.2 Compliance with Green Rating Standards: Ensure that the building's design, construction, and operational procedures comply with the green building rating norms, adhering to the guidelines.
 - 20.4.3 Sustainability Strategies: Develop and propose sustainability strategies and solutions that align with green building criteria, focusing on energy efficiency, water conservation, waste management, indoor environmental quality, and the use of sustainable materials.
 - 20.4.4 Documentation Preparation: Assemble all necessary documentation for Green building certification. This includes preparing detailed reports, calculations, and proofs of compliance with Green Rating standards.
 - 20.4.5 Coordination with Design Team: Work closely with the architectural, structural, and MEP consultants to integrate green building standards into the design and construction processes, ensuring effective incorporation of green strategies.
 - 20.4.6 Training and Awareness: Provide training and guidance to the project team regarding green building standards and certification processes, while also promoting awareness of green building practices and the significance of compliance.
 - 20.4.7 On-site Verification: Perform on-site inspections to confirm adherence to green building guidelines, addressing any discrepancies and implementing necessary corrections.
 - 20.4.8 Submission for Certification: Manage the submission of all required documentation and applications to the green building authority / council for certification. Communicate with the council to smooth the review process and respond to any inquiries or additional requirements.
 - 20.4.9 Post-Certification Support: Offer support for any needs following certification, ensuring the building continues to meet green building standards over its lifespan.
 - 20.4.10 Reporting and Feedback: Regularly report progress to the EPC contractor and the Department, documenting the actions taken, challenges faced, and solutions applied. Provide ongoing feedback and suggestions for continual improvement.

- 20.5 The consultant shall also manage any additional tasks needed for the successful completion of Green building certification, including addressing unforeseen requirements or updates to standards.
21. **Local Body approvals, Statutory approvals and other approvals:**
- 21.1 The agency is responsible for securing all approvals for the architectural schemes and plans from all requisite local bodies, statutory authorities and all other authorities before starting construction work. This responsibility extends to obtaining necessary approvals and certificates from local bodies, the Fire Safety Department, and other authorities not only after the completion of the work but also during the execution phase. If any local bodies or other authorities recommend modifications to the concept architectural drawings provided by the department, the contractor shall implement these modifications with the approval of the Engineer in charge.
- 21.2 The contractor is responsible for obtaining all mandatory approvals and No Objection Certificates, including the Consent for Establishment from local body authorities such as the local Fire Department, local town planning authority, local groundwater authority, local electricity supply authority, local pollution control board, Forest Department, Tree Officers / Authorities, Lift Inspectorate, Central Electricity Authority, Airport Authority of India/Aviation Authorities, and Environmental clearance from the Ministry of Environment, Forest & Climate change, all **at their own expenses**.
- Additionally, the contractor shall obtain Consent for Establishment (CFE) and Consent for Operation (CFO) for the project, as well as for the Sewage Treatment Plant (STP) from the State Pollution Control Board.
- 21.3 The contractor is required to prepare and submit all necessary documents to the local statutory bodies, notifying the Engineer in charge of these submissions. They shall also collect field samples and carry out all necessary tests required for the submission of these applications, again at their own cost. If needed, the contractor should reapply according to the requirements of local bodies and may appoint consultants to assist with obtaining local body approvals, covering these costs themselves.
- 21.4 For record-keeping purposes, two final copies or sets of the documents prepared for submission to local bodies shall also be provided to the Engineer in charge. All documents, designs, and drawings generated from the contract work will become the exclusive property of the Department, and the contractor is prohibited from using them elsewhere.
- 21.5 Upon completion of the project, the contractor shall obtain Completion certificates, Fire clearance certificates, occupancy certificates, consent for operation from pollution control board and all other required certificates from statutory / local bodies before the completed buildings can be handed over to the Department.

21.6 All statutory payments to local bodies are to be made by the contractor and will be reimbursed by the department, upon the contractor providing the documentary proof for payment made to the statutory/local bodies.

22. OTHER MISCELLANEOUS WORKS

22.1 During execution, if there is any need for revisions to architectural drawings, structural drawings, MEP drawings, or the BIM model due to site requirements, GRIHA requirements, local body requirements, user department requirements, or as per the Engineer-in-Charge's instructions, the agency shall make all necessary modifications to the drawings. The modified drawings shall be submitted for approval, and the work shall be executed accordingly after receiving approval. No additional payment shall be made for the modifications to the drawings or for execution.

22.2 Internal water supply lines will be laid out according to a scheme prepared by the contractor and approved by the Engineer in charge. This will include the construction of overhead water tanks on top of the respective buildings as per local bylaws and applicable National Building Construction Standards (NBCS) requirements, ensuring that tank capacities meet or exceed those specified in the scope of work for each building as detailed in the approved architectural drawings. The tanks shall be of reinforced cement concrete (RCC) unless specifically provided otherwise.

22.3 External water supply lines will be laid out according to a scheme prepared by the contractor and approved by the Engineer in charge. The contractor is also responsible for planning, designing, and construction of water storage UG Sumps, and pump houses for water supply, firefighting, domestic water requirements, flushing water requirements, and rainwater harvesting, including the installation of pumps and standby pumps as per approved drawings, specifications, or as directed by the Engineer in charge.

22.4 The contractor is responsible for all costs associated with the restoration of any services damaged during the execution of the project. This includes repairing or replacing any facilities impacted by construction activities.

22.5 The contractor is required to maintain a clean construction site at all times, removing all debris, rubbish, dirt, and surplus or waste materials. This responsibility extends to the maintenance, cleaning, and de-silting of drains and pipelines laid by the agency for all services executed to the entire satisfaction of the Engineer in charge throughout the construction period.

22.6 Prior to the handover of the buildings, the contractor shall also undertake deep cleaning of all buildings, sweeping of roads, paths, landscapes, and desilting of sewer lines and stormwater drains. All necessary machines, equipment, and labour for these tasks will be arranged by the contractor at his own expense.

22.7 Within two months from the date of approval of structural and services drawings, the contractor is required to submit the Schedule of Quantities of items, detailing their rates as per

the relevant Delhi Schedule of Rates (DSR) for Civil, Electrical, and Mechanical works. This should include up-to-date correction slips and analyzed Local Market Rates for items not covered in the DSR, with detailed measurements and specifications, in four sets, as finally approved.

- 22.8 Planning and providing required electrical installations for the proposed building will adhere to NBCS-2026 norms, BIS Codal provisions, BEE & Super ECBC norms, CEA, local electricity board rules, etc., and will include obtaining necessary approvals from local bodies as required.
- 22.9 Roof top rainwater harvesting, surface runoff harvesting, and groundwater recharge systems shall be executed as per approved norms. The contractor is responsible for planning, designing, and executing the rooftop rainwater harvesting system, including laying pipelines and constructing substructures or superstructures, designed to handle the rainfall intensity at the site location.
- 22.10 If the existing compound wall, gate or any other structure or feature needs to be dismantled, removed, or modified during construction, the agency will handle these changes without any additional cost.

22.11 The scope of work includes several key responsibilities:

- 22.11.1 The contractor shall demolish and dismantle any old structures or foundations below the ground within the campus as required by the site conditions.
- 22.11.2 The contractor is responsible for the cutting or transplantation of trees affected by the construction footprint or road layouts or for any other reason, getting approvals from the forest department/ tree authority or local body. They shall also undertake compensatory plantation/ transplantation for trees removed as per policy and maintain these plants at a site approved by the tree authority until the project is handed over. Specialized agency shall be engaged for compensatory plantation/ transplantation of trees. Nothing extra shall be payable to the contractor on this account.
- 22.11.3 The contractor shall obtain the main electric supply, water supply, sewerage connections etc. from the relevant local bodies or departments and coordinate with them to ensure these services are activated promptly. After getting these connections, all bills of charges shall be paid by the contractor till the building is handed over. Nothing extra shall be payable to the contractor on this account.
- 22.11.4 After completion, the contractor is required to prepare and submit all 'As Built' drawings of the buildings and services, along with other related documents in both hard and soft copies.
- 22.11.5 The scope of work includes all costs associated with labour, materials, tools, plants, and machinery necessary for the execution of the entire project as per the detailed design and drawings developed by the contractor in accordance with the tender conditions.

- 22.11.6 All copyrights and other proprietary rights in the works created under this contract will vest with and be assigned to CCU. The department will exclusively own all property rights, title, and interest, including the right to modify or make alterations to the works. These rights do not lapse even if not exercised during the term of the copyright, and the contractor is required to execute any necessary documents to secure these rights for the department. The term "Works" includes all designs and documents prepared by the contractor throughout the project and any work created in fulfilling the contract obligations.
- 22.11.7 The contractor is prohibited from using or allowing the use of project-related drawings, designs, documents, and software without the prior written permission of the Department. Any unauthorized use constitutes a violation of Intellectual Property Rights.
- 22.11.8 The consultant of the contractor has to consider rainfall data for recurrence interval of 25 years (National Building Construction Standards (NBCS) 2026, Vol. 2, para-4.5.11.2.3), HFL, GW table data, overall slope of the plot, external drainage system, available or planned by local bodies while deciding the plinth level. Drainage system to be designed keeping appropriate sections to maintain reasonable flow for most of the year. Applicable national guidelines/ codes are to be followed in this regard.
- 22.11.9 The consultant of the contractor has to consider water supply peak demand based on campus occupancy. Water supply peak demand, overhead tank / UG sump capacity including fire requirement, and calculations will be based on BIS and other applicable codes.
- 22.11.10 The consultant of the contractor has to consider road sections etc. based on projected traffic, IRC, BIS and other applicable codes/ guidelines.
- 22.11.11 The consultant of the contractor has to consider appropriate R-value (thermal resistance) for external walls, roofs, façade, windows according to climatic region and wind zone. ECBC norms and other relevant codes shall be consulted.
- 22.11.12 The consultant of the contractor has to consider appropriate earthquake zone. If any special earthquake feature of the forthcoming site is required then it shall be incorporated in the structural design.
- 22.11.13 The consultant of the contractor shall calculate electrical load based on consumption of all internal and external electrical works, machines, equipment's, motors, pumps etc. for design of substations, DG sets and to obtain approval of electrical connection from the local body.

23. Documentation, Instrumentation, etc.

- 23.1 All drawings related to the project shall be created using the latest version of AutoCAD/Revit. The contractor is responsible for providing soft copies of all approved and proof-checked drawings on DVD, pen drive, or CDs, along with six sets of hard copies or prints. Additionally, the contractor shall submit scanned copies of all proof-checked drawings and "As Built"

drawings. These shall be delivered to the Engineer-in-Charge without any additional costs, in accordance with the approved program and timelines.

23.2 The contractor is also required to submit pen drives along with three sets of hard copies of all design calculations to the Engineer in charge. This submission shall adhere with the approved program and be free of extra charges.

23.3 Additionally, **three copies of the "Operation and Maintenance Manual"** from the respective OEMs need to be provided. This manual should detail access arrangements, essential safety precautions, and procedures for both minor and major repairs for each building component and layout, including periodic renewals of finishes and treatments. These manuals shall be supplied to the Engineer in charge at no additional cost.

23.4 The arrangements for fixing internal and external lighting shall be approved by the Department and executed accordingly by the contractor.

24. **Additional stipulations include:**

24.1 Ramps, plinth walls, etc., shall be provided as required in the project, even if not specifically mentioned in the documents, for which nothing extra shall be payable.

24.2 All quoted rates shall include any type of foundation deemed necessary based on soil investigation and structural design considerations.

24.3 Ramps with stainless steel railing for physically challenged individuals shall be provided at the ground floor of each building. All necessary provisions to make buildings barrier-free shall also be included and are considered part of the plinth area rates.

24.4 The scope of work also covers the shoulders for roads wherever required. Nothing extra shall be payable to the contractor on this account.

25. The parking areas shall be planned and designed to meet the specific requirements outlined in the project specifications, ensuring adequate space and accessibility according to the anticipated usage as per local bylaws and regulations.

26. **SCOPE OF WORK FOR ITEMS IN BUILDING PORTION:**

26.1 General

26.1.1 The site is located on Plain terrain. Plinth height and formation levels shall be designed by the contractor and shall be submitted for approval to the Engineer-in-Charge before execution. The work shall proceed only after receiving approval for the proposed levels. The levels finalized by the Engineer-in-Charge shall be considered final and binding. Details of various buildings/structures are provided below

26.1.2 The present tender is for Design and Modernisation of the Entrance Plaza of National Zoological Park at New Delhi, India which consists of Construction of Food Court, Souvenir Shop & Information Centre, Entry Gate, Entry Forecourt, Miscellaneous structures, Service

blocks (Substation, Solid waste Management, Plant room, STP, WTP, UGT, Toilet block etc.), Security post, Water Bodies, Walkways, Gate house, semi covered areas and other buildings/ miscellaneous works including all Civil, Horticulture, Landscaping, Electrical & Mechanical. The scope of work also covers external development works and other allied works within controlled architectural parameters. The details of complete scope of work also includes demolition of all existing infrastructure or structures falling in the layout/alignment of proposed buildings/developments if any. The indicative list of the structures to be built is as under –

S. No.	Sub-head	Tentative Covered Area (Sqm.)
1	Food Court	5,209
2	Souvenir Shop & Information Centre	1,258
3	Entry Gate	805
4	Entry Forecourt	3,461
5	Miscellaneous structures	1,019
6	External Development Works	As per site conditions
7	Substation, UGT including pumproom STP etc.	As per Detailed Engineering Practices

Note:

1. The above list is indicative only and there are several other structures/features e. g. bridge, fountains, boundary wall, gates, roundabout, ponds, gardens etc. which are also integral part of the scope of work.
2. The pathways shall be provided with random green cover with wire mesh and planter/creepers to give respite from the sun. Sufficient benches shall also be provided along the pathways having green cover. All the pathways shall have the clear width (excluding space of benches, wire mesh, structural framework, etc.) as mentioned in the indicative drawings.
3. The Conceptual preliminary layout plan, basic conceptual architectural plans, and proposed building photographs for finishing purpose are enclosed with the tender document.
4. The areas & floor height shown are indicative only and the work is to be executed as per the approved GFC drawings. However, actual plinth areas are to be worked out from the approved architectural drawings to be prepared and submitted by the contractor. For details, please refer to the conceptual drawings attached to the bid document.

26.1.3 The scope of work involves dismantling/demolishing of the existing structures if any on the proposed layout of buildings/structures/services etc. and disposing the rubbish/debris in acceptable manner in accordance to prevalent bye laws/rules guidelines laid down by the authorities.

26.2 BRIEF PARTICULARS OF CIVIL COMPONENT WORK OF BUILDING PORTION

The scope of work encompasses a comprehensive range of **Planning, Designing and Construction** and installation activities, detailed as follows, but not limited to:

26.2.1 Earthwork: The scope of work for Earthwork includes site preparation including jungle clearance and excavation to the required depths in all types of soil, including ordinary soil, soft rock, and hard rock etc. This involves excavation for building foundations, trenches, RCC retaining walls, CC Toe walls, etc. with the disposal of unsuitable excavated material at designated locations in compliance with local regulations. The work includes filling with approved materials, such as good earth or sand, placed in layers of 150mm and compacted using mechanical compactors to achieve the specified density, verified through compaction tests.

Note: The excavated good earth shall be stored within the National Zoological Park, New Delhi site at a location designated by the Engineer-in-Charge and reused wherever required for filling. Unsuitable excavated earth shall be disposed of at designated locations in compliance with local body regulations, for which nothing extra shall be payable. The excess excavated good earth shall be disposed of within the NZP, New Delhi premises and nothing extra shall be payable on this account. It includes handling all leads and lifts and performing the work under all conditions.

All operations described above are included in the scope of work, and no extra payment shall be made for these activities.

26.2.2 Foundations: The scope of foundation work includes the construction of suitable RCC foundations based on the approved structural design/drawings for all buildings including RCC Retaining walls, CC Toe walls where ever required based on soil conditions, excavation, and the casting of a bottom PCC base concrete, Foundations for entrance and exit ramps will be built with proper slope and support. Additional work includes plinth filling, levelling, compaction, disposal, and supply of good earth, soil stabilization, anti-termite treatment, damp proof course, all foundation works like footings, columns & plinth / Grade beams, and compaction of backfill material, ensuring all foundation systems meet structural and waterproofing requirements.

26.2.3 Structural Components: The structural components include the construction of foundations and retaining walls & toe walls as per the approved design and specifications. Superstructure elements such as columns, beams, lintels, chajjas, slabs, lift shafts, RCC water tanks, and staircases will be constructed to support the building's load. The scope also covers the construction of exit and entrance ramps with proper slope and structural support, ensuring seamless access. A sunken floor will be provided where ever required, and expansion joints will be provided as per CPWD specifications and relevant IS Codes.

Note:

- i) When a satisfactory bearing stratum is not encountered at a reasonable depth below the surface, then the sheet-piling shall be adopted. If the height of the wall and the pressure on the sheet plies are such that an excessively thick pile is required, the provision of a tie can be provided at one level or at many levels. No additional payment shall be made for the execution of these works, as they are included within the scope of work.
- ii) The building foundation and superstructure shall be designed and executed to accommodate the installation of the air-cooled chiller for the central air-conditioning system & Roof top Solar system. This includes the foundation work for the air-cooled

chiller on the terrace, as well as the installation of rooftop solar panels with the necessary structural support on the terrace and other locations as per the directions of Engineer in charge. No additional payment shall be made for the execution of these works, as they are included within the building scope of work.

26.2.4 Walls: This involves construction of various types of masonry / RCC walls including plinth walls for building stability, external walls, internal partition walls for room division, and other wall constructions as required by the approved design and drawings.

26.2.5 Porticos: The building portico shall be designed in accordance with the approved architectural drawings, featuring cantilever projections if any with appropriate structural supports. The design will ensure that the portico is structurally sound and seamlessly integrates with the superstructure, providing both aesthetic appeal and functional support. Proper reinforcement and detailing will be incorporated to withstand any loads and forces acting on the portico.

26.2.6 Doors & Windows: The installation of doors, including fire doors and room doors, as well as windows, ventilators, and associated fittings will be carried out as per the approved specifications. This includes the provision of mosquito-proof shutters, curtain rods and other necessary accessories to ensure proper ventilation, security, and functionality of the building's openings.

26.2.7 Railings & Grills: The installation of railings and grills will be carried out as per the approved design and layout. This includes the provision of safety railings for staircases, balconies, terraces, and other open areas, ensuring structural integrity and safety.

26.2.8 Flooring & Finishes: Installing various flooring materials such as granite, vitrified tiles, wooden, etc. along with skirting. Wall dado with granite, vitrified tiles, wood etc. up to a specified height and internal finishes involving putty, primer, paint applications, polishing etc. are also covered to ensure smooth and polished surfaces.

26.2.9 False Ceiling & Wall Panelling: Installation of false ceilings to conceal structural elements and enhance aesthetics, along with wall paneling for decorative and functional purposes, are part of the interior finishing.

26.2.10 Staircases and Ramps: Construction of staircases and ramps, including structural ramps for accessibility, and installation of railings for safety.

26.2.11 Finishing Work: This includes the execution of finishing work to the building's surfaces, such as plastering, painting, tile cladding, structural glazing, texture finish painting, etc. to enhance appearance and durability as per the approved 3D elevations and drawings.

26.2.12 Waterproofing: Waterproofing treatment shall be applied as required on terrace slabs, Mumty room slabs, sunken slabs, toilet slabs, terrace gardens, foundations, lift pits, below RCC, RCC retaining walls, water tanks, UG sumps, UG pump rooms, OHTs, and any other water retaining

or underground structures. Water stopper shall be provided at construction joints of all water - retaining structures to prevent water ingress.

26.2.13 Internal Water Supply, sanitary lines & Fittings and Fixtures: The scope of work includes the installation of internal water supply systems, sanitary lines, and associated fittings and fixtures. This involves laying of pipelines for both hot and cold-water supply (where ever required as per the direction of the engineer in charge) along with necessary valves, taps, and other fixtures& fittings such as bib cocks, stop cocks, pillar cocks, mixers, and showers etc. The installation will ensure efficient distribution of water throughout the building. Additionally, sanitary lines will be installed for the proper disposal of wastewater, incorporating required fittings such as EWCs, IWCs, washbasins, floor traps, and bottle traps, all as per the approved design and specifications.

26.2.14 Internal partitions & Fire Curtains: The installation of internal partitions, including aluminum and glass partitions, will be carried out to create or modify spaces within the building as per the approved layout. Additionally, fire curtains will be installed in designated areas to enhance fire safety by containing the spread of smoke and flames. The fire curtains will be made of fire-resistant materials and will be deployed in accordance with the approved fire safety design and regulations

26.2.15 External Water supply pipelines & Sewage lines, Fittings, Fixtures, chambers: The scope of work includes the installation of external water supply pipelines and sewage lines, along with the necessary fittings, fixtures, and chambers. This involves laying pipelines for the supply of potable water to the building from the main supply, ensuring proper connection and pressure management. Sewage pipelines will be installed for the efficient disposal of wastewater, with the necessary items such as manholes, inspection chambers, and clean-out points to facilitate maintenance and smooth flow.

26.2.16 Pump Rooms and Sumps: The scope of work includes the construction of the Fire Pump Room, WTP Pump Rooms, STP Pump Rooms, UG Sumps for domestic water, firefighting, rainwater storage tanks, and STP sumps. These facilities will be designed and constructed to meet the specific requirements for water distribution, fire safety, sewage treatment, and rainwater harvesting, using reinforced concrete as per the approved structural and MEP designs.

26.2.17 Venetian Blinds: The scope of work includes the supply and installation of Venetian blinds for all external windows and structural glazing portions. These blinds will be designed to provide effective light control, privacy, and aesthetic appeal. The installation will be carried out with appropriate brackets and fittings, ensuring secure attachment to the window frames and structural glazing.

26.2.18 Water Supply Systems: Provision of a dual piping system, for water supply, RO pipeline system, normal water pipeline system, etc.

26.2.19 Provisions for Appliances: Accommodations for geysers, water purifiers etc.

26.2.20 **Shaft Access:** Platforms and ladders provided in shafts for civil, electrical, fire-related services etc.

26.2.21 **Piping & Sewerage:** Installation of water supply and sewerage lines, ensuring efficient distribution of water and proper wastewater disposal.

26.2.22 **Signage:** The scope of work includes the installation of all required signage inside and outside the building, as per the approved design, regulatory requirements, and direction from the Engineer in Charge. This includes directional signage, emergency exit signs, room identification signs, fire safety signs, and other mandatory signage to ensure safe and efficient movement within the building. The signage will be installed in appropriate locations, ensuring visibility, readability, and compliance with accessibility standards. Additionally, this scope incorporates the installation of signboards for Food Court, Souviner Shop & information centre, Entry gate, Entry Forecourt, Extension of old footover bridge along with its landscaping at Mathura road to enter in Zoo. The contractor shall ensure that these signboards are designed, fabricated, and installed in accordance with the specifications and guidelines provided, without any additional cost beyond the approved scope of work.

26.2.23 **Barrier-Free Design:** Provisions for ramps, accessible toilets, SS studs, Chequered tiles, Braille signage, low height counter at the entrance, parking and other features ensuring barrier-free access.

26.2.24 **Installation of Rooftop Solar Panels with Structural Support:** The scope includes the installation of a rooftop solar system at a minimum height of 2.4 meters on the terrace of building, parking & in any suitable space inside the campus. This involves extending columns above the terrace and providing structural support using mild steel (MS) structures with anit-corroshive treatment and epoxy paint over it for durability. All necessary civil works, including foundation and structural reinforcement, will be carried out to ensure secure installation and optimal performance of the solar system as per the approved design and specifications.

26.2.25 **Overhead Tank / Underground sump Capacities on each building i/c Fire, Domestic & Flushing:** The scope of work includes the design, installation, and commissioning of RCC overhead water tanks (terrace tanks) and underground sumps at designated locations. Each tank is designed to meet the specific requirements for fire, domestic, and flushing water, ensuring sufficient supply for each building. The capacities for each tank are as follows:

Food Court

On Terrace of Food Court :

- **RCC OHT (Fire + Domestic):** Minimum 25,000 liters for dmonestic and 10,000 liters for fire or as per NBCS 2026 design requirements (whichever is higher).

Entry Gate

Terrace of campus control room:

- **PVC OHT (Domestic):** Minimum 2000 liters for domestic or as per NBCS 2026 design requirements (whichever is higher).

Underground Tank :

- **RCC UGT (Fire + Domestic):** Minimum 100000 liters for domestic plus 150000 liters (250000 liters) for fire or as per NBCS 2026 design requirements (whichever is higher).

All tanks will be installed in compliance with the required specifications to ensure proper operation and integration with the building's water supply, firefighting, and drainage systems. Necessary piping, valves, and instrumentation will be included for efficient operation and monitoring, ensuring seamless integration with the overall systems.

26.2.26 Retaining Walls: Planning, design, and construction of RCC retaining walls as needed to form terraces and protect buildings and for roads due to level differences.

26.2.27 Toe Walls: Planning, design, and construction of CC Toe walls as needed to form terraces and protect buildings and for roads due to level differences

26.2.28 Slope Protection: Execution of slope protection works as per site requirements.

26.2.29 RCC Staircases / MS Ladders: Construction of RCC staircases or MS ladders to access terraces in the buildings and at other places as per the approved architectural drawings.

26.2.30 Utility Connections (Water and Electricity): Establishment of water and electricity connections from the municipal/local authorities, including all materials, labour, and approvals for both internal and external works.

26.2.31 Storm Water Drain Connection: Connection of storm water drains to the municipal drainage system, or any other drainage system as decided by the Engineer in charge including all related works and approvals.

26.2.32 Site Levelling & Earthwork including cutting & filling wherever required.

26.2.33 Miscellaneous Works: Any additional work as per the requirement or as directed by the Engineer in charge.

26.3 BRIEF PARTICULARS OF E&M COMPONENT OF WORK IN BUILDING PORTION

The scope of Electrical and Mechanical (E&M) works for the building portion includes a comprehensive range of installations, as outlined below:

26.3.1 Wiring:

26.3.1.1 Food court, Souvenir Shop & Information centre, Entry Gate, Entry forecourt, Miscellaneous structure: Wiring shall be executed with FRLSH PVC insulated copper conductor wires in MS conduits for various services such as lighting, fans, power plugs, CAT 6A cables & OFC cable (for CCTV) etc., FRLSH PVC insulated copper conductor wires in MS conduits or Fire survival cables for fire alarm services and Modular type switches and sockets, LED light fittings, BLDC ceiling/wall fans, and power sockets shall be installed.

- 26.3.2 **Lightning Conductors:** Lightning conductors and earthing systems will be installed as per safety requirements and relevant norms.
- 26.3.3 **Firefighting and Fire Alarm System:** The scope includes the installation of a comprehensive firefighting system, including a wet riser and sprinkler system for fire suppression, external yard hydrants for emergency use, and fire curtains for smoke containment. Additionally, fire extinguishers will be installed at strategic locations, and an automatic fire alarm system shall be integrated to provide early detection and alert in case of fire. Dedicated VESDA system shall be installed in server rooms and communication room. All systems shall be designed and installed as per fire safety norms and regulations.
- 26.3.4 **Emergency and Illuminated Signages:** Emergency Exit and illuminated signages will be provided in in compliance with National Building Construction Standards (NBCS)-2026 norms.
- 26.3.5 **Lighting Automation Including Occupancy Sensors:** Lighting automation with occupancy sensors shall be provided in common toilets, corridor and in rooms as per drawing finalized and GRIHA norms to optimize energy use by controlling lights based on occupancy.
- 26.3.6 **Internal Electrical Installations:** The scope includes the installation of all internal electrical systems, including wiring, distribution boards, switches, outlets, lighting, and power points, rising mains etc. as per the approved electrical design and specifications.
- 26.3.7 **Power Distribution within Building:** The scope includes the installation of the Main LT Panel, along with connections to distribution boards, MCBs, and all necessary components for efficient power distribution within the building. This includes the installation of Rising Mains/ cable, UPS DB, Lighting DB, and Power DB, ensuring proper distribution of electricity to different areas of the building as per the approved electrical design.
- 26.3.8 **External Electrical Service Connections:** The scope includes the installation of external electrical service connections, including the provision of necessary infrastructure for connecting the building to the main electrical grid. This covers the laying of underground cables, installation of external distribution panels, and connections for street lighting, security systems, and other external electrical services, ensuring a reliable and efficient power supply to the building.
- 26.3.9 **Signages for E&M Shafts and Fire Norms:** The scope includes the installation of signages for E&M shafts, including name and number plates for easy identification. Additionally, signages will be provided as per fire safety norms, including emergency exit signs for each floor & Basement, fire equipment locations, and other mandatory fire-related signage, ensuring compliance with safety regulations and facilitating safe building operation in emergencies.
- 26.3.10 **Platforms and Ladders:** Necessary platforms, ladders, and access points will be installed in all shafts for maintenance and service access.

- 26.3.11 All necessary civil works required for the completion of the Fire Fighting System, Substation & DG Set Works, and HVAC (VRV/ VRF System) like making of foundations, RCC ducts for cables covering with chequered plates as per local electricity department and CPWD specifications are included in the Contractor's scope of work. Nothing extra shall be payable to the contractor on this account. Contractors are requested to quote the rates accordingly.

For the **Fire Fighting System**, the Contractor shall undertake all civil works as per Delhi fire services norms necessary for its completion, including excavation, construction of pedestals using reinforced cement concrete (RCC), backfilling, and all other related works. All these activities shall be deemed to have been included in the scope of work and Nothing extra shall be payable to the contractor on this account.

In the case of **Substation and Diesel Generator (DG) Set Works**, the Contractor's responsibilities include all necessary civil works as per central pollution control board norms such as the construction of RCC cable trenches, RCC foundations, platforms and pedestals, exhaust systems for DG sets, and any other required works. All these activities shall be deemed to have been included in the scope of work and Nothing extra shall be payable to the contractor on this account.

For the **HVAC (VRV/ VRF System)**, the Contractor is responsible for all civil works required for the completion of the heating, ventilation, and air conditioning systems (VRV/ VRF), panels, and related equipment. This includes RCC foundation works, platforms, civil works for duct installations, as well as any other necessary works. All these activities shall be deemed to have been included in the scope of work and Nothing extra shall be payable to the contractor on this account.

In general, all civil works required to complete the Electrical and Mechanical (E&M) scope of work are included in the Contractor's scope of work. Hence contractors are requested to quote the rates accordingly and Nothing extra shall be payable to the contractor on this account.

- 26.3.12 Miscellaneous Works: Any additional work as per the requirement or as directed by the Engineer in charge.

26.4 MODE OF MEASUREMENT:

- 26.4.1** Plinth Areas for various buildings i.e., **Food Court, Souviner Shop & information centre, Entry gate, Entry Forecourt, Misc. Structures** shall be measured based on the methodology mentioned in PAR 2025 (A standard Publication of CPWD available on CPWD Website) and/or the relevant IS codes.

- 26.4.2** Items / Areas for which procedure for measuring plinth area is not specified in PAR 2025, the Procedure prescribed in IS 3861 will be followed for measuring plinth area.

- 26.4.3** The plinth area shall be worked out from the approved architectural drawings by the local bodies and also the plinth area of actually constructed at site shall be measured. The lesser of the two areas shall be considered for payment.

26.4.4 **Ladders:** MS ladders for access to water tanks, terraces of all buildings, etc., are included in the plinth area rates and will not be measured separately for payment.

26.4.5 The areas, floor heights, and space utilization provided are tentative and based on the conceptual architectural drawings, the contractor shall be responsible for preparing detailed designs and drawings which may include modifications, Adjustments to space utilization on each floor, functional requirements, elevation features, and façade works shall be made as necessary while developing the 'Good for Construction' drawings, subject to the approval of the Engineer in charge.

26.4.6 The contractor shall be responsible for the planning and designing of the buildings as per the conceptual architectural drawings provided in the bid document.

27. **SCOPE OF WORK FOR ITEMS IN DEVELOPMENT WORKS**

27.1 **Levelling of Site:** The scope includes clearing all vegetation (trees, shrubs, and saplings) and disposing of debris off-site as per local authority norms. Excavation in all types of soil, cutting, and filling will be done to achieve the required formation levels as per the layout plan. Good earth has to be supplied, filled and compacted in layers not exceeding 20 cm under OMC conditions wherever required. Excess earth required will be brought from outside, and surplus material will be disposed of at designated sites. Final grading will be done, along with earthwork for roads, drains, utilities, and horticulture areas. The agency shall obtain all necessary approvals and adhere to relevant norms for vegetation clearance (trees, shrubs, and saplings), including the removal and replanting of trees if required, as directed by the Engineer-in-Charge.

27.2 **CC Roads, foot paths and Kerb stone.**

27.2.1 **Cement Concrete Roads:** As per the approved design by the engineer in charge and as per detailed Scope of Work and detailed specifications mentioned in bid document.

27.2.2 **Foot paths:** As per the approved design by the engineer in charge and as per detailed Scope of Work and detailed specifications mentioned in bid document

27.2.3 **Kerb stone:** As per the approved design by the engineer in charge and as per detailed Scope of Work and detailed specifications mentioned in bid document

27.3 **Retaining wall and Toe walls:** As per the approved design/Structural drawings by the engineer in charge and as per detailed Scope of Work and detailed specifications mentioned in bid document.

27.4 **External Storm Water Drain:** As per the approved design by the engineer in charge and as per detailed Scope of Work and detailed specifications mentioned in bid document.

27.5 **Rainwater harvesting system:** As per the approved design by the engineer in charge and as per detailed Scope of Work and detailed specifications mentioned in bid document.

- 27.6 **Unfiltered External water supply Distribution Lines to all the buildings:** As per the approved design by the engineer in charge and as per detailed Scope of Work and detailed specifications mentioned in bid document.
- 27.7 **Unfiltered External water supply line from Tube Well to UG Sump and for Horticulture Distribution Lines:** As per the approved design by the engineer in charge and as per detailed Scope of Work and detailed specifications mentioned in bid document.
- 27.8 **Tube Wells:** As per the approved design by the engineer in charge and as per detailed Scope of Work and detailed specifications mentioned in bid document.
- 27.9 **Horticulture and Landscaping works:** As per the approved design by the engineer in charge and as per detailed Scope of Work and detailed specifications mentioned in bid document.

28. SCOPE OF WORK FOR ITEMS IN BULK E&M SERVICES

- 28.1 **Internal Electrical Installations and External Lighting:** The scope includes the planning, designing, supplying, installation, testing, and commissioning of Internal Electrical works i/c point wiring, power and circuit wiring, submain wiring with FRLSH copper conductor wire in MS conduit, switch & sockets, MCB distribution board, MCB, MV panels, Earthing, Light & Fan fittings etc. and all works required for installation and commissioning. LED street, compound, pathway, and landscape lighting for the entire campus, including roadside and parking areas. This includes foundation work, pole erection, fixtures, bolts, nuts, and other hardware necessary for the installation of poles. The work also involves excavation, preparation of foundations with concrete, and base plates for securing the poles. Additional materials required for proper installation include power cables, junction boxes, earthing, and the installation of feeder pillar panels with an astronomical timer, including necessary conduit work from the nearest power supply source to each pole. The system will be connected to the street lighting system to achieve the required lux level as per National Building Construction Standards (NBCS)-2026 and CPWD specifications.

The cost of all works mentioned in Sub Head No. D-1 of Part-C and related specifications is included in this item. Foundations, poles, fixtures, power cables, earthing, junction boxes, conduit works, and all other associated works required for the complete installation and commissioning of the street lighting system will be deemed to be covered under this item, and no additional payment shall be made.

- 28.2 **Electrical Sub-station:** The scope includes the design, engineering, fabrication, supply, installation, testing, and commissioning of compact substation with a capacity of 11KV/433V, equipped with 1x315 KVA transformers, will be installed. The substation will include HT & LT panels, automatic power factor correction panels, SPD (Surge Protection Device), bus trunking, and all associated works including foundations, cable trays, control cabling, HT cables, LT cabling to buildings, interconnecting power cables, earthing, safety equipment (such as safety mats and danger notice plates), and all necessary installations to ensure a reliable power supply across the building.

The cost of all works mentioned in Sub Head No. D-2 of Part-C and related specifications is included in this item. LT cabling, metering panels, LT panels, foundations, earthing, connections and terminations, and all other items related to energization of the buildings will be deemed to be covered under the plinth area rates provided in and no additional payment shall be made.

- 28.3 **Diesel Generating Sets:** The scope includes the design, engineering, fabrication, supply, installation, testing, and commissioning of a 160 KVA silent-type DG set in compliance with CPCB 4+ norms. This includes the supply and installation of the AMF panel, communication cabling, bus trunking, DG set exhaust stack with a self-supporting structure of the required height, provision for additional exhaust piping, foundations, supporting arrangements, earthing, and minor allied works. The DG set will be equipped with synchronizing panels and all necessary components for proper functioning.

The cost of all works mentioned in item Sub Head No. D-3 of Part-C and related specifications is included in this item. DG set foundations, earthing, fuel piping, exhaust stack, synchronizing panels, bus trunking, communication cabling, and all other associated works required for the complete installation and commissioning of the DG set will be deemed to be covered under this item, and no additional payment shall be made.

- 28.4 **Uninterrupted Power Supply:** The scope includes the design, engineering, supply, installation, testing, and commissioning of a 3-phase online UPS system with a 30-minute backup, including SMF batteries, interconnecting cables, battery racks, etc. The capacity of the UPS shall be 30 KVA. The work includes completing the system in accordance with the technical specifications, approved drawings, conditions, and detailed scope of work specified in the bid document and as directed by the Engineer-in-Charge.

The cost of all works mentioned in Sub Head No. D-1 of Part-C and related specifications is included in this item. UPS foundations, battery racks, interconnecting cabling, control panels, and all other associated works required for the complete installation and commissioning of the UPS system will be deemed to be covered under this item, and no additional payment shall be made.

- 28.5 **Solar Photo Voltaic Power Generation Plant:** The scope includes the design, engineering, supply, installation, testing, and commissioning of a 50 KWP capacity grid-interactive rooftop solar photovoltaic power generating system. The work will also include obtaining all necessary approvals from CEA, ESCOM, and local bodies, including the net metering arrangement, as required. including all related units such as piping, electrical cabling, controllers, and other necessary components.

The cost of all works mentioned in Sub Head No. D-4 of Part-C and related specifications is included in this item. Solar panels, space frame installed at a minimum 2.4m clear height on the terrace of all building, parking and any spare space within the campus, for mounting the solar panels, and all other civil works required for the installation of solar panels, inverters, DC and AC cables, earthing, and all other associated works required for the complete installation

and commissioning of the rooftop solar system will be deemed to be covered under this item, and no additional payment shall be made

- 28.6 **Passenger Escalator:** The scope includes the design, supply, installation, testing, and commissioning of 02 numbers passenger escalators.

The work will also include obtaining all necessary approvals from Lift Inspector, includes complete the installation in accordance with the technical specifications, approved drawings, conditions, and detailed scope of work specified in the bid document and as directed by the Engineer-in-Charge.

The cost of all works mentioned in Sub Head No. D-5 of Part-C and related specifications is included in this item. Lift erection, Power cabling, control panels, handrails, voice announcement systems, earthings and all other associated works required for the complete installation and commissioning of the lifts will be deemed to be covered under this item, and no additional payment shall be made.

- 28.7 **HVAC (VRV/ VRF System):** The scope includes the design, engineering, fabrication, supply, installation, testing, and commissioning of a 250 HP energy-efficient VRV/ VRF system. The work includes completing the system in accordance with the technical specifications, approved drawings, conditions, and detailed scope of work specified in the bid document and as directed by the Engineer-in-Charge.

The cost of all works mentioned in Sub Head No. D-6 of Part-C and related specifications is included in this item. This includes both outdoor and indoor unit, duct work, TFA, refrigerant, MS frame, copper pipe, insulation, control cable, panel, etc. required for the complete installation and commissioning of the VRV/ VRF system will be deemed to be covered under this item, and no additional payment shall be made. Precision air conditioning of suitable capacity in server room is also within the scope of work.

- 28.8 **Fire Fighting System (Wet riser, sprinkler system, Emergency Lighting, illuminated Signage & Fire Extinguisher):**

The scope includes the design, supply, installation, testing, and commissioning of wet riser and sprinkler system of Fire Fighting in all buildings. All items required for installation and commissioning of whole system including pumps, C class MS pipe, PN 1.6 valves of all types, hose reel, hydrant valves, its box, external yard hydrant, hose pipe, fire brigade connections, branch pipe, sprinkler etc. are within the scope of work. Work also includes supply and fixing of emergency light and illuminated signage in all corridor, staircase, common areas etc. Fire extinguisher of Co2 and ABC type are also to be installed in all buildings including pump house, STP, sub-station etc. All the items required for commissioning and testing of whole system is within the scope of work.

The cost of all works mentioned in Sub Head No. D-7 of Part-C and related specifications is included in this Sub head. Fire Fighting System installation, and all associated works required for the complete installation and commissioning of Fire Fighting System will be deemed to be covered under this item, and no additional payment shall be made.

28.9 Automatic Fire Alarm and Public Address System:

The scope includes the design, supply, installation, testing, and commissioning of Automatic Fire Alarm and Public Address System in all buildings. All items required for installation and commissioning of whole system including main panel, photo thermal detectors, heat detectors, beam detector, MCP, hooter, response indicator, fault isolator, control module, fire survival cable, steel conduit, amplifier, voice controller, mikes, speaker etc. are within the scope of work. All the items required for commissioning and testing of whole system is within the scope of work.

The cost of all works mentioned in Sub Head No. D-8 of Part-C and related specifications is included in this Sub head. Automatic Fire Alarm and Public Address System and all associated works required for the complete installation and commissioning of Fire Alarm and Public Address System will be deemed to be covered under this item, and no additional payment shall be made.

28.10 IP Based CCTV Surveillance System: The scope includes the design, engineering, supply, installation, testing, and commissioning of an IP-based CCTV system for building security, comprising of PTZ, Bullet & Dome cameras, CAT 6A & OFC cabling, MS conduit, digital recording, supporting brackets, connectors, UHD professional digital TVs, workstations, and perpetual software support for both indoor and external surveillance. The work includes completing the system in accordance with the technical specifications, approved drawings, conditions, and detailed scope of work specified in the bid document and as directed by the Engineer-in-Charge.

The cost of all works mentioned Sub Head No. D-9 of Part-C and related specifications is included in this item. CCTV cameras, servers, NVRs, cabling, supporting infrastructure, and all other associated works required for the complete installation and commissioning of the CCTV system will be deemed to be covered under this item, and no additional payment shall be made.

28.11 Sewage Treatment Plant System: The scope includes the Design, Engineering, supply, installation, testing, and commissioning of a Sewage Treatment Plant (STP) of 50 KLD using SBR technology, as specified in the technical specifications. This includes foundation works, tertiary treatment systems, treated water pumps, and all necessary components for the treatment of wastewater for the building/campus. The work also includes obtaining any required approvals and completing the system in accordance with the technical specifications, approved drawings, conditions, and detailed scope of work specified in the bid document and as directed by the Engineer-in-Charge. All the pumps required for water supply inside the campus is also within the scope.

The cost of all works mentioned in Sub Head No. D-10 of Part-C and related specifications is included in this item. Foundation works, STP components, treated water pumps, tertiary treatment systems, and all other associated works required for the complete installation and commissioning of the STP system will be deemed to be covered under this item, and no additional payment shall be made.

- 28.12 **Automated Flap Barrier System:** The scope includes the design, engineering, supply, installation, testing, and commissioning of nine numbers Automated Flap Barrier System at entry gate for comprising controllers, E&M components, locks, readers, smart cards, cabling, recording and display systems, and hardware/software support as required. The system will be installed in accordance with the technical specifications, approved drawings, conditions, and detailed scope of work specified in the bid document, and as directed by the Engineer-in-Charge.

The cost of all works mentioned in Sub Head No. D-12 of Part-C and related specifications is included in this item. Controllers, EM locks, readers, cabling, recording and display systems, and all other associated works required for the complete installation and commissioning of the access control system will be deemed to be covered under this item, and no additional payment shall be made.

- 28.13 **Hydro Pneumatic Pumps:** The scope includes the design, engineering, supply, installation, testing, and commissioning of hydro pneumatic pumps for portable water, flushing water for dual plumbing system, Water for irrigation purpose in horticulture works, in accordance with the technical specifications, approved drawings, conditions, and detailed scope of work specified in the bid document.

The system will be installed as per the technical specifications, approved drawings, conditions, and detailed scope of work specified in the bid document and as directed by the Engineer-in-Charge.

The cost of all works mentioned in Sub Head No. D-11 of Part-C and related specifications is included in this item. Cabling, and all associated works required for the complete installation and commissioning of Hydro pneumatic pumps will be deemed to be covered under this item, and no additional payment shall be made.

- 28.14 **Baggage Scanner, Door Frame Metal Detector:** The scope includes the design, engineering, supply, installation, testing, and commissioning of two numbers computer-based multi-energy X-ray baggage inspection system mounted on castor wheels. The system will be installed in accordance with the technical specifications, approved drawings, conditions, and detailed scope of work specified in the bid document and as directed by the Engineer-in-Charge.

The scope includes the design, engineering, supply, installation, testing, and commissioning of 2 nos. of a 20-zone or above door frame metal detectors with necessary software. The system will be installed as per the technical specifications, approved drawings, conditions, and detailed scope of work specified in the bid document and as directed by the Engineer-in-Charge.

The cost of all works mentioned in Sub Head No. D-1 of Part-C and related specifications is included in this item. control units, cabling, and all associated works required for the complete installation and commissioning of the electromechanical boom barriers will be deemed to be covered under this item, and no additional payment shall be made.

29. DEFECT LIABILITY PERIOD

29.1 General Duration and Scope

The Defect Liability Period (DLP) for the project shall be as mentioned in GCC EPC Projects 2024, covering all buildings, civil development works, electrical and mechanical (E&M) systems, and other associated services. The DLP will commence once the project has been completed in all respects.

29.2 Contractor's Responsibility for Defects

During the DLP (Defect liability period), the contractor is fully responsible for rectifying any defects or deficiencies in civil and E&M works and development works at their own cost. The scope of this responsibility includes:

- **Rectification of Defects:** Any issues related to structural elements, finishes, fixtures, drainage systems, water supply, HVAC, electrical systems, and other related works shall be addressed immediately upon detection.
- **Written Notices:** If the contractor fails to rectify defects after receiving written notice from the Engineer in Charge, the department will carry out the repairs at the contractor's risk and cost.
- **Premises Maintenance:** General cleaning, sweeping of the premises, and desilting of sewer lines and stormwater drains will be conducted once, just before the final handover of the buildings.

29.3 Extended Responsibility for Structural Soundness

Beyond the Defect Liability Period, the contractor is responsible for ensuring the **structural soundness** of the buildings and other civil works, as per **Clause 17** of the GCC EPC Projects 2024. This extended responsibility is for a **minimum of Ten (10) years** from the date of project completion, during which the contractor shall:

- Rectify any defects related to the safety and quality of structural elements, including foundations, beams, columns, slabs, and roofs.
- Address structural issues that may arise during this period, such as cracks, settlement, or other deficiencies, at their own cost.

29.4 Immediate Rectification of Serious Defects

Certain defects that cause serious inconvenience to building occupants shall be addressed **immediately** upon notification. These defects include:

- **Leakages** from roofs, walls, or water supply systems.
- **Reverse floor slopes** that cause ponding of water and affect proper drainage.
- **Warping or opening of joints** in doors, windows, or other elements affecting operational functionality.

The contractor shall rectify such issues within **one week** of receiving the complaint. If not rectified within this period, the department will undertake the repair at the contractor's risk and cost.

29.5 **Rectification Timeline for Other Defects**

All other notified defects during the DLP shall be rectified to the satisfaction of the Engineer in Charge. The timelines are as follows:

- **Minor Defects:** Rectifications or replacements shall be completed as soon as possible but no later than **one month** from the notification.
- **Failure to Comply:** If the contractor fails to rectify defects within this period, the Engineer in charge will carry out the repairs at the contractor's risk and cost after issuance of **10-day notice**.

The Engineer in Charge's decision regarding the severity of the defects (whether serious or otherwise) shall be final and binding on the contractor.

29.6 **On-Site Maintenance Personnel**

To ensure smooth functioning of campus facilities and the prompt resolution of defects during the DLP (Defect liability period), the contractor shall maintain efficient and trained personnel on-site, responsible for both **CIVIL and E&M services**. These personnel will:

- Address defects as they arise.
- Ensure the smooth operation of all systems and services, including civil infrastructure, electrical installations, mechanical equipment, HVAC systems, and plumbing works.

29.7 **Waterproofing Guarantee and Retention**

For all waterproofing works, the contractor shall provide a **05-year guarantee** ensuring no water ingress or leakage. Additionally, **10% of the waterproofing amount** will be withheld from each RA (Running Account) bill as a security deposit during the guarantee period. If any waterproofing defects occur during this period, the contractor shall:

- Rectify the issue within **7 days** of receiving notice from the Engineer in Charge.
- Failure to rectify the defect within this time will allow the department to carry out the repairs at the contractor's risk and cost, utilizing the withheld amount as necessary.

29.8 **Scope of Civil Works During Defect Liability Period**

During the DLP, the contractor is responsible for maintaining and rectifying the following civil works:

- **Structural Defects:** Any issues related to foundation settlement, cracks in beams, columns, walls, or slabs, and problems with the roof structure shall be promptly addressed.
- **Waterproofing Failures:** Rectify any water ingress issues, including leakages from terraces, basements, and roofs, ensuring waterproofing systems function correctly.
- **Surface Defects:** Address damages to finishes like tiles, plaster, paint, and cladding, including floor or wall finishes in corridors, toilets, or other areas.
- **Drainage and External Works:** Rectify any defects in external development works such as pavements, roads, stormwater drains, and landscape areas. Address blockages or failures in stormwater or drainage systems.

- **Horticulture Works:** Ensure the maintenance and rectification of defects in horticultural and landscape features.

29.9 Scope of E&M Works During Defect Liability Period

For all E&M works and bulk services, the contractor's responsibilities include:

- **Internal Electrical Installations and External Lighting:** Address any malfunctions in wiring, lighting, switchboards, panels, and distribution systems. Ensure power supply is consistent, resolving any electrical failures.
- **Electrical Sub-station & Diesel Generating Set:** Maintain and rectify any issues in the substation and diesel generator sets, ensuring reliable power supply and addressing any operational faults or performance issues.
- **HVAC (VRV/ VRF Air Conditioning System):** Ensure the proper operation of VRV/VRF Air conditioning systems, including addressing issues related to performance, ducting, and equipment failures.
- **Sewage Treatment Plant:** Rectify issues related to STP, pumps, and piping. Ensure no leakages or blockages affect the performance of these systems.
- **Firefighting Systems (Wet riser, sprinkler system, Emergency Lighting, illuminated signages & Fire Extinguisher):** Maintain and repair fire safety equipment, including alarms, sprinklers, and hydrants, ensuring they meet safety standards.
- **Automatic Fire Alarm & Public Address System:** Maintain and repair fire alarm and public address system, including alarms, ensuring they meet safety standards.
- **Passenger Escalator:** Ensure the smooth functioning of escalator, resolving any operational or safety issues promptly.
- **Automated Flap Barrier System:** Ensuring the proper operation of Automated Flap Barrier System. addressing defects.
- **IP Based CCTV Surveillance Systems:** Maintain the IP based CCTV surveillance system. Address any connectivity issues, equipment malfunctions, or system failures.
- **Solar Photo Voltaic Power Generation Plant:** Ensure the proper functioning and maintenance of the Solar Photo Voltaic Power Generation Plant, addressing any issues related to panel performance, inverter operations, and electrical connections, ensuring optimal energy generation.
- **Baggage Scanner, Door frame metal detector, Automated flap barrier system:** Ensure the proper functioning and maintenance of the Baggage Scanner, Door frame metal

detector, Automatic flap barrier system, addressing any issues related to performance, operations and electrical connections, ensuring proper functioning.

29.10 **Compliance and Final Inspection:**

Throughout the DLP, all rectifications shall comply with relevant codes, including CPWD, IS, IEC, National Building Construction Standards (NBCS) -2026, and project-specific standards. The contractor is also responsible for providing all necessary documentation and reports related to the rectification work.

At the end of the DLP, a **final inspection** will be carried out by the Engineer in Charge. The Defect Liability Certificate will be issued only after all rectifications have been completed to the Engineer in Charge's satisfaction, officially marking the project's handover.

30. **Maintenance of Services:**

The **contractor's responsibility does not extend to the maintenance of services beyond the project completion**. However, the agency is required to ensure the proper installation and stabilization of all the E&M and bulk services, either during the project completion period or at the end of the project:

- Substation, DG Set, HVAC (VRV/ VRF system), CCTV, Fire fighting system, Fire alarm, STP, Solar PV Power Generation Plant, Escalator, Automated Flap Barrier System, Baggage Scanner, Door Frame Metal Detector, Internal & External Electrical Installation, Hydro Pneumatic Pumps and any other installed E&M Systems.

The agency shall engage its own team of engineers and operators for a minimum period of six months, or until the installed systems are fully stabilized, whichever is later, from the date of completion of the entire project. This ensures that all systems installed and commissioned are functioning properly.

If any of these services are not working properly and are not rectified within seven days of notice, the Engineer in Charge will arrange for the necessary repairs at the contractor's risk and cost.

At the end of this period, the agency shall hand over the systems to the user department, accompanied by comprehensive maintenance and operational manuals. These manuals should provide detailed instructions for the effective operation and ongoing maintenance of the systems

The agency is also required to submit **Guarantee Bonds** for the following works in the prescribed proforma given in the bid document:

- Water-Proofing Works
- Structural Glazing, External cladding system, Galvalume sheet Roofing, Polycarbonate Sheet roofing, STP.
- Glazed Doors, Fire Check Doors

31. **PROJECT MONITORING**

31.1 **INSTALLATIONS OF CCTV AT SITE DURING CONSTRUCTION**

31.1.1 CCTV Installation Requirements: The contractor is required to install a sufficient number of CCTV cameras on-site during construction in accordance with Circular No. F. No. 93/DDG(e-Gov)/2020/24 dated 28.04.2020. The installed system shall provide live feeds of construction activities to the CCU Engineers, accessible by senior officers.

31.1.2 CCTV System Specifications:

- The EPC contractor shall implement a CCTV system, including necessary civil work such as foundation work and towers for camera installation. The system shall cover all buildings and construction areas. The camera types to be installed shall include a combination of PTZ (40%) and Bullet Type (60%), with quantities adjusted as per site requirements to ensure comprehensive coverage and live feed of the entire construction project.

31.1.3 This CCTV system will enable monitoring through a Video Management System (VMS) at the CCU office, New Delhi, on a 24x7 basis. It will also facilitate remote viewing by EE/ SE / CE.

31.1.4 Installation and Maintenance:

The contractor shall provide sufficient dedicated broadband connections with a minimum speed of 5 MBPS and a dedicated static IP address. The CCTV system should be installed immediately after the award of work, extended to all work sites as construction progresses, and maintained in full working order until project completion. The contractor is responsible for ensuring the system remains operational so that the live feed is consistently available for VMS monitoring. No additional payments will be made for these services. The contractor may dismantle and reclaim the CCTV equipment upon project completion.

31.2 Drone Monitoring:

Monthly drone monitoring of the project is required. The contractor shall provide photos and videos taken from the drone and submit these along with documentation on a monthly basis.

31.3 Video Recording:

Video recording for the project shall be done as per relevant clause of GCC.

31.4 Compliance and Execution:

If the CCTV installation, drone monitoring & Video Recording are not executed within seven days of notice, the Engineer in Charge will arrange for the required work to be completed at the contractor's risk and cost.

31.5 Inclusion in Quoted Amount:

The amount quoted by the contractor for the project shall include all aspects of the CCTV scheme, Video recording, drone video and photo documentation. No additional payment will be made for these items.

31.6 The contractor is responsible for thorough project monitoring, which includes preparing monthly resource charts, capturing progress through photos and videos, and submitting detailed fortnightly progress reports. They shall also attend and organize project review meetings with all stakeholders as directed by the Engineer in Charge. Adherence to the construction schedule is crucial, with prompt responses required for any delays.

Detailed specifications for project monitoring are outlined in the Additional Conditions section of Part-B of the Bid Document. Contractors are advised to refer to this section for comprehensive information and requirements related to project monitoring and compliance.

32. **Third Party Quality Assurance (TPQA):**

The project mandates strict Third-Party Quality Assurance (TPQA) measures, requiring the contractor's cooperation with an independently appointed TPQA agency by CCU for material testing and quality verification at no additional cost or time. The contractor shall facilitate access for TPQA activities, including sample collection and testing, ensuring compliance with all specified requirements.

Detailed specifications for TPQA are outlined in the Additional Conditions section of Part-B of the Bid Document. Contractors are advised to refer to this section for comprehensive information and requirements related to TPQA and compliance.

33. **Physical Model (3D) of the Campus:**

33.1 **Preparation and Submission:** The contractor is required to design and construct a 3D physical model of the building complex, using a scale of 1:200 or another appropriate scale. This model shall be completed and displayed at the site office within 45 days from the award of the work.

33.2 **Ownership:** The 3D physical model will become the property of the Government of India upon completion.

33.3 **Inclusion in Rates:** The cost associated with the creation and provision of the 3D physical model is included in the rates quoted by the contractor.

34. The finished plinth level of the buildings will be determined soon after the actual start of work on site. Generally, the plinth level should be 600-750 mm above the crown of the finished main access roads, unless otherwise specified in the approved concept plans. However, the Engineer in charge retains the authority to set the plinth level based on other criteria, and their decision will be final and binding, with no additional cost payable to the contractor.

35. **Contract Document Interpretation, Order of Precedence, and Conflict Resolution:**

35.1 **Interpretation of Tender Documents:**

35.1.1 The tender document is a unified and comprehensive document comprising Part-A, Part-B, Part-C and shall be read in its entirety as a single entity along with the attached drawings. All sections of the tender document are mutually complementary and no part shall be interpreted in isolation. The details, conditions, scope of work, specifications, etc. provided in one section shall be read in conjunction with those given elsewhere in the document. Any information, specification, requirement etc. not explicitly mentioned in one part but available in another shall still be considered applicable, and its absence in a particular section shall not be construed as an omission. The contractor shall be responsible for ensuring compliance with all provisions

across the tender document and shall execute the work in accordance with the cumulative requirements specified therein.

35.1.2 All documents forming part of the contract shall be considered mutually complementary. Any requirement in one document is deemed to be required across all documents unless explicitly excluded.

35.1.3 The work shall be carried out in accordance with the 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. Nothing extra shall be payable to the contractor on this account.

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. 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.

35.2 Dimensions and Drawings:

35.2.1 In the case of discrepancies in dimensions (e.g., Length, Width, Height) mentioned in different contract documents, the dimensions shown on the drawings or as decided by the Engineer in charge will prevail.

35.2.2 Detailed drawings shall take precedence over smaller-scale drawings.

35.2.3 Figured dimensions shall take precedence over scaled dimensions.

35.3 Errors in Description or Quantities

35.3.1 Any error in description, quantity, or rate in the Schedule of Quantities, or any omission from the same, shall not invalidate the contract or relieve the Contractor from executing the work as per the drawings, specifications, and the other contract documents.

35.3.2 The Contractor remains obligated to complete the works, irrespective of such discrepancies.

35.4 Reference to Standards:

35.4.1 Any reference to Standard Specifications, Codes, Guidelines, Regulations, Recommendations, Norms shall imply the latest version of that standard, including all revisions and amendments issued upto the previous day of the last date of submission / uploading of Bid.

35.4.2 The Contractor shall ensure that all relevant publications, including IS Codes applicable to the work, are available on-site at his own cost.

35.4.3 Wherever the bid document specifies that the work shall be executed as per relevant CPWD specifications or other specifications, it refers strictly to the technical work specifications.

35.5 Reporting & Resolution of Discrepancies:

35.5.1 If there is any discrepancy or conflict in the contract documents or between sections, the Contractor shall bring this to the notice of the Engineer-in-Charge. The Engineer-in-Charge will clarify the discrepancy, and their decision shall be final, binding, and conclusive. The Contractor shall execute the work without any dispute following this decision, and no claims regarding this issue will be entertained at any point in time.

35.5.2 If the Contractor fails to bring the discrepancy or conflict to the notice of the Engineer-in-Charge and proceeds with the work based on the approved Good for Construction (GFC) drawings, any claims raised by the Contractor regarding the discrepancy after the completion of that item of the work will not be entertained under any circumstances.

35.5.3 Any changes in the scope of work or execution of additional works carried out by the Contractor without prior notification to and approval from the Engineer-in-Charge will result in such claims being disallowed in the future. The Contractor is responsible for obtaining formal approval before proceeding with any deviations or additional work.

35.5.4 In the event of any discrepancy or inconsistency between the work (including but not limited to items, details, features, specifications, conditions, etc.) specified in different documents of the contract that hold the same level in the established order of precedence, the richer specification/details or as finalized by the Engineer-in-Charge shall govern. Nothing extra shall be payable to the contractor on this account.

35.5.5 In the event that any work (including but not limited to items, details, features, specifications, conditions, etc.) specified in the same contract document differs across various sections or locations of the document, the richer specification/detail or as finalized by the Engineer in charge shall govern. Nothing extra shall be payable to the contractor on this account.

35.5.6 In the event that any work (including but not limited to items, details, features, specifications, conditions, etc.) is specified in only one document of the contract and not in any other contract document, such work shall be deemed to have been included in the scope of the contract, irrespective of the document's position in the order of precedence. Nothing extra shall be payable to the contractor on this account.

35.5.7 In the event that any work (including but not limited to items, details, features, specifications, conditions, etc.) is not explicitly mentioned or shown in any of the contract documents, but is required to meet functional or codal requirements, such work shall be deemed to have been included in the scope of the contract. The Contractor shall execute the work as directed by the Engineer in charge. Nothing extra shall be payable to the contractor on this account.

- 35.5.8 In the event that any work (including but not limited to items, details, features, specifications, conditions, etc.) is shown or mentioned at any place within the tender document, such work shall be deemed to have been included in the scope of work, irrespective of whether it is mentioned elsewhere in the tender document or not. The Contractor shall execute the work as directed by the Engineer in charge. Nothing extra shall be payable to the contractor on this account.
- 35.5.9 In the event of any contradiction or inconsistency in the specifications or details of any item, work, feature, condition at different places within the contract documents, the richer specification/detail or as finalized by the Engineer in charge shall govern. Nothing extra shall be payable to the contractor on this account.
- 35.5.10 In the event that any work (including but not limited to items, details, features, specifications, conditions, etc.) is not shown in the approved drawings but is required to meet functional or codal requirements, the Contractor shall execute such work as directed by the Engineer in charge. Nothing extra shall be payable to the contractor on this account.
- 35.5.11 In the event that any work (including but not limited to items, details, features, specifications, conditions, etc.) is missing from the Good for Construction (GFC) Drawings submitted and approved by the Engineer-in-Charge, but is otherwise required as per the Scope of Work, detailed specifications, technical specifications, industry standards, functional requirements, or any other tender conditions or provisions, such work shall be deemed to have been included in the contract scope, and the contractor shall be bound to execute the same. If at any stage, the Engineer-in-Charge determines that certain work, though not explicitly mentioned in the approved GFC drawings, is essential for the completeness, functionality, or completion of the project, the contractor shall execute such work as directed by the Engineer-in-Charge. The decision of the Engineer-in-Charge in this regard shall be final and binding. Nothing extra shall be payable to the contractor on this account.
- 35.5.12 In the event that the specifications or details mentioned in the tender document are found to be inadequate or improper for meeting functional or codal requirements, the work shall be executed in accordance with the actual requirements or as directed by the Engineer in charge. Nothing extra shall be payable to the contractor on this account.
- 35.5.13 In the event that the specified details of any item, including but not limited to size, thickness, diameter, material, quantity, are not in accordance with functional requirements or the manufacturer's specifications, the item shall be provided as per the necessary requirements or as directed by the Engineer in charge. Nothing extra shall be payable to the contractor on this account.
- 35.5.14 In cases where more than one option is provided for any item, the final decision of the Engineer in charge shall be final and binding. Nothing extra shall be payable to the contractor on this account.

- 35.5.15 In the event that any item, equipment, material etc. is not available as per the prescribed specifications but is available in a variant of better specifications, the same can be used only after the approval of Engineer in charge in writing but nothing extra shall be payable on this account.
- 35.5.16 The decision of Engineer in charge shall be final and binding to the contractor in all other issues which are not specified in the bid document. Nothing extra shall be payable to the contractor on this account.

35.6 Finality of Engineer-in-Charge's Decision:

- 35.6.1 The Engineer-in-Charge's decisions regarding the interpretation of the contract, discrepancies, or any other ambiguities in the documents, specifications, or works will be final, binding, and conclusive on the Contractor.
- 35.6.2 No claim by the Contractor will be entertained after the Engineer-in-Charge has clarified the issue. The Contractor shall not take advantage of clerical, grammatical, or typographical errors in the documents, including the Schedule of Quantities, Brief Scope of Work, Specifications, or any other provisions.

36. Detailed Scope of Work and Payment Terms for Project Execution:

- 36.1 The **Detailed scope of work** includes all provisions of the contract documents, Incidental works, Norms / Standards / Provisions / Regulations / Recommendations / Guidelines of the Local bodies, Statutory bodies, CPWD General conditions of contract EPC 2024, Standard CPWD publications, Standard Govt. publications etc.
The work shall be executed by the agency as per the detailed scope of work and as per the directions of the Engineer-in-Charge.

The **Contract Documents** include Brief Scope of work, Drawings (conceptual drawings), Specifications (Detailed specifications with general notes & specifications, schedules & Appendices, Particular specifications, technical specifications etc.), Conditions (General conditions, Additional conditions, Special conditions, Commercial conditions, conditions for specialised agencies etc.),

The **Incidental works** include the works which are not specifically mentioned herein but will be necessary to complete the work in all respect.

The **Standard Govt. Publications** include all relevant BIS codes of practice, National Building Construction Standard (NBCS) 2026, Energy Conservation and Sustainable Building Code (ECSBC), IPHS guidelines, NDMA guidelines for Safety, Recommendations for Basic Requirements of Office Buildings, Structural & Non-structural elements for Fire Safety, Harmonised Guidelines and Standards for Universal Accessibility in India, CGWB manual on rainwater harvesting, The Indian Electricity Act, Indian Electricity Rules, Central Electricity Authority rules, Local Bodies & Statutory bodies Norms, Publications mentioned in Schedule A to F and all other relevant Codes, Guidelines, Regulations, Recommendations, Norms, Standards, Provisions etc. It includes the latest version of all publications including all revisions and amendments, and all volumes of these publications.

The **Standard CPWD publications** include all CPWD specifications, Plinth Area Rates, Schedule of Rates etc. as mentioned in Schedule A to F, Barrier free and Accessibility, Green rating manual of CPWD, Manual on Accessible built environment, Rainwater harvesting & conservation manual etc. It includes latest version of all publications including all revisions and amendments and also all volumes of these publications.

- 36.2 Cost of all Works executed by the agency as per the detailed scope of work and as per the directions of the Engineer-in-charge shall be deemed to have been included by the agency in the rates quoted by them in schedules. Nothing extra shall be payable beyond the rates quoted by the agency.

All other necessary works required for the successful completion of the project, including the operational functionality of Food Court, Souviner Shop & information centre, Entry gate, Entry Forecourt, Extension of old footover bridge along with its landscaping at Mathura road to enter in Zoo and all other works shall be deemed to have been included in the plinth area rates specified. Bidders are advised to include all such costs in their rates, as no extra payments will be made on any account at a later date.

SPECIFIC CONDITIONS FOR ALL COMPONENTS OF WORK

1. The rate quoted by the agency shall be for all the provisions of the bid document. Nothing extra shall be paid for compliance of the provisions mentioned in the bid document. Extra payment for compliance of any provision shall be made only when it is specifically provided that it shall be paid extra.

The rates quoted by the bidder shall be for all the provisions of the bid document irrespective of the fact whether “Nothing extra shall be paid” is specifically mentioned against any provision or not. This is applicable for all components of work.

2. Any dispute arising out of this tender including dispute related to encashment of any Bank Guarantee / FDR etc., shall be subject to the jurisdiction of courts of Delhi only.
3. In case of reduction in scope of work, no claim on account of reduction in value of work, loss of expected profit, consequential over heads, etc., shall be entertained.
4. The contractor should make temporary arrangement for sewage disposal, water supply, electricity etc. for completed building to make them functional in case permanent arrangements are not ready for which nothing extra shall be payable.
5. The Successful tenderer shall co-ordinate with other contractors and agencies engaged 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 tenderer during the course of work, such expenditure incurred will be recovered from the successful tenderer if the restoration work to the original condition or specification of the dismantled portion of the work was not undertaken by the tenderer himself.
6. The fee payable to statutory authorities for obtaining local body approvals and various permanent service connections shall be reimbursed to the contractor unless specifically provided otherwise elsewhere in the tender document. The reimbursement shall be made only upon production of proof of payment. It is required that the contractor obtains written prior permission from the Engineer in charge before making any such payments. Alternatively, the Engineer in charge has the option to make these payments directly to the local body. However, any penalty imposed for the above activities shall not be reimbursed and will have to be borne by the contractor.
7. All expenditure to be incurred for testing of samples e.g. collection, packaging, sealing, transportation, loading, unloading etc. including testing charges shall be borne by the contractor.

The cost of material used for testing shall also be borne by the contractor.

8. If the contractor does not possess electrical license in his own name, he shall submit an undertaking to associate an agency having valid electrical license of appropriate voltage in its name issued by the State Government concerned Licensing Board under Section 45 of the Indian Electricity Rules, 1956 as amended from time to time for execution of work which

requires such a license. Such associate agency shall keep valid electrical license throughout the period of execution of work by getting it renewed at suitable intervals. In the event of any default on the part of the contractor in this regard, he/ she is liable to be debarred.

If the contractor possesses electrical license in his own name, he also has to follow the requirements prescribed above for associate agency.

9. **MINIMUM ELIGIBILITY CRITERIA FOR THE SPECIALIZED AGENCY(S) TO BE ASSOCIATED**

9.1 **ELIGIBILITY CONDITIONS FOR SPECIALIZED CIVIL WORKS:**

9.1.1 **Specialized Items of Civil Work:** The specialized items of civil work listed below shall be executed through eligible, reputed, and experienced specialized agencies that meet the eligibility criteria outlined in the agreement. These agencies shall currently be active in performing such specialized work.

- i) Water-proofing treatment work
- ii) Pre-construction anti-termite chemical treatment
- iii) Façade works such as structural glazing, tile Cladding, etc.
- iv) Structural steel work with Galvalume sheet and polycarbonate sheet etc.
- v) Architectural Consultancy, Structural Consultancy and MEP Consultancy etc.
- vi) Plumbing Services

9.1.2 **Eligibility for specialized agencies:** The contractor shall engage eligible specialized agencies to execute the specialized works, provided these agencies meet the prescribed eligibility criteria. However, the contractor may choose to carry out some or all of these specialized works directly without associating a separate specialized agency, provided that the contractor fulfills the eligibility conditions outlined in the agreement.

In such cases, the contractor shall demonstrate the necessary expertise and experience, including submitting proof that the personnel have the required certifications and training needed for executing the specialized works. Whether engaging a specialized agency or performing the work directly, all required documentation shall be submitted for approval.

9.1.3 **Eligibility Requirements for Specialized Agencies:** The specialized agency proposed for the execution of specialized civil items shall currently be actively engaged in such works and shall have successfully completed similar projects over the past seven (7) years ending last day of month previous to the one in which tenders are invited. The eligibility criteria for such agencies shall be as follows.

The agency shall have satisfactorily completed:

Three similar works each with a value of not less than 40% of the corresponding specialized item's value.

or

Two similar works each with a value of not less than 60% of the corresponding specialized item's value.

or

One similar work with a value of not less than 80% of the corresponding specialized item's value.

The definition of "similar work" is provided below for each specialized item.

9.1.4 Specialized Civil Work Items and Estimated Costs for Eligibility:

The following are the specific specialized items of civil work and their corresponding, to be used for determining the eligibility of the specialized agencies:

Sl. No.	Component of Specialized works	Approximate Cost of specialized component (in Lakhs)	Similar Work Description
1	Water Proofing Treatment Works.	150.00	“Similar work” refers to Completion of waterproofing treatment work using HDPE membrane PU-Polyurea or an equivalent waterproofing chemical.
	Note: The specialized agency shall collaborate with the manufacturer of the approved waterproofing material. All work shall be executed by an authorized applicator of the company whose waterproofing material has been approved by the Engineer in Charge. (Manufacture Authorization certificate needs to be submitted)		
2	Facade works: (Structural Glazing works, Tile cladding etc.).	127.00	Similar work refers to completion of “Facade works / structural glazing works”
3	Pre-Construction Anti-Termite Chemical treatment	10.00	Similar work refers to completion of “Anti-Termite chemical treatment”
4	Structural Steel with Galvalume Sheet and polycarbonate sheet	200.00	Similar work refers to completion of “Completion of “Structural Steel with Galvalume Sheet and polycarbonate sheet”

Note:

- Approximate Cost of specialized component is taken for the purpose of Eligibility Criteria only, which is rough cost and should not be used or interpreted for any other purpose.
- The detailed conditions applicable to specialized agencies for the civil component of the work shall be as specified in Part-B of the Bid Documents.

9.2 ELIGIBILITY CONDITIONS FOR BULK E&M WORKS

9.2.1 Sub-head wise total cost is taken for the purpose of Eligibility Criteria only, which is rough cost and should not be used or interpreted for any other purpose.

9.2.2 SITC means: Supplying, Installation, Testing & Commissioning.

9.2.3 The Main contractor has to associate agency(s) for the following specialized component(s) conforming to the eligibility criteria of having successfully completed following similar works during last seven years ending last date of the month previous to the month in which tenders are invited.

- 9.2.4 Work completion certificate in Form-D to be signed by the authority not below the rank of Executive Engineer is to be submitted by the main contractor / associated agencies for all the works.

Note: The detailed conditions applicable to specialized agencies for the E&M component of the work are specified in Part-C of this bid documents.

- 9.2.5 The bidder has to develop further the conceptual layout plan 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 all the 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 minimum LOD 350 type detailing.
- 9.2.6 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 master plan be prepared accordingly, if required.
- 9.2.7 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.
- 9.2.8 The scope of work consists obtaining all Statutory Approvals from Local Authorities/ Central Authorities/ Defense Authority/ Environmental Authority/ Airport Authority/ Fire Department/ Pollution Control Board and any other statutory authority/ Local body from inception to completion and occupation. The statutory payments or fees payable to Government/ Local Body, shall be reimbursed to the Contractor by CCU on production of proof for the same. Cutting/transplantation of existing trees shall be done 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.
- 9.2.9 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 & National Building Construction Standards (NBCS) 2026), CPWD Guidelines and Space standards for barrier free built environment for disabled and elderly persons – 1998, ECSBC norms – 2025, GRIHA, BIS Codes, any other codes as applicable. Reference to standard/ code shall mean to their latest version/ edition.

9.2.10 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.

9.2.11 The present tender is for Modernisation of the Entrance Plaza of National Zoological Park at New Delhi, India on EPC mode-1. 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	Food Court	RCC	2	As per indicative drawings
2	Souvenir Shop & Information Centre	RCC	1	As per indicative drawings
3	Entry Gate	RCC	1	As per indicative drawings
4	Entry Forecourt	RCC	1	As per indicative drawings
5	Extension of Foot-over bridge	RCC/Steel Structure	1	As per indicative drawings
6	Miscellaneous Structures defined in this bid document.	RCC	1	As per indicative drawings

9.2.12 The utility duct made up of precast element of M-50 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.

9.2.13 The scope of work consists of anti-termite treatment of soil wherever required for proposed works.

9.2.14 The scope of work includes the planning, designing, construction of the controlled connectivity from the nearby surrounding road to proposed campus.

The contractor shall develop the campus as per layout plan. The work envisages the

development of various landscape features with 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 National Building Construction Standards (NBCS) 2026, 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, 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. 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.

9.2.15 Scope of work consists obtaining minimum **4-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.

9.2.16 Electrical & Mechanical services/works: All the electrical & mechanical services mentioned in Part C of the tender document is in scope of work.

9.2.17 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 is unavailable in market, the conventional products may be used by the contractor at no extra cost to department.

9.2.18 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.

9.2.19 Scope of work also includes training 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 bid document.
- 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 user departments 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), 7th floor, Pt. Deen Dayal Antodaya Bhawan, CGO Complex, Lodhi Road, New Delhi-110003 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), 7th floor, Pt. Deen Dayal Antodaya Bhawan, CGO Complex, Lodhi Road, New Delhi-110003 or his successor or legal assignee thereof.
- 2.3 User/ user department means National Zoological Park (NZP), New Delhi.
- 2.4 Bidder/Agency/Contractor/tenderer means the individual, proprietary firm, firm in partnership, limited company, private or public or corporation.

2.5 “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.***

[7.2, 7.3 and 7.4 are applicable for non-CPWD contractor but not applicable for CPWD enlisted contractors of appropriate class while 7.1, and 7.5 are applicable for both CPWD enlisted contractors as well as non -CPWD contractors] :

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. 23.18 Crores** or two similar works each costing not less than **Rs. 34.77 Crores** or one similar work costing not less than **Rs. 46.37 Crores**.

“Similar Work” shall mean construction of RCC framed structure building and/or composite structure building or completing balance Construction work of RCC framed structure building and/or composite structure building.

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/User department, 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. 17.39 Crores** on construction works during the last three years ending 31st March 2025 (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 2025

7.4 Should have a Banker's Certificate from a commercial Bank for **Rs. 23.18 Crores** or Net Worth certificate of minimum **5.80 Crores** 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 annual turnover 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:

- i) The bidder should submit bidding capacity as per Form 'C-3'.
- ii) Bidding capacity is applicable for all the contractors including CPWD enlisted contractors.
- iii) Bidding capacity formula, for CPWD contractors who are enlisted based on rule 6.1.7 of Rules for Enlistment of Contractors In CPWD, 2026 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.

- iv) Bidding capacity, for CPWD contractors who are enlisted based on rules 9.6.3 & 9.6.4 of RULES FOR ENLISTMENT OF CONTRACTORS IN CPWD, 2026 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 for Enlistment of Contractors in CPWD, 2026 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.

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 during last 7 years (Form 'C')	Maximum	20 marks
(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 at least 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 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 Net worth Certificate in Form 'B1'.

10.0 Experience of similar works:

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 in 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)		
	Average annual turnover (i) Banker's or Net worth 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	
	(ii) With levy of compensation		20 5 0 -5	<u>20</u>
	(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)	

****The evaluation of completed and ongoing works shall be evaluated on the basis of performance certificate submitted/ uploaded by the bidder in Form 'D-1'. The Engineer-in-Charge shall get verified Form 'D-1' from the issuing department. The Form 'D-1' shall be issued by the officer at least not below the rank of Executive Engineer or equivalent with duly signed and stamped by such authority with mobile number. The Engineer-in charge has right to get the work inspect**

independently, if desired so. Based on the performance for quality of work in Form 'D-1' or inspection evaluation, for quality of completed/ ongoing works shall be made on following basis.

S. no.	Grading	Percentage marks
1	Outstanding/excellent	90%
2	Very good	70%
3	Good/Satisfactory	60%
4	Average	50%
5	Poor	30%

LETTER OF TRANSMITTAL

From:

.....
.....

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@gov.in)

Subject: Submission of Bid for the work of **“Modernisation of the Entrance Plaza of National Zoological Park at New Delhi, India on EPC mode-1.”**.

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 ‘J’ in the bid document 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/Net worth certificate and authorize the Executive Engineer, CED-I, Civil Construction Unit (CCU), Ministry of Environment, Forest & Climate Change (MoEF&CC), CGO Complex, Lodhi Road, New Delhi-110003 to approach the Bank issuing the banker’s/Net worth certificate to confirm the correctness thereof. I/We also authorize the Executive Engineer, CED-I, Civil Construction Unit (CCU), Ministry of Environment, Forest & Climate Change (MoEF&CC), CGO Complex, Lodhi Road, New Delhi-110003 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'.
6. 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:
Date of submission

Seal of bidder:
Signature(s) of bidder(s)

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				
		2020-21	2021-22	2022-23	2023-24	2024-25
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.

Unique Document Identification Number (UDIN)

Signature of Chartered Accountant

Name of Chartered Accountant

Membership No. of ICAI

Date and 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) Banker's 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- eeecd1ccu.mef@gov.in](mailto:eeecd1ccu.mef@gov.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 comment 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 officers 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)

PROJECTS UNDER EXECUTION

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	Upto date percentage progress of works	Slow progress if any and reasons thereof	Name and address / telephone number of officers to whom reference may be made	Remarks
1	2	3	4	5	6	7	8	9	10

Signature of Bidder(s)

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 officers 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)

**WORK EXPERIENCE CERTIFICATE OF COMPLETED WORK(S) MENTIONED IN
FORM 'C'**

No.

Date:

1	Name of work		
2	Location of work (mention city and state)		
3	Name of contractor (same as mentioned in Award letter)		
4	Agreement/work order number		
5	Estimate cost		
6	Agreement/work order amount (Rs.)		
7	Gross value of completed work (Rs.)		
8	Amount of Gross value of last paid bill, (if final bill not paid.)		
9	Stipulated date of start (DD-MM-YYYY)		
10	Date of complete:		
	(a) Stipulated date of completion (DD-MM-YYYY)		
	(b) Actual date of completion (DD-MM-YYYY)		
	(c) Justified extended date of completion, if decided (DD-MM-YYYY)		
11	Details of work		
	(a) Nature of work (Building/Infrastructure/Road/Horticulture).		
	(b) Type of structure (RCC framed/load bearing/ composite or any other).		
	(c) (i) Type of Technology used e.g., Cast-in-situ Structural systems, Monolithic concrete construction system, Precast RCC systems, Steel Structure, Pre-stressed concrete system etc.		
	(ii) Technology used of his own or through associated agency.		
	(d) Type of building/ Infrastructure (Office/College/ Hospital/ School/ Hostel/ Quarters/ Flyover/ Bridge/ Road /Culvert etc.)		
	(e) In case of Road work, whether bituminous/CC or both.		
12	Name of electrical/specialized MEP items executed in the work (Please write the names of specialized services)	Executed by self	Executed by associated agency
	a) Internal Electrical installation, External Electrical installation, Lift, Scada, EPBAX CCTV, LAN		
	b) Firefighting, Fire Alarm, HVAC		
	c) Electrical substation, DG set, STP/ETP plant		
	d) Solar Photo Voltaic Power Generation/ Solar Water Heating, Access Control, Baggage scanner system, conveyor Belt		
	e) Gas/Oxygen supply Line, OT Room		
	f) Any other specialized services.		
13	Other information		
	a) If completed work is building construction, then number of storey(s) constructed without basement.		
	b) Number of basement(s).		

	c) If completed work is building construction, then approximate plinth area of the building.	
14	a) Amount of Horticulture work(s), (If executed)	
	b) Horticulture work(s), whether executed by self or through associated agency.	
15	Details of extension of time for delayed completion.	
	a) Whether extension of time for delayed completion has been decided or not? Owner department officers are requested to only mention either 'Yes or No' against this option. (Option of writing "Not applicable" is only acceptable where work is completed before stipulated date of completion).	
	b) If extension of time for delayed completion has been decided then amount of compensation levied, if any?	
16	Is there any conciliation/ mediation/ arbitration/court Case(s) (from start of work till issue of this certificate), Owner / department officers are requested to only mention either "Yes or No,".	
17	Status of owner / department Owner / department officers are requested to only mention (Central/State Government/ PSU/ Private)	
	a) Name of Project Manager or Executive Engineer or Equivalent.	
	b) Address	
	c) Phone	
	d) email	
18.	Remarks, if any.	

The above work has been/was completed satisfactorily.

Signature with seal and designation
(Project Manager or Executive Engineer or Equivalent Officer of owner department)

ASSESSMENT OF QUALITY FOR COMPLETED AS WELL AS ON-GOING WORKS

Name of work:

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).

Signature with seal and designation
(Project Manager or Executive Engineer or Equivalent Officer of owner department)

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	:	Modernisation of the Entrance Plaza of National Zoological Park at New Delhi, India on EPC mode-1.
NIT No	:	06/2026-27/CE/CCU/CED-I/New Delhi (Recall)
Estimated Cost	:	Rs. 57,96,25,394/-
Amount of Earnest Money Deposit	:	Rs. 67,96,254/-
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:

- | | |
|--|--|
| 1. Signature.....
Name and address
Designation | Authorized signatory
Name
Staff code no. |
| 2. Signature
Name and address | Bank seal |

*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

MEMORANDUM OF UNDERSTANDING [M.O.U] FOR ASSOCIATED CONSULTANT

1] M/S [Name of the firm with full address] Enlistment Status
Valid up to:
[Henceforth called the main contractor] And

2] M/S [Name of the firm with full address]
Enlistment Status Valid up to:
[Henceforth, called Associated Consultant]

Name of work:

NIT No.

This MoU is made at on between
the (herewith called the main contractor) and
..... (herewith called the Associated consultant).

Whereas the main contractor has agreed to entrust the consultancy work only to the associated consultant.

We state that MoU 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 this agreement for execution of the consultancy work only in respect of above work. Both of us shall be responsible for the consultancy work as per the agreement to the extent this MoU allows. In case of any delay in the payment by the main contractor, the associated contractor can apply to the CCU, MoEF&CC to release the payment under Clause 7B and deduct the same from the bills of the main contractor. In case of any dispute, either of us will go for mediation by the CE or SE (as the case may be) and his decision shall be final and binding on both of us.

We have further agreed as under:

1. The Associated Consultant will provide consultancy work as per terms and conditions of this agreement.
2. All the machinery and equipment, tools and tackles required for the consultancy work, as per this MoU, shall be the responsibility of the Associated Consultant.
3. The site staff required for the consultancy work shall be arranged by the Associated Consultant as per terms and conditions of this MoU.
4. All the correspondence regarding consultancy work shall be done by the department with the main contractor. In case of non-compliance of the provisions of agreement of the work by the associated consultant, the main contractor shall be held responsible and action will be taken against him as per agreement provisions.
5. In case of non-performance, associated consultant will be debarred from participation or

association in the CCU, MoEF&CC tenders by the CCU, MoEF&CC.

Signature of main contractor

Date:

Place:

Signature of associate consultant

Date:

Place:

Countersigned by the Executive Engineer

**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 “Modernisation of the Entrance Plaza of National Zoological Park at New Delhi, India on EPC mode-1.”.

- i) To be uploaded by 03:00 PM hours on24.09.2026..... to/upload at
- ii) To be opened in presence of tenderers who may be present at 03:30 PM hours on ...24.09.2026..... 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 -----**

Telephone No. -----**

Fax -----**

E-MAIL -----**

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

PROFORMA OF SCHEDULE

SCHEDULE 'A'

Schedule of work -

As per this contract document

SCHEDULE 'D'

Extra schedule for specific requirements/document for the work, if any:	As per this contract document
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SCHEDULE 'E'

Reference to General Conditions of contract	CPWD General Conditions of Contract EPC Projects 2024, as amended / modified upto previous day of the last date of submission of bid.
Name of Work	Modernisation of the Entrance Plaza of National Zoological Park at New Delhi, India on EPC mode-1.
Estimated cost of the work	Rs. 57,96,25,394/-
Earnest money	Rs. 67,96,254/-
Performance Guarantee	(a) 5% of tendered value or Estimated Cost Put to Tender (ECPT) (whichever is higher). (b) Where the tendered amount is less than eighty percent (80%) of the Estimated Cost Put to Tender (ECPT), the Performance Guarantee, in addition to the requirement under (a) above, shall be increased by an amount equal to the difference between eighty percent (80%) of the ECPT and the tendered amount.
Security Deposit	2.50% of tendered amount.

SCHEDULE 'F'

GENERAL RULES AND DIRECTION

Officer inviting tender	The Executive 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 legal successor or assignee thereof.
Applicable mode of EPC contract	EPC Mode-I
Type of Building	Permanent
List of approved construction technologies	NA

Definitions:

2(vi)	Engineer-in-Charge	For Major Component: - 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 legal successor or assignee thereof. For Minor Component: - Executive Engineer (E), Civil Construction Unit (CCU), Ministry of Environment, Forest & Climate Change (MoEF&CC), CGO Complex, Lodhi Road, New Delhi-110003 or his legal successor or assignee thereof.
2(viii)	Accepting Authority	Chief Engineer, CCU, MoEF&CC or his legal successor or Assignee thereof
2(x)a	Percentage on cost of materials and labour to cover all overheads and profits	15%
2(x)b	Standard Schedule of Rates	Delhi Plinth Area Rates 2025 amended / modified upto last date of submission of bid. Delhi Schedule of Rates 2023 Corrected up to last date of submission of bid (for civil works volume I & II). Delhi Schedule of Rates (E&M) - 2025 Corrected up to last date of submission of bid (for E&M works) Schedule of Rates, Analysis of Rates and Specifications (Horticulture & Landscaping)-2025 Corrected up to last date of submission of bid
2(xi)	Department:	Civil Construction Unit (CCU), Ministry of Environment, Forest & Climate Change (MoEF&CC), Government of India.
9(ii)	General Condition of contract 2024 for EPC Project amended / modified up to last date of submission of Bid.	CPWD Form 7.

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 as provided in (i) above	03 Days
Clause 2		
i)	Authority for fixing Compensation under Clause 2:	Superintending Engineer, CCU, MoEF&CC or his legal successor or Assignee thereof

Clause 5

i) Authority to convey the decision for shifting of milestone and Extension of time:	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 Assignee thereof.
ii) Authority to decide rescheduling of mile stones and extension of time.	Superintending Engineer, Civil Construction Unit (CCU), MoEF&CC, CGO Complex, Lodhi Road, New Delhi -110003 or his 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 successor or Assignee thereof.
iv) Schedule of rate of recovery for delay in submission of the modified programme in terms of delay days	Recovery @ Rs. 2000/- on Per day basis
v) Time allowed for execution of work	15 Months
vi) Numbers of days from date of issue of letter of acceptance/ intent for reckoning date of start	10 Days

Table of Milestones

Sl. No.	Description of Milestone(s)	Time allowed (From date of start)	Amount to be withheld in case of Non-achievement of each Mile stone(s)
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1.	i) All pre construction activities, submission and approval of Architectural, Structural & MEP Drawings including approvals from local bodies/authorities. ii) Time schedule of submission of all required drawings for completion of work.	03 months	0.5 % of the Accepted tendered value.
2.	Work done amounting to 8% of accepted tendered amount (Civil + Electrical/Mechanical + Horticulture/Landscape)	06 months	0.7 % of the Accepted tendered value.
3.	Work done amounting to 20% of accepted tendered amount (Civil + Electrical/Mechanical + Horticulture/Landscape).	08 months	0.7 % of the Accepted tendered value.
4.	Work done amounting to 45% of accepted tendered amount (Civil + Electrical/Mechanical + Horticulture/Landscape).	10 months	0.7 % of the Accepted tendered value.
5.	Work done amounting to 60% of accepted tendered amount (Civil + Electrical/Mechanical + Horticulture/Landscape)	12 months	0.7 % of the Accepted tendered value.
6.	Work done amounting to 80% of accepted tendered amount (Civil + Electrical/Mechanical + Horticulture/Landscape)	14 months	0.7 % of the Accepted tendered value.
7.	Work done amounting to 100% of accepted tendered amount (Civil + Electrical/Mechanical + Horticulture/Landscape)	15 months	1.0 % of the Accepted tendered value.

Recovery for delay in submission of the fortnightly progress report within specified period - not exceeding Rs. 2000/- per report for each default.

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	10 days
Part B	Portions with encumbrances	NA
Part C	Portions dependent on work of other agencies	NA

Clause 6

i) Mode of measurement	Computerised Measurement Book
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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. 3.15 Crores (civil) Rs. 75 lakhs (electrical)
Clause 7A Whether clause 7A shall be applicable	Yes
Clause -7B Whether clause 7B shall be applicable	Yes

Clause 8 A: Completion plans to be submitted by the contractor	
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 successor or Assignee thereof

Clause 10 A

As per site requirement and details attached in the relevant pages of this bid document

Clause 10 B

Whether Clause 10 B (ii) shall be applicable	Yes, Mobilization advance shall be applicable after pre construction activities are completed by the contractor i.e., after completion of Planning, Designing and after obtaining various local bodies approvals necessary for commencing the construction work as per this contract document.
Whether Clause 10 B (iii) shall be applicable (Plant, Machinery & Shuttering Material Advance)	Not Applicable
Whether Clause 10C shall be applicable	Not applicable
Whether Clause 10CC shall be applicable	Yes

S. N.	Relevant component of Material /Labour for price escalation	Percentage of total value of work
1	Component of Cement	10%
2	Component of Labour	25%
3	Civil component of the other construction materials	24%
4	Electrical and Mechanical (E&M) Component of Construction Materials	27%
5	Corrosion resistance Steel Reinforcement bars/ TMT bars/Structural steel (including strands and cables)	14%
	Total	100 %

Clause 11:**(i) Specifications to be followed for execution of work.**

Specifications to be followed for execution of work (for civil work)	:	Civil work: CPWD Specifications 2019 Volume- I & II with up to the date corrections slips. - MORTH Specifications for Roads and Bridge work.
Specifications to be followed for execution of work (for Electrical work)	:	Electrical & Other works (amended upto date): - CPWD General Specification for Electrical Works Part I (Internal) & Part II (External) – 2023. - General Specification for Electrical Works (Part III Lifts & Escalators)-2003. - CPWD General Specification for Electrical Works Part IV Substation-2013. - CPWD General Specification for Electrical Works Part V Wet riser and sprinkler system-2020. - CPWD General Specification for Electrical Works Part VI fire detection and alarm system-2018. - CPWD General Specification for Electrical Works Part VII DG Sets– 2013 - CPWD General Specification for Electrical Works Part VIII Gas Based Fire Extinguishing System–2013. - General Specification for Heating Ventilation & Air-Conditioning-2024.
Specifications to be followed for execution of work (for Horticulture & Landscaping work)	:	Schedule of Rates, Analysis of Rates and Specifications (Horticulture & Landscaping)-2025.

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

(ii) Building information Model (BIM)

Building information Model (BIM) is applicable and BIM Professional to be deployed by contractor

Yes

Clause 12:

Deviation limit beyond which clauses 12.2 shall apply for all types 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 and worked out as per sub-clause 12.3 of GCC EPC Projects 2024. Variations/deviations up to 0.25% (zero-point two five percent) of the accepted tendered amount shall be deducted from overall variations/ deviations for making payment.
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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
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Clause 18:

List of Mandatory Machinery, tools & plants to be deployed by the contractor at site: -

As per site requirement and details attached in the relevant pages of this bid document.
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Clause 19

Clause 19 C	Penalty for each default	Rs. 2000/-
Clause 19 D	Penalty for each default	Rs. 2000/-
Clause 19 G	Penalty for each default Enhanced penalty per day for continuous default	Rs. 2000/- Rs. 2000/-
Clause 19 K	Penalty for each default	Rs. 2000/-

Clause 25: Settlement of disputes by Conciliation and Arbitration

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

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

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	Principal Technical representative 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 + Electrical	Deputy Project Manager	12 (and having experience of one similar nature of work)	1+1	Rs.1,00,000/- per Month
3	Graduate Engineer Or Diploma Engineer	Civil + Electrical	Project/Site Engineer	5 or 10 respectively	1+1	Rs. 50000/- Per month
4	Graduate Engineer	Civil + Electrical	Quality Engineer	8	1+1	Rs. 50000/- Per month
5	Diploma Engineer	Civil	Surveyor	8	1	Rs. 30000/- Per month
6	Graduate Engineer	Civil + Electrical	Project Planning /Billing	6	1+1	Rs. 30000/- Per month
7	Graduate Engineer (BIM) Professional	Civil + Electrical	BIM Professional	03	01	Rs. 150000/- 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.

Minimum recovery for not deploying Building Information Model (BIM) professional shall be

Rs.1,50,000/- per month **(Rs. One Lakh Fifty Thousand per month)**

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 (Volume- I & II) 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 (E&M) - 2025 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	:	2% plus/minus.
	(b)	Bitumen All Works	:	2.5% plus only & nil on minus side.
	(c)	Corrosion resistance 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.	Corrosion resistance Steel Reinforcement	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 microns, with lid and pan]	1
8.	Sieve Brushes and sieve shaker capable of 200mm and 450 mm dia sieves, 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 Verniercalipers 150 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

Sl. No.	Equipment	Numbers (Minimum)
26.	Motorized sieve shaker	1
27.	Extra Bottom plates for 15 cm cube mould	5
28.	Standard Vibration Table	1
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 meters	
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
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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 WORKS, HORTICULTURE WORKS AND DEVELOPMENT WORKS

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-I. 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 therefrom 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** Works shall be carried out keeping in view of the various provisions as mentioned in following documents:-
- a) Description of Schedules of quantities.
 - b) Particular specification .
 - c) Special conditions.
 - d) Additional Conditions.
 - e) Drawings.
 - f) CPWD Specifications including up to date correction slips.
 - g) Indian Standards Specifications of B.I.S.
 - h) CPWD General Conditions of Contract EPC Projects 2024 including correction slips issued up to last date of submission of bid including extensions, if any.
 - i) National Building Construction Standards (NBCS) 2026.
 - j) MoRTH Specification for Road and Bridges including correction slips issued up to last date of submission of bid including extensions, if any.
 - k) Manufacturer's specifications and as decided by the Engineer-in-Charge.
 - l) 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** Notwithstanding anything mentioned any where in this bid document, including conditions, and any thing shown in any drawing in the bid document are deemed to be very much part of contract agreement and same shall have to be executed/ provided/ complied with by the contractor and nothing extra shall be paid on this account unless otherwise specified in bid documents for such payments. If something is deficient in design/ drawings then same shall have to be made available by contractor at their own cost and nothing shall be paid on this account. In case of dispute, the decision of Engineer-in-charge shall be final and binding in this regard.
- 1.10** The contractor shall give to the local bodies, 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.
- 1.11** 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.

- 1.12** Proper temporary barricading by fencing with G.I. sheets around the construction site having minimum height of 06 metre or as per rules and regulations of the statutory authority which ever is higher shall be erected by the contractor at the start of work. It shall be done by providing, erecting, maintaining temporary protective barricading of minimum height as per direction of engineer in charge and in accordance with the prevailing guidelines issued by statutory authorities in this context, 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 minimum 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 site 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.

Necessary protective/safety measures including barricading etc. having minimum height 3 meters and or statutory norms shall also be provided during the construction of work around the periphery along the pathways and road work along in near vicinity of Mathura Road, New Delhi.

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. 2000/- 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.

- 1.13** 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.
- 1.14** 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).
- 1.15** No claim whatsoever on account of any discrepancy between the sub-surface strata conditions shall be entertained.

- 1.16 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.
- 1.17 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.
- 1.18 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.
- 1.19 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.
- 1.20 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.
- 1.21 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 up to date till last date or extended last date of submission of tender.**
- 1.22 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.
- 1.23 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.

1.24 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.

1.25 FACILITIES FOR THE DEPARTMENT

- (a) **Site Office-** The contractor shall provide one number site office accommodations of approximately **200 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 LED Screen (Minimum 52 Inch or as directed by Engineer-in-charge) 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 on pro-rata basis 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 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.

1.26 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.

1.27 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.

1.28 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

1.29 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.

1.30 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 its 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.

1.31 i)The contractor is responsible for obtaining **all mandatory approvals** for obtaining the various permanent service connections and occupancy certificate for the buildings. However, **the statutory fee payable to statutory authorities** for obtaining the various permanent service connections and occupancy certificate for the buildings shall be borne by the Department.

ii)The contractor is responsible for obtaining the approvals for shifting of permanent service such as sewer line, electrical/telephone lines, storm water lines etc. However, the statutory fee payable to statutory authorities for obtaining the such approvals shall be borne by the Department. The shifting of these services after obtaining the approvals shall be in the scope of agency.

1.32 The earth work under this work will be treated as earth work as mentioned in CPWD Specifications including up to date correction slips 2019 - Volume 1 or (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.

1.33 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.

1.34 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.

1.35 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.

1.36 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.

1.37 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.

1.38 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.

1.39 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:
 - i) Allow use of toilets, sheds etc.
 - ii) Properly co-ordinate their work with the work of other Contractors.
 - iii) Provide control lines and benchmarks to his Sub-Contractors and the other Contractors.
 - iv) Provide electricity and water at mutually agreed rates.
 - v) Provide hoist and crane facilities for lifting material at mutually agreed rates.

- vi) Co-ordinate with other Contractors for leaving inserts, making chases, alignment of services etc. at site.
 - vii) Adjust work schedule and site activities in consultation with the Engineer-in-Charge and other Contractors to suit the overall schedule completion.
 - viii) 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.

1.40 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.

1.41 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 4-STAR 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.

1.42 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.

1.43 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 up to 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, **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 makes 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 Govt. laboratory i.e. NIT, NSUIT, IIT or National Test House, Ghaziabad (NTH) as 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. Unless specified otherwise all cost of material, testing charges and transportation charges shall be borne by the agency. Nothing extra shall be payable to the agency on this account.

Any non-approved material or substandard material or material failed in the testing or non-ISI material without approval of Engineer-in-charge shall be removed from the site within 24 hours of intimation by the Engineer-in-charge.

- 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. 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.
- xiv. 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.
- xv. The contractor shall give performance test of the entire installation(s) as per the standing specifications before the work is finally accepted.
- xvi. 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.
- xvii. 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.

- xviii. 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.
- xix. 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.

1.44 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.

1.45 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 non-compliance/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.

1.46 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.**

1.47 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.

1.48 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 stated 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.

1.49 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) Up to 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.

1.50 PRODUCT DELIVERY, STORAGE AND HANDLING OF CHEMICALS

- i) The contractor shall construct storage space for Chemical's 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.

1.51 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.

1.52 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.

1.53 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.

1.54 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.

1.55 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, Horticulture work or any other specialized work as decided by the Engineer-in-charge 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.

1.56 APPOINTMENT OF THE CONSULTANT

- (i) The contractor shall engage an architectural consultant having experience of similar works as mentioned in the bid document.
- (ii) Architectural consultant appointed by contractor after approval of Engineer-in- Charge shall provide comprehensive consultancy services in Project Conceptualization covering space utilization, functional relations, preparation of plans including obtaining its statutory and local bodies approval, detailed architectural drawings, detailed structural analysis, design and detailing including designing and detailing of all services, their drawings & approval, external development works, landscaping, etc. Consultant shall prepare and supply all the coordinated good for construction drawings checked and approved. The Consultant shall be associated till completion of the project and obtain completion certificate from the concerned local body.
- (iii) **Experience of Similar Works:** The architectural consultant should have satisfactorily completed **consultancy work for “Providing consultancy services for the construction of building as per criteria and magnitude”** during the last 07 years ending previous day of last date of submission of tender given below.

Agency shall submit the proposal (along with work experience certificate issued by competent authority) of consultant who have work experience of handling satisfactorily completion of similar works as per following criteria during last seven years –

Three works each costing not less than 40% of estimated cost of tender.

Or

Two works each costing not less than 60% of estimated cost of tender.

Or

One work costing not less than 80% of estimated cost of tender.

- (iv) The experience certificate for similar work should be certified by an officer not below the rank of Executive Engineer/Project Manager or equivalent.

- (v) 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.
- (vi) 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.**
- (vii) The proposal for the architectural consultant shall be submitted by the contractor to the Engineer-in-charge with complete documentation as mentioned in above paras (ii), (iii), (iv) and (v). The proposal of architectural consultant shall be approved by the Engineer -in-charge. In case the documentation for architectural consultant is not complying with the requirements as per above para (ii), (iii), (iv) and (v), the new proposal shall be submitted by the contractor on the written direction by the Engineer-in-charge.
- (viii) The architectural consultant shall submit the willingness to get associated with the main contractor for execution of the consultancy 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 architectural consultant. (Format of willingness and MOU is attached).
- (ix) **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	15 years	1	M-Arch	Entire work / Project duration	Rs. 1,50,000/-
B		Team Members / Domain Experts				
1	Architects	10 Years	1	B-Arch	First 6 months on regular basis thereafter as and when required	Rs. 75,000/-

2	Structural Engineer	10 Years	1	M.Tech Structural Engineering	First 6 months on regular basis thereafter as and when required	Rs. 1,00,000/-
3	Electrical Engineer	10 Years	1	B.Tech Electrical	First 6 months on regular basis thereafter as and when required	Rs. 75,000/-
4	All other specialised work / E&M service etc consultants	10 years	1	As per Specialised work requirement	As and when required	Rs. 50,000/-
5	Green Building Consultant	5 Years	1	GRIHA Accredited Professional	Entire Project duration	Rs. 50,000/-

Note: In case of non-performance of the architectural consultant in timely submission of architectural/ structural design/MEP/E&M/Bulk E&M services/ development drawings or any other details or drawings as required by engineer-in-charge, action shall be taken for removal of consultant by the Engineer-in-charge. However, a notice of 3 days shall be given by the engineer-in charge before taking such action. Agency in that case has to give a fresh proposal for new appointment of architectural consultant within 7 days. The new consultant shall be appointed only after fulfilling the terms and conditions as mentioned above, by the Engineer-in charge.

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

- i) 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.
- ii) 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.
- iii) The contractor is required to deploy resources as per availability of site and as per programme chart of the work. Contractor has to make all efforts judiciously to deploy the labours and materials to ensure commensurate progress of work as per programme chart. However, no claims of the contractor shall be entertained for any kind of idle labour, idle machinery, idle technical/non-technical staff and idle T&P etc.
- iv) 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.
- v) Gypsum plaster shall be executed using pneumatic spray machine of reputed make.
- vi) 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.
- vii) The Aluminum door-windows-framework, lamination and Lipping on flush doors shall be factory made.
- viii) 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.

- ix) Unless otherwise specified, Monkey ladder shall be provided for overhead water tanks, mummy and lift machine room doors with frame and steps of 40x40x6 mm angle iron, etc.
- x) Wall mounted door stoppers shall be provided to protect the wall where the door handle would run into it.
- xi) 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.
- xii) 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.
- xiii) Wherever M.S. grill provided in window, weight of grill in each window should not be less than 12 kg/sqm.
- xiv) Wherever utility ducts, drains etc. are required, the same shall be provided with precast concrete units made of M-50 grade concrete and reinforcement steel of grade of Fe-500D.
- xv) Wherever the doors are required to be fixed to AAC block masonry, the frame shall be fixed in RCC band or concrete block masonry.
- xvi) 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.
- xvii) 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 NBCS 2026 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 SPECIAL CONDITIONS FOR GREEN BUILDING

The building shall confirm to minimum 4-Star rating as per GRIHA. norms. The contractor shall follow the all guidelines to achieve minimum 4-star GRIHA rating. The contractor shall be fully responsible for maintaining the desired records / documentation which shall be required for achieving minimum **4-star GRIHA rating**. The copies of these records /documentation shall be provided to the appointed GRIHA consultant by the contractor, GRIHA council and Engineer in charge. The contractor shall provide full cooperation to appointed GRIHA consultant, GRIHA council and Engineer in charge and all officers visiting the sites. The contractor shall attend all the site visits / meetings conducted by the

appointed GRIHA consultant, GRIHA council and Engineer in charge time to time and shall provide the necessary compliances accordingly at site for this purpose.

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 NBCS 2026.
 - xvii) Adopt additional best practices and prescribed norms as in NBCS 2026.
- 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), Manganese (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:

2.10.1.1 Any dusty material.

2.10.1.2 Areas where demolition work is carried out.

2.10.1.3 Any unpaved main-haul road and.

2.10.1.4 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 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 **GRIHA**.
- 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 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 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).

2.28 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.

2.29 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 up to 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.
- 2.30 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.
- 2.31 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.
- 2.32 The contractor shall comply with the safety procedures, norms and guidelines (as applicable) as outlined in the Part 7 of **National Building Construction Standards (NBCS) 2026** 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.
- 2.33 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).

- 2.34 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.
- 2.35 Wherever required, Contractor shall meet and carry out all activities on site, supplement information, and make submittals.
- 2.36 **CONSTRUCTION WASTE**
- 2.36.1 The contractor shall demolished the existing buildings any other structure falling in the layout plan of the proposed construction work as per direction of Engineer-in-charge. The old boundary wall as shown in the layout plan shall be demolished by the contractor as per direction of Engineer-in-charge. Waste materials as a result of such demolition shall be removed from site and disposed off as per local body norms. Nothing shall be paid extra to the contractor on this account.
- 2.36.2 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.
- 2.36.3 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.
- 2.36.4 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.
- 2.36.5 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.
- 2.36.6 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.
- 2.36.7 The storage of material shall be as per standard good practices as specified in Part 7, Section 2 in Storage, Stacking and Handling practices, NBCS 2026 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.

2.36.8 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.

2.36.9 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.

2.37 **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 liters
 - ii) Electricity consumption in 'kwh' units
 - iii) Diesel consumption in liters
 - 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 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. The action shall be taken as per term and conditions of contract.

The GRIHA consultant shall be removed immediately by given a notice of 3 days. Agency has to give a fresh proposal for new appointment of GRIHA consultant within 7 days.

3 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 weeks' 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 Special Conditions for Corrosion resistance Steel Reinforcement

- 4.1 The Contractor shall/procure ISI marked **Corrosion Resistant TMT bars of grade 500D (CRS)** 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 100 ton	For consignment above 100 ton
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 45 tonnes or part there of	One sample for each 50 tonnes or part there of
Over 16mm dia bars	One sample for each 50 tonnes or part there of	One sample for each 75 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 to the up-to-date correction slip 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 up to 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, mumty, 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 NBCS 2026** by using vermiculite coating as per manufacturer's specifications and by applicators approved by them.

4.0 Concrete Work:

All concrete works shall be carried out in general as per CPWD Specifications 2019, Volume-I & II with up-to-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, 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 and nothing extra shall be payable for this.**

RCC WORKS:

Suitable type of foundation (isolated/combined, strip, raft, pile etc.) shall be design as per site conditions with RCC using specified grade of concrete. RCC retaining/breast wall shall be provided as per good for construction drawings and site condition. Unless specified otherwise, all structural members like footings/foundations, columns, beams, slab etc., shall be provided with **M-35 grade**.

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

- 6.1** Design mix shall be carried out as per IS 10262, IS 456, IS 4926, and other relevant IS codes / CPWD Specifications amended up to 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 may install fully automatic Batch Mix Plant at site or in nearby area wherever permissible. In case, contractor opt for installing of Batch Mix Plant then agency has to install new fully automatic Batch Mix Plant at site. The old Batch Mix Plant shall not be permitted, in any case. If desired by the Engineer-in-charge the contractor has to submit the vouchers of new purchased fully automatic Batch Mix Plant. All permissions/NOCs (including payment/fee if any stipulated) from the concerned authorities shall be obtained by the contractor and no claim of hindrance on account of delay in installation of batching plant shall be admissible. Contractor may 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 fully responsible for “manufacturer of concrete” and the “placement 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: -
- i. 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.
 - ii. Calibration checks of the Fully Automatic Batching plant /RMC.
 - iii. 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 plant. 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 plant.
- 6.7** All relevant records of produced and used concrete shall be made available to the Engineer-in-Charge or his authorized 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

- i. 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 uniformly 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.
- ii. 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

- iii. 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.

- iv. 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.
- v. 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 up to 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 up to 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 **Corrosion Resistant TMT bars of minimum grade Fe 500D (CRS).**

- 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 up to 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.

- a) Chicken mesh 85gsm or fiber mesh of good quality to be provided in plaster at the junction of Masonry and RCC or CC Member/band in any kind of masonry work and or AAC masonry work.
- b) 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.
- c) 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.
- d) F.P.S clay bricks of class designation 7.5 in cement mortar 1:6 (1 Cement: 6 Coarse Sand) shall be used in brick work in foundation up to plinth level.

Outer envelope wall of the buildings shall be of AAC blocks masonry minimum 200 mm thickness 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. All type of internal masonry work which is affected by water shall be carried out by using Clay bricks of class designation 7.5 in the building as per CPWD specifications. In rest of the internal masonry work shall be of AAC blocks.

Plaster shall be of 12mm thick with ready mixed cement plaster and 15mm thick with ready mixed cement plaster on rough side on inner and outer surfaces by using chicken mess of required specification mentioned in this Bid documents.

- 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. At every third course of AAC blocks masonry, GI strips of 1.5mm thickness and width 25mm shall be provided centre to centre of AAC Blocks as shear connectors between the two walls at the spacing of 1.0 metre intervals.
- 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/m3)	Compressive Strength (N/mm2)		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 **100 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 100 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: $X - 0.6 R > \text{minimum value specified in above Table}$. 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 specifications 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 up to 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.

- a) Windows along with glazing shall be designed for wind loads applicable to the area/location as per relevant IS codes.
- b) 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.

- c) 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.
- d) 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.
- e) 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.
- f) Door Frames – **Doors frame for flush doors shutters shall be of 2nd class teak wood as per CPWD specifications.**
- g) Laminates- Flush doors shall be provided with 1.5mm 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.
- h) 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.
- i) **Hollow Metal Doors (Pressed Metal Doors):** Hollow Metal doors should confirm to IS 16074 & IS 4351 and shall be made of pressed galvanized steel confirming 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 mitered, 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.

- j) **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.
- k) **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 resign 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.
- l) **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.

m) 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.

- n) **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.
- o) 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.
- p) **HARDWARE FOR DOORS /WINDOWS:** Following specifications of the hardwares for door /windows shall be followed:
 - i) **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 up to 120kgs
 - ii) **VISION PANEL:** Unless otherwise specified, toughened glass of 6 mm thickness.
 - iii) **GRAVITY COORDINATOR:** Door coordinator /sequencer for the double leaf doors
 - iv) **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.
 - v) **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
 - vi) **FLOOR SOCKET:** Spring loaded dust excluding floor socket with fixing accessories, in satin Chrome finish.
 - vii) **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.
 - viii) **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.
 - ix) **PA BRACKET:** Parallel arm bracket suitable for surface mounted door closer for fixing of door closer in silver finish.

- x) **ARMOR PLATE:** Armour plate with smoothened 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.
- xi) **PUSH PLATE:** Push plate with smoothened edges and rounded corners flush face fixing screws size 150 x 400 x 1.2 mm in SS 304 grade in satin stainless steel.
- xii) **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.
- xiii) **MOP PLATE:** Mop plate with smoothened 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.
- xiv) **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.
- xv) **D- TYPE HANDLE:**
 - i. D type 300mm long CTC, 22mm Dia Pair of pull handle in SS 304 B/B fixing.
 - ii. Offset type D handle of 450mm long CTC, 25mm Dia pair of handles in SS 304 B/B fixing.
- xvi) **FLUSH PULL HANDLE:** Stainless steel Flush Pull handle with fixing of screw at flush with surface of doors.
- xvii) **Door Stoppers:** Stainless Steel (grade 304) wall mounted or hanging floor door stoppers in stainless steel satin finish with necessary ss screws etc.
- xviii) **Door Closer:** Aluminum die cast body tubular type universal hydraulic door closer (having brand logo with ISI mark, IS: 3564, embossed on the body, with necessary accessories and screws etc.
- xix) **Stainless Steel handles:** Bright /matt finished Stainless Steel handles (Window) of approved quality & make with necessary screws etc.
- xx) **Pull Handle:** 25mm dia, 300 mm long in cranked / square shape stainless steel (Grade 304) satin finish pull handle with necessary screws etc.
- xxi) **Sliding Door Bolt:** 250x16mm Stainless steel (Grade 304) satin finish sliding door bolts of superior quality with necessary SS screws etc.
- xxii) **Mortice Latch:** Brushed finished 100mm mortice latch in stainless steel satin/polished finish with euro deadlock (Coin release) with rose rings and pair of stainless steel (grade 304) lever handles with necessary SS screws etc.
- xxiii) **Tower Bolt:** Stainless steel (Grade 304) tower bolts with necessary SS screws etc. complete.

11.0 FIRE CHECK/RATED DOOR:

CPWD Specification 2019 Vol. I & II with revisions/ amendments / correction slips up to last date of bid submission (including extensions, if any), National Building Construction Standards (NBCS) 2026 and manufacturer's specification will be followed. Fire Check doors shall be provided in buildings wherever necessary and required as per National Building Construction Standards (NBCS) 2026, 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 NBCS 2026. 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.

- a) 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.
- b) 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.
- c) 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.
- d) 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.
- e) 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.

- f) 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.
- g) 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.
- h) 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.
- i) 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.
- j) Glazed Fire Check/Rated Doors/Window/Partition -
 - i) Fire check/rated glazed door/window/fixed partition, shall be provided as per following specification.
 - ii) 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.
 - iii) 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.

- iv) 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.
- v) 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 NBCS 2026, 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.

k) Metal Fire Check/Rated Doors-

- i) 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 NBCS 2026 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 its 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.
- ii) 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.
- iii) 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).

I) 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:

- i) **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.
- ii) **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 up to 120kgs.
- iii) **VISION PANEL:** Unless otherwise specified, bidirectional interlayered glass of 15 mm thickness shall be used.
- iv) **GRAVITY COORDINATOR:** Door coordinator /sequencer for the double leaf doors.
- v) **PANIC BAR-SINGLE POINT:** Panic bar / latch (Single point) suitable for single / active leaf of door.
- vi) **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.
- vii) **EXTERNAL TRIM:** External trim on back side of the Panic Latch.
- viii) **ELECTROMAGNETIC HOLD OPEN-**Electro Magnetic hold open device for holding the door in open condition EM with armature plate with 24v DC.
- ix) **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.
- x) **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.

- xi) **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.
- xii) **FLOOR SOCKET:** Spring loaded dust excluding floor socket with fixing accessories, in satin Chrome finish.
- xiii) **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.
- xiv) **DELTA SEAL:** Delta Seal for acoustic, fire and smoke protection, suitable for wooden and steel frames, self-adhesive, Finish = Black, in black finish.
- xv) **PA BRACKET:** Parallel arm bracket suitable for surface mounted door closer for fixing of door closer in silver finish.
- xvi) **ARMOR PLATE:** Armour plate with smoothened 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.
- xvii) **PUSH PLATE:** Push plate with smoothened 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.
- xviii) **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.
- xix) **MOP PLATE:** Mop plate with smoothened 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.
- xx) **KICK PLATE:** Kick plate with smoothened 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.
- xxi) **PULL HANDLE:**
 - i. D type 300mm long CTC, 22mm Dia Pair of pull handle in SS 304 B/B fixing.
 - ii. Offset type D handle of 450mm long CTC, 25mm Dia pair of handles in SS 304 B/B fixing.
 - iii. FLUSH PULL HANDLE: Stainless steel Flush Pull handle with fixing of screw at flush with surface of doors.
 - iv. Pull Handle: 25mm dia, 300 mm long in cranked / square shape stainless steel (Grade 304) satin finish pull handle with necessary screws etc.

- xxii) Door Stoppers: Stainless Steel (grade 304) wall mounted or hanging floor door stoppers in stainless steel satin finish with necessary ss screws etc.
- xxiii) Sliding Door Bolt: 250x16mm Stainless steel (Grade 304) satin finish sliding door bolts of superior quality with necessary SS screws etc.
- xxiv) Mortice Latch: Brushed finished 100mm mortice latch in stainless steel satin/polished finish with euro deadlock (Coin release) with rose rings and pair of stainless steel (grade 304) lever handles with necessary SS screws etc.
- xxv) Tower Bolt: Stainless steel (Grade 304) tower bolts 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 makes 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 conforming to IS: 6315, having brand logo embossed on the body / plate with double spring mechanism and door weight up to 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-in-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

- i) 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
- ii) 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 stone, Vitrified 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 up to 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.

- a) 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.
- b) 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.
- c) 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.
- d) The Engineer-in-Charge or his representative may, if required, visit the source of supply of the various materials (Granite Stones/Marble/Vitrified Tiles/wooden etc.) to assess the quality as well as availability of the material in the required quantities.
- e) 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.
- f) 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.

- g)** The material (Granite Stones/Marble/Vitrified Tiles/wooden 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.
- h)** The following tolerances shall be allowed in the dimension of granite stone slab:
- a) Length $\pm 1\text{mm}$
 - b) Width $\pm 1\text{mm}$
 - 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.

- i)** 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.
- j)** 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.
- k)** 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.
- l)** 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.
- m)** All the tiles (flooring/wall lining/Skirting/dado) shall be fixed with quick set tile adhesive of minimum thickness of 6 mm. Also joints of flooring tiles having 3 mm width shall be grouted using epoxy grout 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).

- n) 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.
- o) 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.
- p) 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.
- q) 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.
- r) 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.
- s) One piece Granite stone for treads / risers in staircase shall be used including rounding of nose.
- t) 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.
- u) For the skirting in the enclosures with curvilinear profiles, the (Granite Stones/Marble/ Vitrified Tiles/Wooden 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.
- v) 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.
- w) 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.
- x) 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.

- y) 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.
- z) 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.
- aa) 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.
 - bb) **Wooden Flooring:** It shall consist 12mm thick AC-5 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.
 - cc) 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 up to last date of bid submission (including extensions if any). Metal false ceiling shall be provided in wet areas like toilets and other places as per direction of Engineer-in- charge. 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.

a) 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 galvanized 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 up to 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 peirce into 12x50mm or even bigger size dash fastners 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.

b) 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 G.I. 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..

c) 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 $k = 0.052 - 0.057 \text{ w/m K}$, 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 up to 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.

d) 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 channels 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.

- e) 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.
- f) At inlet mouth of rain water pipe, cast iron grating 15 cm diameter and weighing not less than 440 grams shall be provided.
- g) 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 2019.

15.0 FINISHING WORK:

- a) All AAC walls shall be finished with 12 mm thick ready mixed cement plaster on walls finished in smooth line and level etc. complete.
- b) All brick wall in toilet/ shaft portion shall be finished with 12mm thick with ready mixed cement plaster and 15mm thick with ready mixed cement plaster on rough side.
- c) 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.
- d) Necessary drip course shall be provided in Chajja, Balcony, Projecting Roof, Beams etc.
- e) All the internal surfaces including exposed ceiling (non false ceiling areas) shall be finished with 2 mm thick cement-based wall putty, one coat of cement primer and two or more coats of paints specified in finishing schedule.
- f) Application of paints shall be done with mechanical equipment. Mechanical sanding machine (for scrubbing & preparation of surface) shall be used by the contractor.
- g) 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.
- h) 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.

- i) 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.
- j) Water repellant coat: 2 to 3 coats of Silicone based water repellant, 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 NBCS 2026, 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 florid 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:

- a) 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. The shop drawings approved by the Engineer-in-charge shall be got vetted/Proof checked from the reputed Government institutes like IIT's and NIT's or any other reputed Government Institutes. The

Government institutes to be engaged for proof checking/ vetting shall be got approved from the Engineer-in-charge. The fee for vetting/proof checking of structural drawings to Proof-Checking Institute shall be borne by the contractor.

- 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.

b) Submittals: On commencement of the work pertaining to steel structure, the Contractor shall submit the following in two sets:

- i) 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.
- ii) Complete fabrication drawings, schedule of quantity, cutting lists, bolt lists, welding schedules.
- iii) Results of any tests, as and when conducted and as required by the Engineer-in-charge.
- iv) Manufacturer's mill test reports/certificates in respect of steel materials, bolts, nuts and electrodes etc. as may be applicable.
- v) 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.
- vi) The total number of experienced personnel of each category like fitters, welders, riggers etc., which he intends to deploy on the work / project.

- c) 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.
- d) Design and drawings will show as appropriate the salient dimensions of structural members.
- e) 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 bolting 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.
- f) 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.
- g) 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.
- h) 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.
- i) 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:
 - i) Assembly drawings, giving exact sizes of the sections to be used and identification marks of the various section's members.
 - ii) Dimensional drawings of base plans, anchorage detail of bearing bolt's location etc.
 - iii) Complete quantity schedule of materials and detailed drawings of all sections.
 - iv) Detailed shop drawings for proper co-ordination with the concrete components to which the steel members shall be connected, as required.
 - v) Any other drawings or calculations that may be required for proper completion of the works and clarification of the works or substituted parts thereof.

- vi) All 'as-built' drawings in 4 prints and 1 plot on Garware film or equivalent and on CD.

j) 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.

k) Materials

- i) 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.
- ii) 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.
- iii) Grating, Handrail, Ladder, Insert Plates with lugs, Anchor Bolts including nuts and washers shall be galvanized.
- iv) 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.
- v) Field connections may be welded or bolted. However, bolted connections shall be preferred over welded connections.
- vi) Adequate provision shall be made in structural arrangement for installation and successful implementation façade cleaning system for all building blocks.

l) STORAGE OF MATERIALS

- i) 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.
- ii) The steel to be used in fabrication shall be stored in a separate stack clear of the ground section wise and lengthwise.
- iii) 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.

- iv) 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.
- v) 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.
- vi) 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.

m) Handling and Storing of Materials:

- i) 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.
- ii) The store should be provided with adequate handling equipment 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.
- iii) 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.
- iv) 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.
- v) Small fitting hand tools are to be kept in containers in covered stores.
- vi) 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.
- vii) IS:7293 and IS:7969 dealing with handling of materials and equipment 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.

- n) **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.
- o) **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.
- p) **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.
- q) **Assembling:**
- i) 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.
 - ii) 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.
 - iii) 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.
 - iv) All fasteners shall have a washer under nut or bolt head whichever is turned in tightening.
 - v) 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.
- r) **Transportation & Handling**
- i) 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.

- ii) 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.
- iii) 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.

s) Field Bolts:

- i) 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.
- ii) 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.
- iii) 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.
- iv) 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.
- v) 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.
- vi) 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.

t) Tightening of bolts:

- i) Bolted connection joints with high strength friction grip bolts shall be inspected for compliance of codal requirements.

- ii) 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.
- iii) 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.

u) 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.

v) 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 NBCS 2026**. 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).

w) STRUCTURAL STEELWORK SPECIFICATION FOR WELDED STRUCTURE:

- i) 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.
- ii) **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.
- iii) **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.
- iv) **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.
- v) **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.

- vi) **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.
- vii) **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:
 - a. Type and size of electrodes
 - b. Current and (for automatic submerged arc welding) arc voltage
 - c. Length of run per electrode; or (for automatic welding) speed of travel
 - d. Number and arrangement of runs in multi run welds
 - e. Position of welding
 - f. Preparation and set-up of parts
 - g. Welding sequence
 - h. Pre or post heating
 - i. Any other relevant information.
 - j. 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.

- viii) **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.

- ix) **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.
- x) **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.
- xi) **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.
- xii) **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.
- xiii) **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.
- xiv) **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.
- xv) **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.
- xvi) **Dislodging:** After making each run of welding, all slag shall be thoroughly removed and the surface cleaned.
- xvii) **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.

xviii) Weather Conditions: Welding shall not be done under weather conditions, which might adversely affect the efficiency of welding.

xix) 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.

xx) 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.

xxi) 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.

x) 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.

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

z) 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.

aa) 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.

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 on horizontal surfaces and post applied SBS based self-adhesive waterproofing membrane on vertical surfaces.

A) WATERPROOFING OF ALL KIND OF TERRACES BY USING POLYUREA WATERPROOF COATING.

- i) **Surface Preparation** – The concrete Surface should be properly hand - grinded / machine grinded and be made free from all the depression/undulations, dust dirt, laitance and all the adhesion inhibiting material. Cement Grouting (**if Required**) to be carried out on all the dynamic cracks on the concrete surface. Wherever the crack width exceeds 1mm or more, the cracks should be cut open in a V groove shape, widened and packed with flexible cement mortar (1:2) or a polymer modified mortar (PMM) and finished off to match with adjacent surface. All the depressions, holes, and any other undulations on the entire concrete surface if any must be treated / filled with high strength polymer modified mortar/ micro concrete and the surface should be fully repaired and levelled. For more stubborn dirt and contaminants where algae and fungal growth is stubborn, a high-pressure jet water blast is recommended. This method is particularly effective in removing any oily residues, bird droppings, or other contaminants that a broom or brush might miss. When using a pressure washer, ensure the water pressure is not too high to avoid damaging the surface.

- ii) **Wall and Slab Joint / Construction Joint Treatment** – After the entire surface preparation has been completed in all respect on the mother slab, all the Wall - Slab-Joints / Construction Joints on the entire slab area to be treated with Hydrophobic Joint Sealing Tapes of width 200 mm fixed in place with a high adhesion high strength 2 Component Acrylic polymer modified cementitious Slurry system. Apply 1st coat of Waterproofing slurry on the Wall – Slab joint and immediately place the tape over it and press it into the still wet slurry with a steel trowel to ensure adhesion and release any trapped air. In the same manner, the entire Wall – Slab joints / Construction Joints and the pipe and concrete joints to be treated on the whole area. **The hydrophobic joint tapes should be vapor permeable, hydrophobic in nature to resist > 5 bars of water head according to EN 12390-8: Service Temperature of -30°C / +90°C, Peel Strength of >30N/mm sq as per DIN 16860, Tensile Elongation of > 350% as per DIN EN ISO 527-3, shore A hardness of > 80.**
- iii) **Solvent Free Epoxy Primer Application** – After the entire Wall – floor joints have been treated and completed in all respect and the concrete surface is in a completely dry condition, providing and applying a solvent free primer epoxy / Concrete sealer by brush or a lamb wool roller at the specified application rate of 0.150/Kg/sqmt - 0.200 Kg/ Sqmt on the prepared concrete substrate subject to substrate porosity. The primer should have an adhesive strength of 4Mpa as per ASTM D1640, solid Content of 98% as per ASTM D 2369. The Polyurethane liquid primer should be CE / BIS or IS certified.
- iv) **2 Component Hybrid Polyurea Waterproof Coating** – Providing and application of two component, hot spray applied hybrid Polyurea waterproofing system at a coverage of 2.00 Kgs/m² for 1.60 mm (DFT) applied in single or double coat over the epoxy primer. The cured membrane shall have an elongation of 400 % - 450%, Tensile strength of > 15 MPa as per ASTM D 412 / EN-ISO-527-3 and lesser water absorption of < 0.8 %, shore A hardness of 80 as per ASTM D2240 / DIN 53505 / ISO R868, service application temperature -40 to 80 degree C, have a Solid content of 82 % (+/- 2 %) as per (ASTM D1353), Adhesion to concrete > 50 kg/cm² as per (ASTM D4541), Puncture Resistance > 1000 N as per ASTM E 154, Tear Strength of - 42 N/mm as per ASTM D 642, crack bridging capacity of 2mm as per ASTM C 1305, Viscosity (Brookfield) - 1,000-2,000 cP as per ASTM D2196-86, @ 25°C. The fully cured system should be root resistant and should hold a CE (ETAG 005) certification. The product should be CE certified fulfilling the requirements of EN 1504-2 as a protective coating. IMPORTANT NOTE - Post ponding should be done for a minimum period of 72 hours only after a minimum period of 4 - 5 days of application of the waterproofing system to check for any leakages
- v) **Laying of non-woven fabric and Screed / PCC** – Before laying of Screed is done, single layer of non-woven geotextile cloth of minimum 200 gsm should be laid on the waterproof coating so as to create a slip membrane between the coating and PCC / Screed.
- vi) **Laying of Screed / PCC** – Providing and laying of Concrete Screed on the water proofed surface (minimum after 7 days after completing the waterproofing) at an average thickness of 2.5” - 3” with proper slope towards the drainage point. It is recommended to put a welded wire mesh in between the screed. The screed should be laid in a panel size of 4m x 4m which would reduce and minimize shrinkage cracks in the screed to much extent. These additions would sufficiently help in minimizing the

cracks in the screed.

vii) Drainage Board for Horizontal Areas (Landscape Areas only)- Supply and application of 500 Fleece or Equivalent HDPE Dimple board with non-woven geotextile fabric with 100 mm overlap. Key properties: Total Thickness: - 8.0 (+/- 0.8) mm, Total weight: - 600 (+/- 30) g/m², Compression resistance: - 200 (+/- 40) kPa, drain flow capacity – Horizontal application at 20 kPa: - 0.25 (-0.05) l/(m*s) Drain flow capacity – Vertical application at 20 kPa: -1.75 (-0.35) l/(m*s).

viii) Vertical Protection of Membrane in tower area: Providing and applying a protection plaster 12 – 15 mm thick in the ratio of 1:4. Note: Before plaster work, a thin coat of epoxy primer has to be applied over the cured waterproofing membrane, immediately followed by sprinkling of sand while the primer is still wet.

ix) Underdeck thermal insulation shall be used if required as per DSR 2023.

- b) BELOW RAFT / GRADE SLAB WATERPROOFING:** Providing and laying weldable grade, 1.5mm composite thick fully bonded pre-applied HDPE waterproofing membrane with factory made thermo fusible 100mm wide side laps and end laps for the horizontal area of the basement as per manufacturer's recommendation. The membrane should be of maximum roll size, to reduce the number of joints, it has minimum 100mm wide factory made adhesive free weldable side lap the membrane comprising of an HDPE layer and a pressure sensitive adhesive layer which is covered by a weather proof protective and trafficable granular layer to protect self-adhesive polymer layer. Lay out the membrane sheets in the area using standard width roll and bond the sheets together by thermofusing (welding) longer edges and end laps by hot air welding with Leister Twinny or suitable equipment. The membrane shall be taken up to minimum 100mm or as approved on the vertical within the shuttering of the footings, Grade slab, Raft slab or in case of any confined wall areas up to the full height of the confined portion of the retaining wall. The membrane shall be of a special HDPE grade with overlaps that should be hot air fusion welded on site to ensure foolproof joints. The membrane shall have a tensile strength of >25 MPa (ASTM D 412), Elongation of >500% (ASTM D 412), high puncture resistance of >1100 N (ASTM E 154), lap joint strength of at least 10 N/m (ASTM D 1876) (both side and end laps) and UV exposure resistance of 30 days. The membrane shall comprise of a HDPE layer and a pressure sensitive adhesive layer which is covered by a weather proof protective and trafficable granular layer to protect self-adhesive polymer layer. The membrane should be applied loosely above the PCC and the side laps and end laps should be welded together using tinny welding machine. The HDPE membrane should get fully bonded to the RCC raft after pouring the concrete. The work shall include cleaning & removal of all the dust, dirt, oil, grease, cement laitance, loose particle & prepare the P.C.C. substrate for laying of waterproofing system. The system does not require any screed protection and reinforcement can be laid directly on the membrane.
- c)** Basically, all the RCC works shall be given waterproofing treatment by adding the cementitious integral crystalline admixture @ 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.

- d) Post applied minimum 1.5 mm thick SBS based self-adhesive waterproofing membrane 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.
- e) 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 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 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. All the Wall – Slab Joints / Construction Joints on the entire area are to be treated with Hydrophobic Joint Sealing Tapes of width 200 mm fixed in place with a high adhesion high strength 2 Component Acrylic polymer modified cementitious Slurry system as per item no. 18.1 (b) mentioned above.
- f) **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 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% 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 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. All the Wall – Slab Joints / Construction Joints on the entire area are to be treated with Hydrophobic Joint Sealing Tapes of width 200 mm fixed in place with a high adhesion high strength 2 Component Acrylic polymer modified cementitious Slurry system as per item no. 18.1 (b) mentioned above.

- g) Waterproofing of STP:** It shall be treated on internal vertical and horizontal surfaces with two-component, high elasticity acrylic modified cementitious coating system 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. All the Wall – Slab Joints / Construction Joints on the entire area are to be treated with Hydrophobic Joint Sealing Tapes of width 200 mm fixed in place with a high adhesion high strength 2 Component Acrylic polymer modified cementitious Slurry system as per item no. 18.1 (b) mentioned above.

19.0 Specification for awning work at food court 1st floor open terrace:

The fabric used should be high quality and durable & strong PVDF- coated polyester or PTFE coated glass fiber fabric. The fabric should be UV resistance, fire retardant and capable of withstanding extreme weather conditions. All necessary fittings and fixtures for securing the awning should be designed and provided. The awning should require minimal maintenance with the fabric being easy to clean and resistant to dirt and grime.

The awning must be using 100% Aluminium frame and with superior grade hardware allowing the awning to be easily attached to wood, brick, RCC or stone by using required size of approved quality dash fastener and Stainless steel bracket.

DEVELOPMENT WORK:

20.1 Planning, Designing and Construction of Road Works and Footpath Works:

- a)** All roads shall have cement concrete pavements using VDF, as per MORTH specifications (Latest edition), laid over sub grade duly prepared with power roller of required thickness as per design and as per traffic categories & volume. 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 MoRTH Specifications for Road and bridge work (Latest edition).

- b)** The road and allied services shall be developed as per layout plan approved by Engineer-in-charge. The minimum width of carriageway shall be 6 meter for all roads or as applicable as per Fire norms, whichever is maximum. The road shall have provision of footpath of minimum 1.2 meter width on both sides. The Drains shall be designed behind the footpath on both sides of road. The footpath shall be separated with kerb stones.
- c)** Formation of road alignment with approved sizes as per approved drawing including Levelling cutting and embanking as per profile, rolling and preparing the sub-grade fit for laying road.
- d)** If excavated earth is not sufficient enough to fill embankments, the same shall be filled with earth suitable for filling, shall be brought from outside and nothing shall be paid extra towards the same.
- e)** Cutting 6mm wide and 50 mm deep groove in Vacuum dewatered concrete pavement and filling with polysulphide/ expansive material etc. complete as per specification and as directed by the Engineer – in – charge.
- f)** Cambers, road longitudinal slopes etc. shall be followed as per Morth specification and providing NP3 pipes 300mm dia for road crossing of other services (civil and E&M) at every 50-meter interval.
- g)** MoRTH Specifications shall be followed for cement concrete pavement/ road.
- h)** Covered/open parking areas shall be provided as per requirement with 80 mm thick multicolored retro-refeective Paver blocks of grade M-40 made 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 as per approved Engineer-in-charge.
- i)** 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.
- j)** 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.
- k)** 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. The minimum thickness of GSB material to be laid in

subbase is not less than 300 mm

- l) Plain Cement Concrete having minimum thickness 100mm M-10 Grade having minimum cement content of 220 kg/cum shall be provided over granular sub-base and below CC pavement on roads.
- m) *The proposed finished level of proposed cement concrete pavement shall be achieved by scrapping / removing of existing bitumen road/cement concrete /earthen surface etc. and or as per direction of Engineer-in-charge.*
- n) Cement Concrete Pavement: Cement concrete pavement (having minimum thickness 200 mm) of design mix M-30 grade concrete (minimum cement content 350 kg/cum) 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, MoRTH specification 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.
- o) Factory made Kerb stone: It shall be of M-30 grade cement concrete 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.
- p) RCC Perforated Drain Covers: Factory made precast RCC perforated drain covers having concrete of strength not less than M-30, required sizes for road side drains/underground utility shaft or duct, shall be provided. These should be properly reinforced to carry the desired load.
- q) 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.
- r) Road Surface marking: 1.5mm thick, 150mm wide 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. shall be provided on Cement Concrete Pavement as per MoRTH specifications and or as per direction of Engineer-in-charge. The thermo-plastic road marking paint for indicating divider line and edge line, speed breakers, road crossing for pedestrians at junction etc. shall be provided on complete pavement as per direction of Engineer-in-charge.
- s) Retro Reflective Overhead Signage Boards: It shall consist manufacturing, supplying and fixing made up of 2 mm thick aluminum 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.

- t) The different lanes as specified below shall be constructed with same specification mentioned in this bid document for CC pavement above and or elsewhere :
- i) A dedicated separate lane alongwith footpath each for four(4)-wheeler and two (2) wheeler shall be constructed from Mathura Road to the bus/three-wheeler dropoff shelter at National Zoological Park entry so as to segregate four-wheelers and two-wheelers as mentioned in lay out plan drawing in the bid document. The minimum width of each lane shall be 6 m.
 - ii) 7.5-meter-wide dedicated service lane alongwith footpath shall be constructed from Mathura Road to Bus parking area and also up to parking area of the National Zoological Park, located behind petrol pump.
 - iii) The entry and exit lane of National Zoological Park parking area behind the petrol pump shall be constructed with cement concrete pavement having minimum width 15 meter.
 - iv) 7 m wide drive way lane for direct entry from Mathura Road to Purana Quila and National Zoological Park entry as shown in tender drawing shall be constructed
- u) **Extension of existing footover Bridge at Mathura Road up to entry area of NZP:** The extension of existing footover bridge shall be carried out by using structural steel as per approved structural design duly vetted by institute duly approved by Engineer-in-charge. The existing steel bridge is situated near vicinity of Petrol Pump at Mathura Road, New Delhi. The extension of footover steel bridge shall be extended upto entry level of National Zoological Park as mentioned in tender drawings available in Bid documents.

The specification for structural steel work to be carried out for extension of footover bridge have already been mentioned in this Bid document. All structure steel work including existing shall be painted with Epoxy Primer and Two or More coat Epoxy Primer paint. Nothing extra shall be paid on this account.

20.2 RCC RETAINING WALL

- a) Planning, Designing and Construction of RCC Retaining wall: The height, base width, and stem thickness (thicker at the bottom, thinner at the top) are specific to the structural design calculations for the site. For general guidance, the base width is often related to the wall's height. A minimum concrete grade of M30 (design mix) is generally specified for retaining structures The design and execution must conform to the latest applicable BIS codes.

- b) Weep holes (typically 110mm dia HDPE/PVC pipes) are essential to relieve hydrostatic pressure and must be provided at a rate of at least two per square meter of surface area. A 15cm thick gravel layer or a proper drainage system should be provided behind the wall, especially in clayey foundation conditions, to ensure well-drained backfill. Expansion joints (typically 40 mm wide) should be provided every 20m to 25m along the length of the wall. The external surface of the wall shall be finished with 6mm thick cement plaster (1 cement:3 fine sand)

20.3 Cement Concrete Toe Wall:

Planning, Designing and Construction of Cement Concrete Toe wall : Concrete toe walls are to be constructed at the base of embankments or slopes to provide stability and prevent erosion. It is to be designed in accordance with the relevant MORTH and IS Codes, ensuring adequate strength and durability. The wall is generally built along roadsides or embankment toes wherever required to maintain the soil slope and protect against scouring due to rainwater or surface runoff. The minimum grade of concrete used shall be M-35 unless otherwise specified, as per design requirements. Drainage provisions such as weep holes and filter media are incorporated to relieve hydrostatic pressure and enhance performance.

20.4 BOUNDARY WALL:

The New Boundary Wall shall be constructed after dismantling the existing boundary wall as per requirement and tender drawings available in the Bid documents. The drawing of tentative pattern and design of proposed new boundary wall is also available in the Bid documents. The detail drawing on the basis of tender drawing shall be prepared and shall be got approved by the Engineer-in-charge. The construction of proposed boundary wall shall also be got carried out by the agency at several new locations (where no boundary wall exist at present). The proposed boundary wall after dismantling and at several new locations (where no boundary wall exist) shall be part of scope of work. Nothing extra shall be paid on this account.

20.5 EXTERNAL SEWAGE SYSTEM :

Planning, Designing and Construction of Providing and laying Sewer lines with HDPE DWC Pipe SN 8 Grade including Manholes of required size, shape and depth complete and as per direction of Engineer- in- charge.

The agency has to plan, design, prepare the drawings for Sewerage system as per provisions of NBCS 2026 and CPWD specifications 2019 and get the same approved from Engineer – In – Charge before execution the competent authority.

A sewer line with HDPE DWC Pipe SN 8 Grade pipes is to be operated from the chambers of the building shafts to first sewer man hole and HDPE DWC Pipe SN 8 Grade from first manhole to last manhole up to STP/ septic tank shall be executed as per approved plumbing including the following operations:

- a) Excavation of trench (All kinds of soil & hard rock) for laying Pipes and refilling after laying pipes as per CPWD specification 2019.
- b) Constructing Manholes, drop manholes of required size (shape based on depth, gradient and interval) etc., as per CPWD specifications and NBCS 2026 specifications including construction of gully trap, grit chamber, screen chamber etc., complete including plastering on external surface of all manholes and chambers.

- c) Man holes of size 90X80X45 cm and 120x90x90cm deep inside openings for first manhole and remaining Manholes up to STP / septic tank are to be provided as per approved drawings as per CPWD specification.
- d) Heavy duty SFRC manhole covers and PVC coated foot rests as per schedule of finishes shall be provided for all manholes

20.6 EXTERNAL WATER SUPPLY LINES

- a) Planning, Designing and Construction of Providing and laying Water supply main, branch and distribution lines including chambers and fittings/specials such as Tees, Bends, collars, Unions, tappers, caps, Sluice Valves, Gate Valves, scour valves, non-return valves, air-relief valves, thrust blocks etc. complete and as per direction of Engineer- in- charge.
- b) The water supply network should cater to the needs of supplying water from UG sumps/main grid line to building. The G.I. Pipe & Fittings line shall be used for connection from source of water supply to UG sump and from UG sump to overhead tank.
- c) The agency has to plan, design, prepare the drawings for water supply system and get the same approved from Engineer – in – Charge before execution.
- d) Excavation of trench (All kinds of soil & hard rock) for laying Pipes and refilling after laying pipes as per CPWD specification. Earth work excavation for chambers, valves, thrust blocks etc. and refilling after construction/ laying.
- e) Providing and laying G.I. Pipe & Fittings to UG Sump from main grid line inlet chamber per the approved drawing along with specials like Tees, Bends, sockets, Tappers, non return valves, etc.
- f) Construction of chamber of minimum inside dimension 600x600x600mm for sluice valves shall be as per CPWD specification and as per approved drawing.
- g) The building is to be connected with nearest water supply lines so that water supply should be made to the building along with fittings, gate valves, non-return valves, masonry chambers for valves, including excavation, providing sand all-round and refilling after laying etc.as per CPWD specifications.
- h) Treated water line for horticulture using minimum 40/32/25mm dia or as per design requirement, G.I pipes with specials like Tees, Bends, sockets, Tappers, non return valves, etc. shall be provided in lawn area such that each tapping point covers a radius of 15 meters in horticulture/development area.

20.7 STORM WATER DRAINS

- a) Planning, Designing and Construction of Providing and laying storm water drains along roads, with Factory made perforated removable covers with SFRC, of minimum wall size 100 mm and raft 100 mm thick with necessary haunching and

finishing the exposed surfaces with 1:3 cement mortar and as per direction of Engineer- in- charge.

- b) The agency has to plan, design, prepare the drawings for Storm water drain and get it approved from Engineer – in – Charge before execution.
- c) 300 mm (minimum depth) varying depth required to maintain slope along the Roads including excavation of earth (All kinds of soil & hard rock) to the required profile, laying in position and fixing with cement mortar 1: 3 (1 cement: 3 coarse sand) over a bed of 100mm CC 1:5:10 and bottom of the drain shall be finished with 40mm thick CC 1:2:4 and floating coat of neat cement in required gradient as per CPWD and Specification and approved drawing by the competent authority.
- d) Factory made precast Heavy Duty SFRC drain covers, of size 1000 x 600x50 mm including providing edge binding with M.S.flats of size 50 mm x 1.6 mm complete, all as per direction of Engineer-in-charge.

Note: The Contractor shall take adequate protective measures to see that the excavation operations do not damage the adjoining structures or dislocate the services. Water supply pipes, sluice valve chambers, existing sewerage pipes, manholes, drainage pipes and chambers, communication cables, power supply cables etc. met within the course of excavation shall be properly supported and adequately protected, so that these services remain functional. However, if any service is damaged during excavation shall be restored in reasonable time and nothing extra is payable on this account.

20.8 RAIN WATER HARVESTING SYSTEM:

- i) Planning, Designing and Construction of Rain water harvesting system of size mentioned below, including preparation of preliminary & detailed working drawings & execution of all integrating all services with External Development works all complete as per directions of Engineer- in- Charge.
- ii) It shall be designed such that the water from terrace as well as from land scape surface shall be collected in Rain water harvesting system.
- iii) A silt pit of size not less than 2000 x1000 mm with brick work before RWH system, shall be provided.
- iv) Construction of rain water recharge pits of Internal dia. 2500 mm lined with brick work 230 mm thick wall (Internal dia. 2500 mm), then filling with boulders, gravel and coarse sand as per approved drawing.

20.9 SIGNAGES:

Planning, Designing and Providing of Signages; Signages inside/outside buildings shall be as per NBCS 2026 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 NBCS 2026 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.

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 per approved drawings and complete as per the directions of Engineer - In - Charge.

21 Sanitary Installations and Water Supply:

a) General: Planning, Designing and Construction

- i) All the work in general shall be carried out as per CPWD Specifications 2019, Volume-I & II with revisions/ amendments / correction slips up to 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:
 - a) Sanitary pipes, fittings and fixtures.
 - b) Internal and external water supply.
 - c) Internal and external drainage.
 - d) Approval from local authorities, if any.
 - e) Balancing, testing & commissioning.
 - f) Test reports and completion drawings.
- ii) G.I pipes shall be used for hot & cold-water supply including all G.I fittings as per direction of Engineer-in-Charge.
- iii) All Storm pipes/ NP3 RCC pipes shall be complete with fittings. The laying of pipes shall be laid with all norms.
- iv) 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.
- v) All concealed work shall include cutting chases and making good the walls etc.
- vi) 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.
- vii) Plumbing shall have provision for Geysers, water purifier, washing machines, Dish washers, cage washers or any other equipment as per functional requirement.
- viii) Piping has to be done such that water meter maybe provided with individual buildings at a designated location.

- ix) In toilets and other waste water disposal areas sanitary pipe lines shall be suspended from the floor slabs 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.
- x) Plumbing system shall be designed and provided as per the functional requirements of the buildings.
- xi) Double stack system shall be followed. All sewerage to be connected to one stack and all drainage to be connected to other stack
- xii) Water supply and sanitary fittings shall be provided as per the functional and architectural requirements.
- xiii) Pipes shall be duly fixed to the wall by bracket. All pipes shall be fixed with clamps at maximum 1.00 m spacing.
- xiv) All drainage in balconies shall have their inlets in plan. All drainage through balconies shall be connected to Rain Water Harvesting.
- xv) Utility balcony drainage shall be suitably treated and shall be not connected to Rain Water Harvesting System.

b) Internal water supply line-

- i) All internal concealed/Exposed on wall water supply lines shall be of G.I pipes of required dia as per CPWD and NBCS 2026 specifications.
- ii)
- iii) For buildings, the stacks shall be provided in shafts which shall be covered with weather proof doors and accessible for maintenance.
- iv) 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 as per the schedule attached with this bid document.
- v) 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.

vi) **UGT Storage:** Underground water tank storage of minimum 2 days of daily water demand shall be provided.

vii) **Water Distribution:**

- a) **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.
- b) **R.O. Water** – Localised RO units shall be provided in order to meet the work / project requirement.
- c) 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.

viii) **Materials for Water Supply System:**

- a) Internal Toilets water supply - G.I Pipes and Fittings
- b) Pipe under vertical in shaft and terrace for cold and hot water supply - G.I Pipes and Fittings
- c) R.O Water Supply Pipe – Stainless Steel 316 grade Pipes and Fittings.
- d) R.O Water Storage Tank – Stainless Steel 316 grade Pipes and Fittings
- e) 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.
- f) Valves up to 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.

- c) '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.
- d) '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.
- e) Full size /length float mirror over wash basin slab to be provided over wooden backdrop of approved design.
- f) **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) 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 centering 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.
 - (iv) 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.

- g) **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.
- h) 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.

- i) **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 power to 1000 liters of water. The power 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. 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.

- a) 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. 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. 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) 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 NBCS 2026 / CPWD specifications.

- d) The Sewerage system shall be **HDPE Double Wall Coil (DWC)** SN-8 Grade pipes confirming to IS: 16098 including all fittings wherever required e.g., tees, bends of any degree, couplings, adapters, plugs, unions etc. and jointing as manufacturer recommendation etc. including testing of joints etc. complete. **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.
- e) **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.).
- f) **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 12/15mm 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.

Note: The service connection for Water Supply/Electricity/Sewerage from MCD/Sewerage Department/Delhi Jal Board/Electricity Board shall be taken by the agency in consultation with the department. The statutory fees paid to these statutory bodies for taking the service connections mentioned above shall be reimbursed to the agency after submitting, the documentary proof of payment. Nothing extra shall be paid on this account in this regard.

24 Façade Work:

Planning, Designing and Providing of Facade Work: The front elevation of the Food court building, Information centre and Souviner shop building shall be covered by Structural Glazing system suitably designed. The side elevations and back side elevations of these buildings shall be the combination of ACP, AAC block masonry wall with texture paint 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.

a) Scope of the work:

- i) 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.
- ii) 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.
- iii) 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.
- iv) 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.

- v) 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.
- vi) 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.
- vii) 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.
- viii) 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.
- ix) 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.
- x) 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.

b) Façade System Description

- i) The contractor shall devise a suitable framing system for vertical/roof façade application keeping in view the performance characteristics and aesthetics requirements.
- ii) 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.
- iii) 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.

- iv) 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.
- v) 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.
- vi) 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.
- vii) 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).

c) 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.

- a. Movement within the system
- b. Movement between system and perimeter framing components.
- c. Dynamic loading and release of loads
- d. Deflection of structural support framing
- e. Tolerance of supporting components
- f. Shortening of building concrete structural columns
- g. Creep of concrete structural members
- h. Inter story drift
- i. A mid span slab edge deflection: of 25mm
- j. 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 / mm² and a maximum of 575 N / mm². The minimum uniform water flow rate of 3.4L/rn²/min.

d) 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.

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

- (i) **STANDARD:** - AAMA 501.2 — 94 Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage.
- (ii) **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.
- (iii) **EQUIPMENT:** - Testing equipment generally consists of the following and any other equipment 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.

- f) **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.
- g) **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.
- h) **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.

- i) **Test for structural performance:** When tested in accordance with; ASTM E330, the glazing system shall conform to the performance requirements.
- j) **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.
- k) **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.

l) **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.

- e) Glazing unit for façade of roof shall be: 8mm clear fully tempered glass + 1.52mm PVB + 8mm clear fully tempered glass.
 - f) Single glazed unit in façade, shall be 8 mm thick clear heat strengthened glass having following properties:
 - g) 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/ Profile 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.
 - h) 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.
 - i) 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) **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 modules 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.

(vii) 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 aluminium extrusions shall be coated with minimum 70% Kynar 500 based PVDF fluoropolymer resin coating (minimum 35micron thick) of approved colour 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.

(viii) 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 aluminium 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.

(ix) **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.

(x) **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.

(xi) **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.

m) **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.

n) 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.

o) 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.

p) 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.

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

r) 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.

- s) **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
- t) **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
- u) **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. Mock-up shall have to be approved by engineer-in-charge before placing final order for delivery of the approved products.
- v) **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.
- w) **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.
- x) **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.
- y) **PROTECTION:**

- i) 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.
- ii) 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.
- iii) 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.
- iv) 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.
- v) 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.
- vi) The fixing method for sheets is to be indicated in shop drawings and a sample approved by the Engineer-in-charge.

z) CLEANING

- i) 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.
- ii) 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.

- iii) 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.
 - iv) 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.
 - v) 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.
 - vi) 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.
 - vii) 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.
 - viii) 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.
 - ix) 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
- aa) 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.
- bb) 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.
- cc) 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:

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

25. Acoustical 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 up to 95% at 30⁰ C without sagging/warping or delaminating. Product shall be certified under GRIHA or IGBC/LEED.

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 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.

- 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.
- 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.
- 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 $\geq 400\text{kg/m}^3$) 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.
- 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.
- 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. 20MM ROCK FIBER ACOUSTICAL FALSE CEILING (BIO-SAFE):** Providing and fixing Rock Fiber (Bio-Safe) Acoustical (NRC 0.9- 0.95) Micro Look Edge False Ceiling Tile of size 595X595X20 mm of approved texture, design and pattern. Rock Wool Tile should have Acoustical Tissue Paper on the top face and Harden edge to achieve NRC up to 0.95 as per ASTM C423/ISO 354. The tiles should have Anti-Bacterial coating & Passed the Test Method as per JIS Z 2801: 2010, Should passed resistance to fungal attack test as per ASTM: G21-15. Relative Humidity (RH) more than 85%, Fire Performance as per Vertical flammability test (UL94) Classification V1 (Flame extinguishes within 30 seconds with no dripping) in true horizontal level suspended on interlocking T-Grid of hot dipped all round galvanized iron section of 0.30 mm thick (galvanized @120 GSM) comprising of main T runners of 15x32 mm (Centre Black) of length 3000 mm, cross T of size 15x32mm (Centre Black) of length 1200 mm and secondary intermediate cross T of size 15x32 mm (Centre Black) 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 dashfasteners, 4mm diameter fully threaded hanger rod up to 1000 mm length and L-shape level adjuster of size 85x25x2 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 22x19x3000 mm made of 0.40 mm thick sheet, to be fixed to the wall with help of plastic raw l plug at 450 mm centre to centre & 40 mm long dry wall S.S. screws. 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. (Supplier Company should be OEM and OEM Test Certificates will be required from contractor). The work shall be carried out as per specifications, drawings and as per directions of the Engineer-In-Charge.

25.9. Fabric Acoustical Wall Paneling (0.9NRC): Providing and fixing of Fabric Acoustical Wall Paneling with square edges made of Rockwool with Glass-wool Tissue substrate 25mm thick and wrapped on the front side with an acoustically transparent and fire-resistant fabric with an option of colors as per the choice of the Architect/ Engineering- in charge of size 600x1200 or 600x600 mm providing a minimum sound absorption level of 0.90 NRC. The GI Metal system includes G.I Stud having Size 48 mm X 36 mm X 34 mm X 0.50mm, length 3600mm, and Floor Channel Size 50 mm X 32 mm X 32 mm X 0.50 mm, length 3600 mm is fastener vertically/ horizontally at every 600mm filled with 50mm 1000 GSM nonwoven thermal bonded polyester wadding. Then 8 mm HDMR perforated Board should be Screwed to the GI frame with the help of 25X 6 mm metal screw for pasting of 25mm thick fabric acoustical panel with the help of rubber base Adhesive as per drawing and design of Engineer-in Charge. (Original equipment manufacturer MTC along with NRC certificate would be required at the time of installation)

25.10. 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 $\geq$ 0.80

Coating insulant - R 0.03 per mm (W/m²·K)

Minimum Thickness: 6mm

(ii) Other parameters

Bond strength : > 600 psf

Compression strength : > 400 psf

26.0 Planning, Designing and Execution of Horticulture & Landscape Works: Contractor shall furnish all materials, labour and related terms necessary to complete the works as indicated in drawings approved by engineer in charge 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:
 - 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:
 - 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 x0.15m 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 x0.6m 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 '1'

FINISHING SCHEDULE, DOOR AND WINDOW SCHEDULE, HARDWARE SCHEDULE

SCHEDULE OF FINISHING
MAIN ENTRANCE GATE

Structure shall be RCC framed structure. The columns and fascia of the roof slab shall be cladded in ACP. The side walls on the both side to entrance gate shall be finished in combination of ACP and Texture Paint.

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
1	ENTRY / EXIT LANE AREA	80MM THICK MULTICOLOR RETRO-REFLECTIVE CEMENT CONCRETE PAVER BLOCKS	CLADDING WITH COMBINATION OF ACP AND TEXTURE PAINT	BAFFLE TYPE METAL FALSE CEILING
2	CAMPUS CONTROL ROOM	10 MM THICK FULL BODY GLAZED VITRIFIED TILE VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED DESIGN. (SIZE OF TILE TO BE 600MM X 600MM MINIMUM)	FULL BODY GLAZED VITRIFIED TILE. SKIRTING WITH 12MM THICK PREMIXED GYPSUM PLASTER 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	CCTV MONITORING ROOM	10 MM THICK FULL BODY GLAZED VITRIFIED TILE VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED DESIGN. (SIZE OF TILE TO BE 600MM X 600MM MINIMUM)	FULL BODY GLAZED VITRIFIED TILE. SKIRTING WITH 12MM THICK PREMIXED GYPSUM PLASTER 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	MANAGER CABIN	10 MM THICK FULL BODY GLAZED VITRIFIED TILE VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED DESIGN. (SIZE OF TILE TO BE 600MM X 600MM MINIMUM)	FULL BODY GLAZED VITRIFIED TILE. SKIRTING WITH 12MM THICK PREMIXED GYPSUM PLASTER 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	TRAFFIC & POLICE ASSISTANCE ROOM	10 MM THICK FULL BODY GLAZED VITRIFIED TILE VITRIFIED TILES WITH 3MM SPACER	FULL BODY GLAZED VITRIFIED TILE. SKIRTING WITH 12MM THICK PREMIXED GYPSUM PLASTER AND	CALCIUM SILICATE TILES 600MM X 600MM. TILES TO REMAIN UNCUT. PERIPHERAL AREAS

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
		AS PER APPROVED DESIGN. (SIZE OF TILE TO BE 600MM X 600MM MINIMUM)	PLASTIC EMULSION PAINT ABOVE SKIRTING.	TO HAVE JOINTLESS CALCIUM SILICATE BOARD FALSE CEILING WITH PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS.
5	MONITORING ROOMS (8 NO.S)	10 MM THICK FULL BODY GLAZED VITRIFIED TILE WITH 3MM SPACER AS PER APPROVED DESIGN. (SIZE OF TILE TO BE 600MM X 600MM MINIMUM)	FULL BODY GLAZED VITRIFIED TILE. SKIRTING WITH 12MM THICK PREMIXED GYPSUM PLASTER 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.
6	TOILET	10MM THICK MATT ANTI-SKID VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED DESIGN. (SIZE OF TILE TO BE 600MM X 600MM MINIMUM)	GLAZED VITRIFIED TILES OF SIZE 1200MM X 600MM UPTO FALSE CEILING HEIGHT AS PER APPROVED DESIGN AND SHADES.	GI METAL FALSE CEILING LAY IN PLAIN TEGULAR EDGE GLOBAL WHITE COLOUR TILES OF SIZE 595X595 MM AS PER CPWD SPECIFICATIONS.

Other important notes on finishes:

1. 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 as approved by engineer-in-charge.
3. Glazed vitrified tiles whether glossy or matt shall be as per approval and approved detailed engineering drawings.
4. Min. Thickness of putty, wherever mentioned, shall be 2mm.
5. Skirting shall be flushed with dado.
6. Unless otherwise specified, height of skirting shall be 150 mm and min. Height of dado shall be 1200 mm above skirting.
7. Unless otherwise specified, skirting shall be made in the same material as the flooring.
8. 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.
9. All exposed structural steel members shall be covered with fire retardant paint to ensure 2 hours fire protection.
10. All public areas are required to be universally accessible and wherever required as per accessible guidelines, tactile studs and strips shall be provided in flooring.
11. Counter in toilets shall be polished, bevelled and edge moulded 18 mm thick granite of approved shade.
12. All sill, lintel and jambs shall be in 18mm thick granite with half/full round edge moulding as per approved design.
13. All electrical distribution boards shall be wall recessed in a niche and covered with an aesthetic enclosure.
14. The above finishing items shall be executed strictly as per specifications of respective items mentioned in CPWD specifications.

**SCHEDULE OF FINISHING
SOUVENIR SHOP AND INFORMATION CENTRE**

Structure shall be RCC framed structure. The columns shall be cladded in ACP. The front elevation of the Information centre and Souviner shop building shall be covered by Structural Glazing system with double glass unit (6mm + 12mm + 6mm) suitably designed for U-value of glass. The side elevations and back side elevations of this building shall be in the combination of AAC block masonry wall, finished with ACP cladding and texture paint. The facia of the roof slab shall be cladded in ACP.

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
1	ENTRY & EXIT STEPS, ACCESSIBLE RAMP	18MM THICK LEATHER FINISH GRANITE FLOORING WITH 3MM SPACER. MINIMUM SIZE & WIDTH OF STONE SHALL NOT LESS THAN 750MM	LEATHER FINISH GRANITE SKIRTING	NA
2	SOUVENIR SHOP	18MM THICK PRE-POLISHED GRANITE FLOORING WITH 3MM SPACER. MINIMUM SIZE & WIDTH OF STONE SHALL NOT LESS THAN 750MM AS PER APPROVED DESIGN PATTERN AND SPECIFICATIIONS BY ENGINEER-IN-CHARGE.	PRE-POLISHED GRANITE STONE SKIRTING WITH 12MM THICK PREMIXED GYPSUM PLASTER AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	CALCIUM SILICATE/GRG tiles of size 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	OFFICE AREA WITH MEETING TABLES	10 MM THICK FULL BODY GLAZED VITRIFIED TILE VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED DESIGN. (SIZE OF TILE TO BE 600MM X 1200MM MINIMUM)	FULL BODY GLAZED VITRIFIED TILE. SKIRTING WITH 12MM THICK PREMIXED GYPSUM PLASTER 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	MANAGER CABIN	10 MM THICK FULL BODY GLAZED VITRIFIED TILE VITRIFIED TILES WITH 3MM SPACER AS PER APPROVED DESIGN. (SIZE OF TILE TO BE 600MM X 1200MM MINIMUM)	FULL BODY GLAZED VITRIFIED TILE. SKIRTING WITH 12MM THICK PREMIXED GYPSUM PLASTER 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
				PAINT OVER PUTTY AS PER SPECIFICATIONS.
5	INFORMATION DESK AREA	10 MM THICK FULL BODY GLAZED VITRIFIED TILE WITH 3MM SPACER AS PER APPROVED DESIGN. (SIZE OF TILE TO BE 600MM X 1200MM MINIMUM)	FULL BODY GLAZED VITRIFIED TILE. SKIRTING WITH 12MM THICK PREMIXED GYPSUM PLASTER 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.

Other important notes on finishes:

1. 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 as approved by engineer-in-charge.
3. Glazed vitrified tiles whether glossy or matt shall be as per approval and approved detailed engineering drawings.
4. Min. Thickness of putty, wherever mentioned, shall be 2mm.
5. Skirting shall be flushed with dado.
6. Unless otherwise specified, height of skirting shall be 150 mm and min. Height of dado shall be 1200 mm above skirting.
7. Unless otherwise specified, skirting shall be made in the same material as the flooring.
8. 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.
9. All exposed structural steel members shall be covered with fire retardant paint to ensure 2 hour fire protection.
10. All public areas are required to be universally accessible and wherever required as per accessible guidelines, tactile studs and strips shall be provided in flooring.
11. Counter in toilets shall be polished, bevelled and edge moulded 18 mm thick granite of approved shade.
12. All sill, lintel and jambs shall be in 18mm thick granite with half/full round edge moulding as per approved design.
13. All electrical distribution boards shall be wall recessed in a niche and covered with an aesthetic enclosure.

SCHEDULE '2C'**SCHEDULE OF FINISHING
FOOD COURT**

Structure shall be RCC framed structure. The columns shall be cladded in ACP. The front elevation of the Food Court building shall be covered by Structural Glazing system with double glass unit (6mm + 12mm + 6mm) suitably designed for U-value of glass. The side elevations and back side elevations of this building shall be in the combination of AAC block masonry wall, finished with ACP cladding and texture paint. The facia of the roof slab shall be cladded in ACP.

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
1	ENTRY & EXIT STEPS, ACCESSIBLE RAMP & FOYER INCL. TOILET LOBBY	18MM THICK LEATHER FINISH GRANITE FLOORING WITH 3MM SPACER. MINIMUM SIZE & WIDTH OF STONE SHALL BE 750MM.	LEATHER FINISH GRANITE SKIRTING	NA
2	FOOD COURT INCLUDING SEATING REA – GROUND & FIRST FLOOR	18MM THICK PRE-POLISHED GRANITE FLOORING WITH 3MM SPACER. MINIMUM SIZE & WIDTH OF STONE SHALL BE 750MM AS PER APPROVED DESIGN PATTERN AND SPECIFICATIONS.	PRE-POLISHED GRANITE STONE SKIRTING WITH 12MM THICK PREMIXED GYPSUM PLASTER AND PLASTIC EMULSION PAINT ABOVE SKIRTING.	DESIGNED MULTI LEVEL FALSE CEILING IN COMBINATION OF: BAMBOO MAT 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
3	OUTLETS INCLUDING KITCHEN	25MM THICK, 550X550MM PRE-POLISHED KOTA STONE FLOORING	KOTA STONE SKIRTING AND 12MM THICK PREMIXED GYPSUM PLASTER AND PLASTIC EMULSION PAINT ABOVE SKIRTING	PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS ON CEILING SLAB
4	ELECTRICAL, AHU, UTILITY ROOMS	25MM THICK, 550X550MM PRE-POLISHED KOTA STONE FLOORING	KOTA STONE SKIRTING AND 12MM THICK PREMIXED GYPSUM PLASTER AND PLASTIC EMULSION PAINT ABOVE SKIRTING	PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS ON CEILING SLAB
5	INTERNAL STAIRCASES	18MM THICK LEATHER FINISH GRANITE FLOORING WITH 3MM SPACER.	LEATHER FINISH GRANITE SKIRTING	SOFFIT: PLASTIC EMULSION PAINT OVER PUTTY AS PER

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
		(SINGLE LENGTH JOINT FREE X TREAD WIDTH) WITH HALF ROUND NOSING AND 4 NOS. STAINLESS STEEL INSERTS		SPECIFICATIONS
6	GENTS, LADIES & ACCESSIBLE TOILETS	18MM THICK LEATHER FINISH GRANITE FLOORING WITH 3MM SPACER. MINIMUM SIZE & WIDTH OF STONE SHALL BE 750MM, STONE SIZE AS PER APPROVED DESIGN PATTERN AND SPECIFICATIONS.	GLAZED VITRIFIED TILES OF SIZE 1200MM x 600MM UPTO FALSE CEILING HEIGHT AS PER APPROVED DESIGN AND SHADES.	GI METAL CEILING LAY IN PLAIN REGULAR EDGE GLOBAL WHITE COLOUR TILES OF SIZE 595X595 MM AS PER CPWD SPECIFICATIONS.
7	JANITOR ROOM	25MM THICK, 550X550MM PRE-POLISHED KOTA STONE FLOORING	KOTA STONE SKIRTING AND 12MM THICK PREMIXED GYPSUM PLASTER AND PLASTIC EMULSION PAINT ABOVE SKIRTING	PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS ON CEILING SLAB
8	SERVICE AREA, PLATE COLLECTION, DISH WASHING	25MM THICK, 550X550MM PRE-POLISHED KOTA STONE FLOORING	KOTA STONE SKIRTING AND 12MM THICK PREMIXED GYPSUM PLASTER AND PLASTIC EMULSION PAINT ABOVE SKIRTING	PLASTIC EMULSION PAINT OVER PUTTY AS PER SPECIFICATIONS ON CEILING SLAB
9	OPEN TERRACE AT 1 st FLOOR (GROUND FLOOR ROOF SLAB)	18MM THICK LEATHER FINISH GRANITE FLOORING WITH 3MM SPACER. MINIMUM SIZE & WIDTH OF STONE SHALL BE 750MM.	LEATHER FINISH GRANITE SKIRTING	THE CEILING OF OPEN TERRACE AT 1 st FLOOR SHALL BE COVERED WITH AWNING
10	SERVICE PLATFORM	25MM THICK, 550X550MM PRE-POLISHED KOTA STONE FLOORING	KOTA STONE SKIRTING	NA
11	LOADING UNLOADING AREA	80MM THICK RETRO-REFLECTIVE INTERLOCKING CEMENT CONCRETE PAVER TILES/ BLOCKS OF GRADE M-40	NA	NA

Other important notes on finishes:

1. 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 as approved by engineer-in-charge.
3. Glazed vitrified tiles whether glossy or matt shall be as per approval and approved detailed engineering drawings.
4. Min. Thickness of putty, wherever mentioned, shall be 2mm.
5. Skirting shall be flushed with dado.

6. Unless otherwise specified, height of skirting shall be 150 mm and min. Height of dado shall be 1200 mm above skirting.
7. Unless otherwise specified, skirting shall be made in the same material as the flooring.
8. 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.
9. All exposed structural steel members shall be covered with fire retardant paint to ensure 2 hour fire protection.
10. All public areas are required to be universally accessible and wherever required as per accessible guidelines, tactile studs and strips shall be provided in flooring.
11. Counter in toilets shall be polished, bevelled and edge moulded 18 mm thick granite of approved shade.
12. All sill, lintel and jambs shall be in 18mm thick granite with half/full round edge moulding as per approved design.
13. All electrical distribution boards shall be wall recessed in a niche and covered with an aesthetic enclosure

SCHEDULE OF FINISHING**ENTRY FORE COURT**

Structure shall be RCC framed structure. The columns shall be cladded in ACP. The side elevations and back side elevations of this area shall be in the combination of AAC block masonry wall, finished with ACP cladding and texture paint. The facia of the roof slab shall be cladded in ACP.

S. N.	DESCRIPTION	FLOOR	SKIRTING/WALLS/DADO	CEILING
1	ENTRY FORE COURT & EXIT RAMP	80MM THICK MULTICOLOUR/ RETRO- REFLECTIVE CEMENT CONCRETE PAVER TILES/BLOCKS LAID TO PATTERN AS PER APPROVAL OF GRADE M-40	NA	BAFFLE TYPE METAL FALSE CEILING
2	CLOAK ROOM	18MM THICK PRE-POLISHED GRANITE FLOORING WITH 3MM SPACER. MINIMUM SIZE & WIDTH OF STONE SHALL BE 750MM, SPACE PERMITS AS PER APPROVED DESIGN PATTERN AND SPECIFICATIONS.	WALL DADO WITH GRANITE STONE WITH TOP AND NOSE DULY ROUNDED UPTO 900 MM. ABOVE 900MM: 12MM THICK PREMIXED GYPSUM PLASTER 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.

Other important notes on finishes:

1. 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 as approved by engineer-in-charge.
3. Glazed vitrified tiles whether glossy or matt shall be as per approval and approved detailed engineering drawings.
4. Min. Thickness of putty, wherever mentioned, shall be 2mm.
5. Skirting shall be flushed with dado.
6. Unless otherwise specified, height of skirting shall be 150 mm and min. Height of dado shall be 1200 mm above skirting.
7. Unless otherwise specified, skirting shall be made in the same material as the flooring.
8. 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.
9. All exposed structural steel members shall be covered with fire retardant paint to ensure 2 hour fire protection.
10. All public areas are required to be universally accessible and wherever required as per accessible guidelines, tactile studs and strips shall be provided in flooring.
11. Counter in toilets shall be polished, bevelled and edge moulded 18 mm thick granite of approved shade.
12. All sill, lintel and jambs shall be in 18mm thick granite with half/full round edge moulding as per approved design.
13. All electrical distribution boards shall be wall recessed in a niche and covered with an aesthetic enclosure

RAILING AND PARAPET SCHEDULE

S.N.	Location	Description of item/ Brief Specification
1	INFORMATION CENTER & SOUVENIR SHOP	RAMP WITH RAILING: STAINLESS STEEL RAILING WITH DOUBLE HANDRAIL OF STAINLESS STEEL 316 GRADE STAINLESS STEEL OF DOUBLE HANDRAIL WITH 50 MM DIA. OF 18 GAUGE, 1100 MM HEIGHT WITH ADEQUATE RODS PARALLEL TO HANDRAIL, BALUSTERS, FLANGES, END CAPS, NEWEL POSTS WITH CAPS ETC. COMPLETE AS PER GUIDELINES FOR BARRIER FREE AND ACCESSIBILITY.
2	FOOD COURT	STAIRCASE RAILING: STAINLESS STEEL RAILING WITH STAINLESS STEEL 316 GRADE STAINLESS STEEL OF 50 MM DIA. OF 18 GAUGE, 1100 MM HEIGHT WITH ADEQUATE RODS PARALLEL TO HANDRAIL, BALUSTERS, FLANGES, END CAPS, NEWEL POSTS WITH CAPS ETC. COMPLETE AS PER GUIDELINES FOR BARRIER FREE AND ACCESSIBILITY RAMP RAILING: STAINLESS STEEL RAILING WITH DOUBLE HANDRAIL OF SS 316 GRADE STAINLESS STEEL OF 50 MM DIA. OF 18 GAUGE, 1100 MM HEIGHT WITH ADEQUATE RODS PARALLEL TO HANDRAIL, BALUSTERS, FLANGES, END CAPS, NEWEL POSTS WITH CAPS ETC. COMPLETE AS PER GUIDELINES FOR BARRIER FREE AND ACCESSIBILITY

Notes:

1. Stainless steel railing shall be provided considering the requirement for the differentially abled personnels (wherever required) as per the standards.
2. Surface finish of all the stainless-steel materials will be in 240 grit satin finish / matt finish.
3. All stainless-steel material will have to be coated by a solution of inox to avoid finger imprints and avoidance of settlement of environment / atmospheric dust.
4. 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.
5. 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.

DOOR & WINDOW SCHEDULE – MAIN ENTRANCE GATE

TAG	LOCATION	WIDTH (R.O)	SILL (R.O)	LINTEL (R.O)	REMARKS
MS GATE					
G01	MAIN GATES (9 NOS.)	3600	0	2400	SWING GATE MADE OF STAINLESS OF STEEL (GARDE SS 316) WITH COMBINATION OF SS TUBE AND HPL PLANKS/ SHEET
METAL DOOR					
D01	TRAFFIC & POLICE ASSISTANCE ROOM, CAMPUS CONTROL ROOM	1250	0	2450	BOTH SIDE 1MM THICK PRELAMINATED FACTORY FINISHED 35MM THICK WOODEN FLUSH DOOR SHUTTER AND 2 ND CLASS TEAK WOOD FRAME
D05	MONITORING ROOMS	750	0	2150	BOTH SIDE 1MM THICK PRELAMINATED FACTORY FINISHED 35MM THICK WOODEN FLUSH DOOR SHUTTER AND 2 ND CLASS TEAK WOOD FRAME
WOODEN DOOR					
D02	MANAGER, CCTV MONITORING ROOM	950	0	2450	BOTH SIDE 1MM THICK PRELAMINATED FACTORY FINISHED 35MM THICK WOODEN FLUSH DOOR SHUTTER AND 2 ND CLASS TEAK WOOD FRAME
D03	TOILET	950	0	2450	WPC DOOR FRAME AND 35 MM THICK WPC (WOOD POLYMER COMPOSITE) SOLID PLAIN FLUSH DOOR SHUTTER
D04	TOILETS (WC CUBICLES)	750	200	2000	CUBICLES
WINDOWS					
W01	TRAFFIC & POLICE ASSISTANCE ROOM	5900	850	2450	MOULDED GRANITE FRAME ON ALL FOUR SIDES WITH UPVC SLIDING WINDOWS WITH DGU (6+12+6) MM THICK GLASS
W02	TRAFFIC & POLICE ASSISTANCE ROOM	1550	1150	2450	MOULDED GRANITE FRAME ON ALL FOUR SIDES WITH 12MM THICK

					TOUGHENED GLASS WITH NECESSARY HOLES AND FITTINGS
W03	CAMPUS CONTROL ROOM	3050	850	2450	MOULDED GRANITE FRAME ON ALL FOUR SIDES WITH UPVC SLIDING WINDOWS WITH DGU (6+12+6) MM THICK GLASS
W04	MONITORING ROOMS	1650	1150	2450	MOULDED GRANITE FRAME ON ALL FOUR SIDES WITH 12MM THICK TOUGHENED GLASS WITH NECESSARY HOLES AND FITTINGS

Note: Any additional doors and windows as required as a result of the detailed engineering shall be provided in line with the guidelines laid in this Bid document and as per NBCS 2026. The above size are tentative and minimum and may change as per site requirement during execution of work. The decision of Engineer-in-charge shall be final and binding in this regard.

HARDWARE SCHEDULE FOR DOOR & WINDOWS - MAIN ENTRANCE GATE

HARDWARE	D01	D02	D03	D04	D05
VISION PANEL	N	N	N	N	N
DOUBLE BALL BEARING HINGES	Y	Y	Y	Y	Y
DOOR CLOSER	N	Y	Y	N	N
DOOR LOCK	Y	Y	Y	Y	Y
DOOR HANDLE (PAIR)	Y	Y	Y	Y	Y
FLUSH BOLT	Y	Y	N	N	Y
FLOOR SOCKET	N	N	N	N	N
DOOR STOPPER	Y	Y	Y	N	Y
DOOR BOTTOM SEAL	N	N	N	N	N
DELTA SEAL	N	N	N	N	N
PUSH PLATE	N	N	N	Y	N
SIGN PLATE	Y	Y	Y	Y	N

NOTE: 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.

The hardware of fire check/rated doors and windows shall also be fire rated. They shall be either UL or CE certified.

Hardware shown with annotation/markings 'Y' against particular door type in hardware schedule shall be provided. Hardware shown with annotation/markings 'N' against particular door type in hardware schedule shall not be provided. However, if required (as per NBCS 2026 or other standards or for functionality), contractor shall provide the hardware shown with annotation/markings '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.

**DOOR & WINDOW SCHEDULE –
INFORMATION CENTER & SOUVENIR SHOP**

TAG	LOCATION	WIDTH (R.O)	SILL (R.O)	LINTEL (R.O)	REMARKS
ALUMINIUM GLAZED DOOR					
D01	ENTRY/ EXIT	2450	0	2450	FULLY GLAZED DOOR ASSEMBLY WITH ALUMINIUM DOOR SHUTTER WITH 12MM THICK TOUGHENED GLASS.
D02	OFFICE AREA WITH MEETING TABLES	1550	0	2450	FULLY GLAZED DOOR ASSEMBLY WITH ALUMINIUM DOOR SHUTTER WITH 12MM THICK TOUGHENED GLASS.
D03	INFORMATION DESK AREA, MANAGER ROOM	1550	0	2450	FULLY GLAZED DOOR ASSEMBLY WITH ALUMINIUM DOOR SHUTTER WITH 12MM THICK TOUGHENED GLASS.
GLAZING					
GL1	SOUVENIR SHOP	28500	150	4050	GLAZED CURTAIN WALL
WINDOWS					
W01	TICKETING OFFICE	1100	1150	2450	MOULDED GRANITE FRAME ON ALL FOUR SIDES WITH 12MM THICK TOUGHENED GLASS WITH NECESSARY HOLES AND FITTINGS

NOTE: Any additional doors and windows as required as a result of the detailed engineering shall be provided in line with the guidelines laid in this Bid document and as per NBCS 2026. The above size are tentative and minimum and may change as per site requirement during execution of work. The decision of Engineer-in-charge shall be final and binding in this regard

HARDWARE SCHEDULE FOR DOOR & WINDOWS – INFORMATION CENTER & SOUVENIR SHOP

HARDWARE	D01	D02	D03
VISION PANEL	Y	Y	Y
DOUBLE BALL BEARING HINGES	Y	Y	Y
DOOR CLOSER	Y	Y	N
GRAVITY COORDINATOR	N	Y	N
DOOR LOCK	Y	Y	Y
DOOR HANDLE (PAIR)	Y	Y	Y
FLUSH BOLT	N	N	N
FLOOR SOCKET	N	N	N
DOOR STOPPER	N	Y	Y
DOOR BOTTOM SEAL	N	N	N
DELTA SEAL	N	N	N
PUSH PLATE	N	N	N
SIGN PLATE	Y	Y	Y

NOTE: 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.

The hardware of fire check/rated doors and windows shall also be fire rated. They shall be either UL or CE certified.

Hardware shown with annotation/markings 'Y' against particular door type in hardware schedule shall be provided. Hardware shown with annotation/markings 'N' against particular door type in hardware schedule shall not be provided. However, if required (as per NBCS 2026 or other standards or for functionality), contractor shall provide the hardware shown with annotation/markings '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.

DOOR & WINDOW SCHEDULE – FOOD COURT

TAG	LOCATION	WIDTH (R.O)	SILL (R.O)	LINTEL (R.O)	REMARKS
ALUMINIUM GLAZED DOOR					
D01	FOOD COURT ENTRY/ EXIT	3050	0	2450	FULLY GLAZED DOOR ASSEMBLY WITH ALUMINIUM DOOR SHUTTER WITH 12MM THICK TOUGHENED GLASS.
METAL DOOR					
D02	OUTLETS INCLUDING KITCHEN	1050	0	2450	STANDARD DUTY HOLLOW METAL DOORS CONFIRMING TO IS 16074 & IS 4351 MADE OF PRESSED GALVANIZED STEEL WITH VISION PANEL
D07	SERVICE AREA, PLATE COLLECTION	2050	0	2450	STANDARD DUTY HOLLOW METAL DOORS CONFIRMING TO IS 16074 & IS 4351 MADE OF PRESSED GALVANIZED STEEL WITH VISION PANEL
FHC	FHC	1050	0	2450	STANDARD DUTY HOLLOW METAL DOORS CONFIRMING TO IS 16074 & IS 4351 MADE OF PRESSED GALVANIZED STEEL WITH VISION PANEL
WOODEN DOOR					
D03	GENTS & LADIES TOILETS	1250	0	2450	WPC DOOR FRAME AND 35 MM THICK WPC (WOOD POLYMER COMPOSITE) SOLID PLAIN FLUSH DOOR SHUTTER
D04	ACCESSIBLE TOILETS	1250	0	2450	WPC DOOR FRAME AND 35 MM THICK WPC (WOOD POLYMER COMPOSITE) SOLID PLAIN FLUSH DOOR SHUTTER WITH SLIDING ARRANGEMENT
D05	JANITOR ROOM	800	0	2450	BOTH SIDE 1MM THICK PRELAMINATED FACTORY FINISHED 35MM THICK WOODEN FLUSH DOOR SHUTTER AND 2 nd CLASS TEAK WOOD FRAME
D06	TOILETS (WC CUBICLES)	750	200	2000	CUBICLES
FIRE CHECK DOOR					
FD1	ELECTRICAL, AHU, UTILITY ROOMS	1550	0	2450	PROVIDING AND FIXING OF ISI MARKED MEDIUM DUTY

					HOLLOW METAL FIRE RATED DOORS AS PER IS 3614: 2021 WITH VISION PANEL
GLAZING					
GL1	GROUND FLOOR	73000	150	2450	GLAZED CURTAIN WALL
GL2	FIRST FLOOR	222800	150	2450	GLAZED CURTAIN WALL

NOTE: Any additional doors and windows as required as a result of the detailed engineering shall be provided in line with the guidelines laid in this Bid document and as per NBCS 2026. The above size are tentative and minimum and may change as per site requirement during execution of work. The decision of Engineer-in-charge shall be final and binding in this regard.

HARDWARE SCHEDULE FOR DOOR & WINDOWS – FOOD COURT

HARDWARE	FD1
VISION PANEL	Y
DOUBLE BALL BEARING HINGES	Y
DOOR CLOSER	Y
GRAVITY COORDINATOR	Y
DOOR LOCK	Y
DOOR HANDLE	Y
PANIC BAR	N
FLUSH BOLT	Y
FLOOR SOCKET	N
DOOR STOPPER	Y
DOOR BOTTOM SEAL	Y
DELTA SEAL	Y

HARDWARE	D01	D02	D03	D04	D05	D07
VISION PANEL	Y	Y	Y	N	N	Y
DOUBLE BALL BEARING HINGES	Y	Y	Y	Y	Y	Y
DOOR CLOSER	Y	Y	Y	Y	Y	Y
GRAVITY COORDINATOR	Y	N	N	N	N	Y
DOOR LOCK	Y	Y	Y	Y	Y	Y
DOOR HANDLE(PAIR)	Y	Y	Y	Y	Y	Y
FLUSH BOLT	Y	Y	N	Y	N	Y
FLOOR SOCKET	Y	N	N	N	N	N
DOOR STOPPER	N	Y	N	N	N	Y
DOOR BOTTOM SEAL	N	N	N	N	N	N
DELTA SEAL	N	N	N	N	N	N
PUSH PLATE	Y	N	N	Y	N	Y
SIGN PLATE	Y	Y	Y	Y	Y	Y

NOTE:

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.

The hardware of fire check/rated doors and windows shall also be fire rated. They shall be either ul or ce certified.

Hardware shown with annotation/markings 'Y' against particular door type in hardware schedule shall be provided. Hardware shown with annotation/markings 'N' against particular door type in hardware schedule shall not be provided. However, if required (as per NBCS 2026 or other standards or for functionality), contractor shall provide the hardware shown with annotation/markings '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 '5D'**DOOR & WINDOW SCHEDULE – ENTRY FORE COURT**

TAG	LOCATION	WIDTH (R.O)	SILL (R.O)	LINTEL (R.O)	REMARKS
METAL DOOR					
D01	CLOAK ROOM	1250	0	2450	STANDARD DUTY HOLLOW METAL DOORS CONFIRMING TO IS 16074 & IS 4351 MADE OF PRESSED GALVANIZED STEEL WITH VISION PANEL
WINDOW					
W01	CLOAK ROOM COLLECTION	1800	1150	2450	MOULDED GRANITE ON ALL FOUR SIDES WITH 12MM THICK TOUGHENED GLASS WITH NECESSARY HOLES AND FITTINGS
MS GATE					
G01	ENTRY GATE (14 NOS.)	AS PER SITE REQUIREMENT			AUTOMATED FLAP BARRIER SYSTEM
G02	EXIT GATE	AS PER SITE REQUIREMENT			S.S. TURNSTIE REVOLVING DOOR WITH COUNTING SYSTEM.

NOTE: Any additional doors and windows as required as a result of the detailed engineering shall be provided in line with the guidelines laid in this Bid document and as per NBCS 2026. The above size are tentative and minimum and may change as per site requirement during execution of work. The decision of Engineer-in-charge shall be final and binding in this regard

HARDWARE SCHEDULE FOR DOOR & WINDOWS – ENTRY FORE COURT

HARDWARE	D01		
VISION PANEL	Y		
BUTT HINGES	Y		
DOOR CLOSER	Y		
GRAVITY COORDINATOR	N		
DOOR LOCK	Y		
DOOR HANDLE	Y		
PANIC BAR	N		
FLUSH BOLT	Y		
FLOOR SOCKET	N		
DOOR STOPPER (HALF DOME)	Y		
DOOR BOTTOM SEAL	N		
DELTA SEAL	N		
PUSH PLATE	Y		
SIGN PLATE	Y		

NOTE:

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.

The hardware of fire check/rated doors and windows shall also be fire rated. They shall be either ul or ce certified.

Hardware shown with annotation/markings 'Y' against particular door type in hardware schedule shall be provided. Hardware shown with annotation/markings 'N' against particular door type in hardware schedule shall not be provided. However, if required (as per NBCS 2026 or other standards or for functionality), contractor shall provide the hardware shown with annotation/markings '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 OF PLUMBING FIXTURES & FITTINGS

S. N.	ITEM	DESCRIPTION	FINISH
I	WASHROOMS / TOILETS		
A	BASIN AREA		
1	BASIN FAUCET	PRESSMATIC WALL MOUNTED BASIN TAP (AUTO CLOSING) WITH WALL FLANGE (SQUARE)	CHROME
2	BOTTLE TRAP	BOTTLE TRAP (WITH INTERNAL PARTITION) 32MM SIZE WITH 300MM & 190MM LONG WALL CONNECTION PIPES & WALL FLANGE	CHROME
4	CLICK WASTE	CLICK CLACK WASTE 32MM SIZE HALF THREAD WITH 80MM/ 130MM HEIGHT	CHROME
5	BRAIDED HOSE	600MM LONG BRAIDED HOSE WITH M10X1 NIPPLE, 15MM NUT, O-RING & RUBBER WASHER	CHROME
6	ANGULAR STOP COCK	ANGULAR STOP COCK WITH WALL FLANGE	CHROME
7	BASIN	TABLE TOP BASIN, SIZE: 700 X 435 X 135MM	WHITE
8	AUTOMATIC SOAP DISPENSER	SOAP DISPENSER	SS
9	HAND DRIER PANEL	(HAND DRYER + TISSUE DISPENSER + WASTE RECEPTACLE)	SS
B	URINAL		
1	URINAL	URINAL WITH FIXING ACCESSORIES, SIZE: 370X315X620MM	WHITE
2	ANGULAR STOP COCK	ANGULAR STOP COCK WITH WALL FLANGE	CHROME
3	SENSOR	AQUISENSE SENSOR CONCEALED TYPE FLUSHING VALVE FOR URINAL COMPLETE SET WITH INSTALLATION BOX WITH CONTROL COCK	CHROME
C	WC AREA		
1	HEALTH FAUCET	HAND SHOWER (HEALTH FAUCET) WITH 1 METER LONG EASY FLEX TUBE IN CHROME FINISH & WALL HOOK	CHROME
2	TOILET ROLL HOLDER WITH FLAP	TOILET ROLL HOLDER WITH STAINLESS STEEL FLAP	CHROME
3	ANGULAR STOP COCK	ANGULAR STOP COCK WITH WALL FLANGE	CHROME

S. N.	ITEM	DESCRIPTION	FINISH
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
5	FLUSH PLATE	CONTROL PLATE KUBIX	CHROME
6	WC	RIMLESS, BLIND INSTALLATION WALL HUNG WC WITH UF SOFT CLOSE SEAT COVER, HINGES, ACCESSORIES SET, SIZE : 345X490X360 MM	WHITE
7	ROBE HOOK	DOUBLE COAT HOOK	CHROME
II	DIFFERENTLY ABLED TOILET		
A	BASIN AREA		
1	BASIN FAUCET	SENSOTRONIC SENSOR FAUCET FOR WASH BASIN	CHROME
2	BOTTLE TRAP	BOTTLE TRAP (WITH INTERNAL PARTITION) 32MM SIZE WITH 300MM & 190MM LONG WALL CONNECTION PIPES & WALL FLANGE	CHROME
4	CLICK WASTE	CLICK CLACK WASTE 32MM SIZE HALF THREAD WITH 80MM/ 130MM HEIGHT	CHROME
5	BRAIDED HOSE	600MM LONG BRAIDED HOSE WITH M10X1 NIPPLE, 15MM NUT, O-RING & RUBBER WASHER	CHROME
6	ANGULAR STOP COCK	ANGULAR STOP COCK WITH WALL FLANGE	CHROME
7	BASIN	WALL HUNG INTEGRATED BASIN, WITH FIXING ACCESSORIES SIZE : 490X450X375 MM	WHITE
B	URINAL		
1	URINAL	URINAL WITH FIXING ACCESSORIES, SIZE: 370X315X620MM	WHITE
2	SENSOR	AQUISENSE SENSOR CONCEALED TYPE FLUSHING VALVE FOR URINAL COMPLETE SET WITH INSTALLATION BOX WITH CONTROL COCK	CHROME
C	WC AREA		
1	HEALTH FAUCET	HAND SHOWER (HEALTH FAUCET) WITH 1 METER LONG EASY FLEX TUBE IN CHROME FINISH & WALL HOOK	CHROME
2	TOILET ROLL HOLDER WITH	TOILET ROLL HOLDER WITH STAINLESS STEEL FLAP	CHROME

S. N.	ITEM	DESCRIPTION	FINISH
	FLAP		
3	ANGULAR STOP COCK	ANGULAR STOP COCK WITH WALL FLANGE	CHROME
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
5	FLUSH PLATE	CONTROL PLATE KUBIX	CHROME
6	WC	RIMLESS, BLIND INSTALLATION WALL HUNGWC WITH UF SOFT CLOSE SLIM SEAT COVER,HINGES, ACCESSORIES SET,SIZE : 370X490X365 MM	WHITE
D	MISCELLANEOUS		
1	TISSUE DISPENSER PANEL	(TISSUE DISPENSER + WASTE RECEPTACLE	Stainless Steel
2	AUTOMATIC SOAP DISPENSER	SOAP DISPENSER	Stainless Steel
3	SPECIALLY-ABLED TOILET FITTINGS SUCH AS GRAB BARS FOR WASH BASIN, WC AND ACCESSIBLE GRABRAIL		

**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.	1200 MM X 3000MM X 300 MM		50 METERS

S. N.	AREAS	QUANTITY (TENTATIVE)	TYPE	SIZE	REFERENCE	VISIBILITY
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
BUILDING/ AREA SIGNAGE						
1	BUILDING SIGNAGE FOR BUILDINGS/BLOCKS	COMBINATION OF: BLOCK NAME & LOGO ALL OTHER LETTERS DESCRIBING BLOCK (APPROX. 20 LETTERS PER BLOCK)	WALL MOUNTED. BACKLIT AND CUSTOM DESIGNED FOR EACH BLOCK IN BRUSHED STAINLESS STEEL LASER CUT LETTERS 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

S. N.	AREAS	QUANTITY (TENTATIVE)	TYPE	SIZE	REFERENCE	VISIBILITY
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
REGULATORY AND SAFETY SIGNAGE						

S. N.	AREAS	QUANTITY (TENTATIVE)	TYPE	SIZE	REFERENCE	VISIBILITY
1	INDUSTRIAL SAFETY	AS PER STATUATORY REQUIREMENTS 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 STATUATORY REQUIREMENTS AND IS: 9457 & IS: 12349		10 METRES
2	GENERAL SAFETY	AS PER STATUATORY REQUIREMENTS 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 STATUATORY REQUIREMENTS AND IS: 9457 & IS: 12349		10 METRES
3	ROAD SAFETY	AS PER STATUATORY REQUIREMENTS AND STANDARD ENGINEERING PRACTISE.	3MM PVC SINGLE SIDED WITH PHOTO-LUMINOUS / GLOW IN DARK VINYL (6-8 HOURS GLOW) FIXED USING SS STUDS.	AS PER STATUATORY REQUIREMENTS AND IRC:67		10 METRES
4	ELECTRICAL SAFETY/ ELECTRICAL EQUIPMENT SIGNAGE	AS PER STATUATORY REQUIREMENTS 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 STATUATORY REQUIREMENTS AND IS: 9457 & IS: 12349		10 METRES

Note: The details mentioned above is only indicative for signages. However, actual numbers/requirement of the signages shall be work out as per relevant IS code/Specifications for signages in this regard. The design/drawing/content and number shall be got approved from the Engineer-in-charge before execution. Nothing extra shall be paid in this account

SCHEDULE '9'

SCHEDULE OF HORTICULTURE

S. N.	BOTANICAL NAME	COMMON NAME	TYPE	HEIGHT / LENGTH	CALIPER	CANOPY	Tentative Qty.
1	Pyrostegia Venusta	Golden Shower	Climber	3 mts	-	Min 3 mts runners/plant	100
2	Tecomaria Capensis	Cape Honey suckle	Shrub	0.90 mts	-	Multi branching, bushy	200
3	Clematis Terniflora	Sweet Autumn Clematis	Climber	3 mts	-	Min 3 mts runners/plant	200
4	Ipomea Alba	Moonflower	Climber	3 mts	-	Min 3 mts runners/plant	200
5	Jasminum Polyanthum	Pink Jasmine	Climber	3 mts	-	Min 3 mts runners/plant	200
6	Bougainvillea Shubra	White Bougainvillea	Climber	3 mts	-	Min 3 mts runners/plant	200
7	Thunbergia Grandiflora Alba	White Clock Viine	Climber	3 mts	-	Min 3 mts runners/plant	200
8	Green Species						
9	Vernonia Elaengifolia	Railway creeper	Climber	3 mts	-	Min 3 mts runners/plant	200
10	Jacquemontia pentantha	Skyblue Cluster vine	Climber	3 mts	-	Min 3 mts runners/plant	300
11	Ipomea Tricolor heavenly blue	Morning Glory	Climber	3 mts	-	Min 3 mts runners/plant	300
12	Celosia	Safed Murga	Shrub	0.30 mts	-	Multi branching, Bushy	300
13	Gomphrena Globosa	Gul-e- makhmal	Shrub	0.30 mts	-	Multi branching, Bushy	300
14	Chrysanthemum Indicum	Guldaudi	Shrub	0.40 mts	-	Multi branching, Bushy	500
15	Rosa x hybrida	Hybrid tea rose	Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
16	Grandiflora Rose		Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
17	Rosa Europeana	Floribunda Rose	Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
18	Rosa Multiflora	Polyanthas Rose	Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
19	Climber and Rambler Rose		Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
20	Landscape Rose		Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
21	Shrub Rose		Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
22	Bourbon Rose		Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
23	Polianthes tuberosa	Tuberose	Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
24	Rosa x hybrida	Hybrid tea rose	Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
25	Grandiflora Rose		Shrub	0.60 mts	8 mm	Multi branching, Bushy	500

S. N.	BOTANICAL NAME	COMMON NAME	TYPE	HEIGHT / LENGTH	CALIPER	CANOPY	Tentative Qty.
26	Rosa Europeana	Floribunda Rose	Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
27	Rosa Multiflora	Polyanthas Rose	Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
28	Climber and Rambler Rose		Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
29	Landscape Rose		Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
30	Shrub Rose		Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
31	Bourbon Rose		Shrub	0.60 mts	8 mm	Multi branching, Bushy	500
32	Bridelia stipularis	Climbing Bridelia	Creeper	0.30 mts	-	Min 0.3 mts runners/plant	100

NOTE – The above details of horticulture plant/species for plantation are tentative. The actual requirement shall be worked out by the agency in consultation with user department during execution of work. Relevant plant/species to be planted as per architectural design intent and as directed by the engineer-in-charge.

SCHEDULE-‘7’

STAGE PAYMENT SCHEDULE

S. NO.	DESCRIPTION	PERCENTAGE OF TENDERED AMOUNT
1	FOR PLANNING, DESIGNING AND LOCAL BODY APPROVAL	1.00%
2	FOOD COURT	29.84%
3	SOUVENIR SHOP & INFORMATION CENTRE	11.08%
4	ENTRY GATE	4.21%
5	ENTRY FORECOURT	16.13%
6	EXTERNAL DEVELOPMENT WORKS	22.91%
7	MISCELLANEOUS STRUCTURES, SUBSTATION, UGT INCLUDING PUMP ROOM, STP ETC.	4.22%
8	E&M BULK SERVICES	10.61%
	TOTAL	100%

SCHEDULE OF STAGE PAYMENT
(For Planning, Designing and local body approvals)

S. No	Description of Item	% of tendered amount
1.	Preparation of the layout plan of entrance plaza, NZP and building plans, submission and obtaining approval of these plans from all local bodies and statutory authorities including Environmental clearance (if required).	0.3%
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.	0.4%
3.	On submission and approval of as – built completion drawings and obtaining completion/occupancy certificate from local body.	0.3 %
	Total =	1.00%

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 Food Court Building) (Civil Work)**

S. No	Description of Item	% of tendered amount
1.	Completion of all work in foundation up to plinth level	
A	Earthwork (in excavation/filling) & PCC Work	1.13%
B	RCC Works	2.62%
2.	Completion of super structure work (RCC work) of the building	5.27%
3.	AAC/Brick work walls of whole building	1.69%
4.	Flooring, skirting, dado, wall lining work	1.98%
5.	Doors & Windows, wall guard/ hand rail, corner guard i/c all hardware and accessories at all floors	1.27%
6.	Internal False Ceiling Work & wall paneling work	1.27%
7.	Finishing Work	1.77%
8.	Waterproofing work i/c/ Over deck Insulation if any	1.05%
9.	Façade work (Exterior Cladding, Curtain Wall, Structural glazing, louvers etc.)	2.27%
10.	Other Works, viz. Stainless-steel work, Signages etc.	0.41%
11.	Water Supply, Sewerage, Drainage System	
A	Water Supply System & Sanitary Installations	0.42%
B	Sewerage System	0.42%
C	Fitting & Fixtures	0.42%
D	Drainage	0.43%
12.	Completion and Handing Over	
	i. Testing & Commissioning	1.05%
	ii. Handing over	1.05%
	Total =	24.52%

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 FOOD COURT) (E&M PART)**

S. No	Description of Item	% of Tendered amount
A	Internal, External EI including telephone conduit, lighting arrestor etc	
1	Supply of conduit, MCB DB and boxes on all floor	0.18
2	Installation of above equipment as per specification	0.02
3	Supply of cable tray, raceway, trunking and wires etc.	0.38
4	Installation of above equipment as per specification	0.04
5	Supply of Switch, socket, MCB, RCCB etc	0.25
6	Installation of above equipment as per specification	0.04
7	Supply of LV/MV Cables, Earthing, Lighting conductor etc.	0.55
8	Installation of above equipment as per specification	0.05
9	Supply of Rising main, LT Panel, Feeder Pillar etc.	0.73
10	Installation of above equipment as per specification	0.07
11	Supply of light fitting, fans, exhaust fan etc.	0.73
12	Installation of above equipment as per specification	0.07
13	Testing commissioning of above equipment	0.55
14	Supply of Fire fighting equipment like pipe, pump, panel, hose reel, hydrant and all types of valves, illuminated signages etc	0.67
15	Installation of above equipment as per specification	0.27
16	Testing commissioning of above equipment	0.16
17	Supply of Fire alarm equipment like main panel, detector, PA system, MCP, hooter etc	0.35
18	Installation of above equipment as per specification	0.13
19	Testing commissioning of above equipment	0.08
	Total	5.32

SCHEDULE OF STAGE PAYMENT
(INFORMATION CENTRE AND SOUVENIER SHOP) (Civil Work)

S. No	Description of Item	% of tendered amount
1	Completion of all work in foundation up to plinth level	
A	Earthwork (in excavation/filling) & PCC Work	0.41%
B	RCC Works	1.36%
2	Completion of super structure work (RCC work) of the whole building	2.53%
3	AAC/Brick work walls of whole building	0.59%
4	Flooring, skirting, dado, wall lining work	0.85%
5	Doors& Windows, wall guard/ hand rail, corner guard i/c all hardware and accessories at all floors	0.31%
6	Internal False Ceiling Work & wall paneling work	0.31%
7	Finishing Work	0.81%
8	Waterproofing work i/c/ Over deck Insulation if any	0.28%
9	Façade work (Exterior Cladding, Curtain Wall, Structural glazing, louvers etc.)	0.81%
10	Other Works, viz. Stainless-steel work, Signages etc.	0.14%
11	Water Supply, Sewerage, Drainage System	
A	Water Supply System & Sanitary Installations	0.27%
B	Sewerage System	0.17%
C	Fitting & Fixtures	0.17%
D	Drainage	0.14%
12	Completion and Handing Over	
	i. Testing & Commissioning	0.28%
	ii. Handing over	0.28%
	Total =	9.71%

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 SOUVENIR SHOP AND INFORMATION CENTRE) (E&M PART)**

S. No	Description of Item	% of Tendered amount
A	Internal, External EI including telephone conduit, lighting arrestor etc	
1	Supply of conduit, MCB DB and boxes on all floor	0.06
2	Installation of above equipment as per specification	0.01
3	Supply of cable tray, raceway, trunking and wires etc.	0.1
4	Installation of above equipment as per specification	0.01
5	Supply of Switch, socket, MCB, RCCB etc	0.08
6	Installation of above equipment as per specification	0.01
7	Supply of LV/MV Cables, Earthing, Lighting conductor etc	0.15
8	Installation of above equipment as per specification	0.02
9	Supply of Rising main, LT Panel, Feeder Pillar etc	0.2
10	Installation of above equipment as per specification	0.02
11	Supply of light fitting, fans, exhaust fan etc	0.2
12	Installation of above equipment as per specification	0.02
13	Testing commissioning of above equipment	0.15
14	Supply of Fire fighting equipment like pipe, pump, panel, hose reel, hydrant and all types of valves, illuminated signages etc	0.14
15	Installation of above equipment as per specification	0.07
16	Testing commissioning of above equipment	0.04
17	Supply of Fire alarm equipment like main panel, detector, PA system, MCP, hooter etc	0.05
18	Installation of above equipment as per specification	0.02
19	Testing commissioning of above equipment	0.02
	Total	1.37

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
(MAIN ENTRANCE GATE) (Civil Work)**

S. No	Description of Item	% of tendered amount
1	Completion of all work in foundation up to plinth level	
A	Earthwork (in excavation/filling) & PCC Work	0.21%
2	Completion of RCC work of the whole structure	1.75%
3	AAC/Brick work walls of whole building	0.26%
4	Flooring, skirting, dado, wall lining work	0.09%
5	Doors& Windows, wall guard/ hand rail, corner guard i/c all hardware and accessories at all floors	0.17%
6	Internal False Ceiling Work & wall paneling work	0.22%
7	Finishing Work	0.22%
8	Waterproofing work i/c/ Over deck Insulation if any	0.15%
9	Façade work (Exterior Cladding, Curtain Wall, Structural glazing, louvers etc.)	0.22%
10	Other Works, viz. Stainless-steel work, Signages etc.	0.07%
11	Completion and Handing Over	
A	Testing & Commissioning	0.10%
B	Handing over	0.10%
	Total =	3.56%

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 ENTRY GATE) (E&M PART)**

S. No	Description of Item	% of Tendered amount
A	Internal, External EI including telephone conduit, lighting arrestor etc	
1	Supply of conduit, MCB DB and boxes on all floor	0.03
2	Installation of above equipment as per specification	0.01
3	Supply of cable tray, raceway, trunking and wires etc.	0.06
4	Installation of above equipment as per specification	0.01
5	Supply of Switch, socket, MCB, RCCB etc	0.04
6	Installation of above equipment as per specification	0.01
7	Supply of LV/MV Cables, Earthing, Lighting conductor etc.	0.08
8	Installation of above equipment as per specification	0.01
9	Supply of Rising main, LT Panel, Feeder Pillar etc.	0.12
10	Installation of above equipment as per specification	0.01
11	Supply of light fitting, fans, exhaust fan etc.	0.12
12	Installation of above equipment as per specification	0.01
13	Testing commissioning of above equipment	0.09
14	Supply of Fire fighting equipment like pipe, pump, panel, hose reel, hydrant and all types of valves, illuminated signages etc	0.01
15	Installation of above equipment as per specification	0.01
16	Testing commissioning of above equipment	0.01
	Total	0.65

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
(ENTRY FORECOURT) (Civil Work)**

S. No	Description of Item	% of tendered amount
1	Completion of all work in foundation up to plinth level	
A	Earthwork (in excavation/filling) & PCC Work	0.20%
B	RCC Works Sub-structure	2.00%
2	Completion of super structure work (RCC work) of the whole building	6.30%
3	AAC/Brick work partition walls of whole building	0.53%
4	Flooring, skirting, dado, wall lining work, paver blocks	2.46%
5	Doors& Windows, wall guard/ hand rail, corner guard i/c all hardware and accessories at all floors	0.39%
6	Internal False Ceiling Work & wall paneling work	0.68%
7	Finishing Work	0.39%
8	Waterproofing work i/c/ Over deck Insulation if any	0.33%
9	Façade work (Exterior Cladding, Curtain Wall, Structural glazing, louvers etc.)	0.39%
10	Other Works, viz. Stainless-steel work, Signages etc.	0.07%
11	Water Supply, Sewerage, Drainage System	
A	Water Supply System & Sanitary Installations	0.13%
B	Sewerage System	0.13%
C	Fitting & Fixtures	0.13%
D	Drainage	0.07%
12	Completion and Handing Over	
A	Testing & Commissioning	0.33%
B	Handing over	0.33%
	Total =	14.86%

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 Entry Fore Court) (E&M Part)**

S. No	Description of Item	% of Tendered amount
A	Internal, External EI including telephone conduit, lighting arrestor etc	
1	Supply of conduit, MCB DB and boxes on all floor	0.06
2	Installation of above equipment as per specification	0.01
3	Supply of cable tray, raceway, trunking and wires etc.	0.12
4	Installation of above equipment as per specification	0.01
5	Supply of Switch, socket, MCB, RCCB etc	0.08
6	Installation of above equipment as per specification	0.01
7	Supply of LV/MV Cables, Earthing, Lighting conductor etc.	0.18
8	Installation of above equipment as per specification	0.02
9	Supply of Rising main, LT Panel, Feeder Pillar etc.	0.24
10	Installation of above equipment as per specification	0.02
11	Supply of light fitting, fans, exhaust fan etc.	0.24
12	Installation of above equipment as per specification	0.02
13	Testing commissioning of above equipment	0.18
14	Supply of Fire fighting equipment like pipe, pump, panel, hose reel, hydrant and all types of valves, illuminated signages etc	0.01
15	Installation of above equipment as per specification	0.01
16	Testing commissioning of above equipment	0.01
17	Supply of Fire alarm equipment like main panel, detector, PA system, MCP, hooter etc	0.01
18	Installation of above equipment as per specification	0.01
19	Testing commissioning of above equipment	0.01
	Total	1.27

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
(MISCELLANEOUS STRUCTURES, SUBSTATION, UGT INCLUDING PUMP ROOM, STP
ETC) (Civil Work)

S. N	Description of Item	% of tendered amount
	Infrastructure Development	
1	Levelling, Roads, footpaths, Horticulture, Signage, etc. on pro-rata basis.	
A	Levelling (excavation/cutting/filling) works	0.19%
2	Completion of RCC work of the whole structure	1.75%
3	AAC/Brick work walls of whole building	0.26%
4	Flooring, skirting, dado, wall lining work	0.25%
5	Doors& Windows, wall guard/ hand rail, corner guard i/c all hardware and accessories at all floors	0.07%
6	Internal False Ceiling Work & wall paneling work	0.05%
7	Finishing Work	0.10%
8	Waterproofing work i/c/ Over deck Insulation if any	0.10%
10	Other Works, viz. Stainless-steel work, M.S Work, Signages etc.	0.37%
2	External/bulk Services	
A	Water-Supply System	0.05%
B	Sewerage System	0.05%
C	Drainage System/RWH	0.05%
3	Storm water drains	0.10%
5	Horticulture works	0.58%
6	Completion and Handing Over	
A	Testing & Handing over	0.25%
	Total =	4.22%

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
(Bulk E& M Services)**

S. No	Description of Item	% of Tendered amount
1	Supply of escalator equipment complete	0.51
2	Installation of above equipment as per specification	0.21
3	Testing commissioning of above equipment	0.13
4	Supply of CCTV equipment complete	1.19
5	Installation of above equipment as per specification	0.45
6	Testing commissioning of above equipment	0.24
7	Supply of Substation equipment like transformer, HT panel, LT Panel etc	0.22
8	Installation of above equipment as per specification	0.1
9	Testing commissioning of above equipment	0.06
10	Supply of DG set equipment	0.18
11	Installation of above equipment as per specification	0.08
12	Testing commissioning of above equipment	0.05
13	Supply of UPS System	0.06
14	Installation of above equipment as per specification	0.03
15	Testing commissioning of above equipment	0.02
16	Supply of VRV/VRF System equipment.	1.54
17	Installation of above equipment as per specification	0.6
18	Testing commissioning of above equipment	0.36
19	Supply of Solar PV Generation Plant equipment.	0.29
20	Installation of above equipment as per specification	0.12
21	Testing commissioning of above equipment	0.07
22	Supply of Street Lighting parts like pole, light cable etc.	0.87
23	Installation of above equipment as per specification	0.35
24	Testing commissioning of above equipment	0.27
25	Supply of STP Plant equipment.	0.48
26	Installation of above equipment as per specification	0.12
27	Testing commissioning of above equipment	0.12
28	Supply of Baggage Scanner equipment.	0.4
29	Installation of above equipment as per specification	0.29
30	Testing commissioning of above equipment	0.11
31	Supply of Door Frame Metal Detector equipment.	0.07
32	Installation of above equipment as per specification	0.03
33	Testing commissioning of above equipment	0.02
34	Supply of Hydro Pneumatic System Equipment.	0.02
35	Installation of above equipment as per specification	0.01

36	Testing commissioning of above equipment	0.01
37	Dismantling of existing poles.	0.01
38	Dismantling and Reinstallation of two Existing Transformers.	0.04
39	Supply of Automated Flap Barrier System related Equipment.	0.5
40	Installation of above equipment as per specification	0.24
41	Testing commissioning of above equipment	0.14
	Total =	10.61

**SCHEDULE OF STAGE PAYMENT
(FOR EXTERNAL DEVELOPMENT WORKS) (Civil Work)**

S. N	Description of Item	% of tendered amount
	Infrastructure Development	
1	Levelling, Roads, footpaths, Horticulture, Signage, etc. on pro-rata basis.	
A	Levelling (excavation/cutting/filling) works	1.09%
B	Internal Roads with CC pavement with Kerb stones, pavers on footpath, grass pavers, painting, marking etc.	10.05%
2	External/bulk Services	
A	Water-Supply System	1.12%
B	Sewerage System	1.12%
C	Drainage System/RWH	1.12%
3	Storm water drains	1.90%
4	Retaining wall, Boudnary wall & Toe wall	2.30%
5	Landscape fountain	0.50%
6	Fish Pond, AMPHI, Stepped sitting area (As per Drawing)	2.00%
7	Horticulture works	1.28%
8	Completion and Handing Over	
A	Testing & Handing over	0.43%
	Total =	22.91%

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.

**LIST OF PREFERRED MAKE / MANUFACTURERS FOR DIFFERENT MATERIALS
TO BE USED IN THIS PROJECT FOR CIVIL & HORTICULTURE WORKS**

S. NO.	DETAILS OF MATERIALS	MANUFACTURERS NAME
1	ANTI TERMITE PESTICIDES	BAYER, FMC INDIA, HINDUSTAN INSECTICIDES
2	ALUMINIUM COMPOSITE PANEL	ALUCOBOND, REYNOBOND, ALSTONE, ALUDECOR
3	ADHESIVE TAPE	3M, NORTON, TESA
4	AAC BLOCK	TATA TISCO BUILD, ULTRATECH (XTRLITE), BIRLA AEROCON, SIPOREX
5	ALUMINIUM SECTIONS FOR DOORS & WINDOWS ETC.	JINDAL, HINDALCO
6	AAC BLOCK ADHESIVE	ULTRATECH, ARDEX ENDURA, WEBER
7	ACOUSTIC SEAL / DOOR SEAL	LORIENT, RAVEN, DORMA, 3M, HAFELE
8	AIR TRANSFER GRILL	RUSKIN, SYSTEM AIR, TROX, TREMCO
9	ACOUSTICAL PANELS, ACOUSTICAL FALSE CELING, ACOUSTICAL CLADDING, ACOUSTICAL CLOUD CEILING, ACOUSTICAL CARPET FLOORING, ACOUSTICAL GLASS FIBER REINFORCED GYPSUM PANEL/ BOARD, ACOUSTICAL SPRAY	ARMSTRONG, GYPTECH, ECOPHON-SAINT GOBAIN
10	BITUMEN MEMBRANE FOR WATERPROOFING, HDPE MEMBRANE FOR WATERPROOFING, POLYUREA MEMBRANE FOR WATERPROOFING	SIKA, SAINT GOBAIN, SOPREMA , FOSROC, PIDILITE, ASIAN PAINTS
11	BAMBOO DECKING, ROOFING & CLADDING	ECO GREEN FLOORING, LAMIWOOD, EPITOME BAMBOOWOOD
12	BACKER ROD	SUPREME/SYSTRANS
13	CEMENT	ACC, AMBUJA, ULTRATECH, JK CEMENT, WONDER
14	CERAMIC GLAZED TILES	SOMANY, KAJARIA, RAK
15	CRYSTALLIANE CEMENTITIOUS WATERPROOFING COMPOUND	XYPEX, KRYTON
16	CALCIUM SILICATE BOARD FOR FIRE DOOR	PROMOTECH, PROMINA, RAMCO
17	CPVC PIPES	ASTRAL, PRINCE, SFMC

S. NO.	DETAILS OF MATERIALS	MANUFACTURERS NAME
18	CALCIUM SILICATE TILES FALSE CEILING	AEROLITE, RAMCO, HILUX
19	C.P. BRASS FITTING AND ACESSORIES	ROCA, KOHLER, TOTO, GROHE, EURONICS
20	DASH, ANCHORING FASTENERS	HILTI, FISCHER
21	EPDM GASKET	HANU, ANAND, VICTOR
22	EPOXY MORTAR	FOSROC, SIKA, MYK LATICRETE
23	EXPANSION JOINT	MIGUA, CS, CAMEO
24	ENGINEERED WOODEN FLOORING AND SKIRTING	MIKASA (GREENLAM), TARKETT, HAVWOODS, PARADOR (HIL), PERGO, KAHRs
25	ENGINEERED MARBLE	HR JOHNSON, KALINGA STONE
26	FIRE SEALENT	HILTI, 3M, MCCOY
27	FLOAT GLASS, REFLECTIVE GLASS, TINTED GLASS, HIGH PERFORMANCE GLASS, LOOKING GLASS / MIRROR LACQUERED GLASS, HIGH PERFORMANCE GLASS, FIRE RESISTANT GLASS	MODI GLASS, SAINT GOBAIN GLASS
28	FIRE CHECK DOORS (METAL/ROLLING/GLAZED)	PACIFIC FIRE CONTROLS, JC FIRE DOOR
29	FLOOR HARDENER, POLYSULPHIDE SEALANT, WATERPROOFING COMPOUND, ADMIXTURES/ CURING COUMPOUND	FORSROC, PIDILITE, SOPREMA
30	FIRE STOP IN CURTAIN WALL SYSTEM	HILTI, 3M, FISCHER, LORIENT
31	FLY ASH BRICKS	SIPOREX, SUNVIK, HIL
32	GYPSUM BOARD	SAINT GOBAIN, ARMSTRONG, LAFARGE, GYPTECH
33	GI PIPES	JINDAL HISAR, TATA
34	GI FITTINGS	UNIK, TATA, JINDAL
35	GLASS MOSAIC TILE	ITALIA, CORAL, KAJARIA
36	HIGH PERFORMANCE EPOXY BASED RESIN ANCHOR SYSTEM	HILTI, FOSROC, CICO
37	HDPE PIPES	SUPREME, FINOLEX, ASTRAL, RELIANCE
38	HYDRAULIC DOOR CLOSER, FLOOR SPRING, DOOR AUTOMATION,	DORMA, GEZE, EBCO, HAFELE, HORMANN

S. NO.	DETAILS OF MATERIALS	MANUFACTURERS NAME
	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	
39	INTUMESCENT FIRE / SMOKESEAL	ASTRO FLAME, RAVEN, SEALZ, LORIENT
40	MECHANICAL COUPERS	USHA MARTIN, DEXTRA, HALFEN, SANFIELD
41	MS SECTIONS (PIPES, BOXES CHANNELS)	JINDAL HISAR, TATA
42	METAL/ALUMINUM FALSE CEILING	SAINT GOBAIN, HUNTER DOUGLUS, ARMSTRONG, GYPTECH
43	OUTDOOR SIGNAGES	3M, AVERY DENNISON, VEDAAANSHI SIGNS
44	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	GREENLAM, MERINO, CENTURY, DURO, KIT PLY
45	POLYCARBONATE SHEET	DANPALON, SOLALITE, DPI SYSTEM, EVERLITE, CPI
46	POP OUT VENT FOR FAÇADE AND SYSTEM WINDOW HARDWARE	COTSWOLD, SCHUCO, ALUK, REYNAERS
47	PRECAST PAVER BLOCK	ACC, NOVACO, ULTRATECH, MODI COVER BLOCKS
48	READY MIXED CEMENT CONCRETE	ACC, ULTRA TECH, AFCON, LAFARGE (NUVACO)
49	READY MIX GYPSUM PLASTER	SAINT GOBAIN, ULTRATECH
50	READY MIX CEMENT PLASTER	WEBER, ULTRATECH, BIRLA
51	ROLLER BLIND	VISTA, MAC, HUNTER DOUGLUS
52	CORROSION RESISTANT STEEL (TMT FE-500D OR MORE)	TATA., RINL, JINDAL STEEL & POWER LTD, JSW STEEL LTD., SAIL
53	STRUCTURAL STEEL SECTIONS	TATA, JINDAL, SAIL, RINL
54	SILICON SEALANT	GE, DOW CORNING, PIDILITE

S. NO.	DETAILS OF MATERIALS	MANUFACTURERS NAME
55	S.S. MATERIAL/HADRAILS/RAILINGS	JINDAL STAINLESS STEEL LTD., TATA STEEL, SAIL
56	SOIL, WASTE, VENT PIPES & FITTINGS	ASTRAL, PRINCE, SFMC, SUPREME
57	SS SINK	NILKANTH, NIRALI, JAYNA
58	SANITARY WARE (URINAL, WASH BASIN, WC ETC.)	GROHE, KOHLER, TOTO, ROCA
59	SS TACTILE	EMINENT, FERROTECH, SUNDARAM, JINDAL
60	SLUICE VALVES, GATE / BALL VALVES	ZOLOTO, KIRLOSKAR, LEADER
61	TILE ADHESIVE, STONE ADHESIVE, EPOXY GROUTING COMPOUND	PIDILITE, ARDEX ENDURA, WEBER
62	UPVC WINDOWS	FENESTA, ALUPLAST, KOENMERLING
63	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, RAK
64	VINYL / CONDUCTIVE FLOORING, DADO SKIRTING	FORBO, TARAKETT, ARMSTRONG, GERFLOOR
65	WHITE CEMENT	BIRLA, J.K. WHITE, ULTRATECH
66	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
67	WOOD ADHESIVE	FEVICOL, 3M, ARALDITE
68	WALL PUTTY	JK, BIRLA, ASAIN PAINT
69	WPC (WOOD POLYMER COMPOSITE) DOOR SHUTTER, FRAME	GREENPLY, CENTURY, RAJSHREE, ALSTONE INDUSTRIES PVT LTD
70	WEATHER/STRUCTURE SILICON SEALANT	WACKER, MCCOY, DOW CORNING
71	AUTOMATIC SLIDING GLASS DOOR	DORMA, AUTO INGRESS,

S. NO.	DETAILS OF MATERIALS	MANUFACTURERS NAME
	WITH COMPLETE MECHANISM	GEZE, GODREJ, HAFELE
72	TOILET CUBICLES	GREENLAM, MARINO, CENTURY
73	GALVALUME ROOF SHEET	TATA, JSW
74	THERMAL INSULATION PUF PANEL	BASF INDIA LTD., MANALI PETRO CHECMIALS LTD., UB PETROPRODUCTS LTD.

Note: - The articles / materials which are not mentioned in the above said list shall be approved by the NIT approving authority before execution of work.

**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.

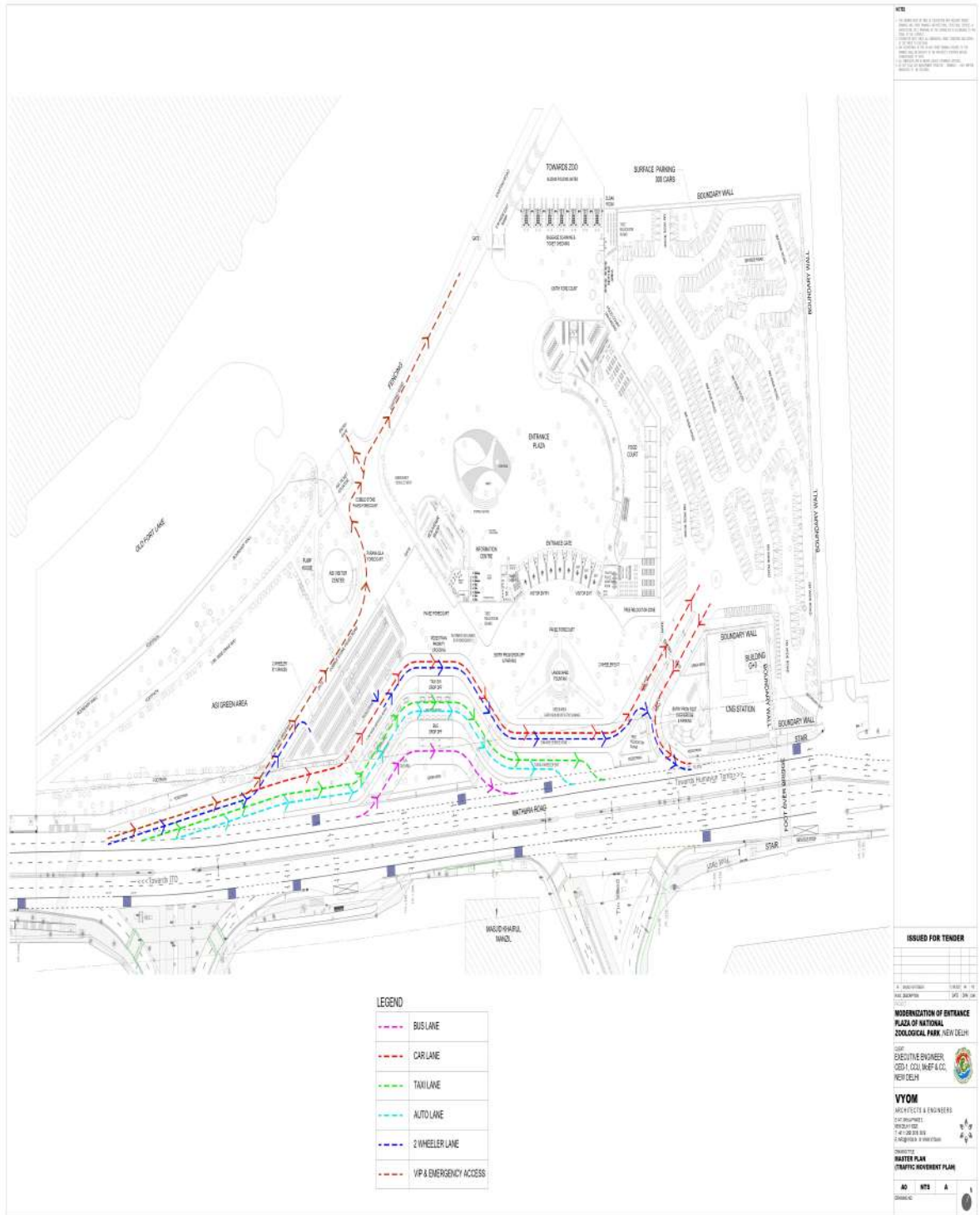
SIGNED FOR AND BEHALF OF THE PRESIDENT OF INDIA BY in the presence of

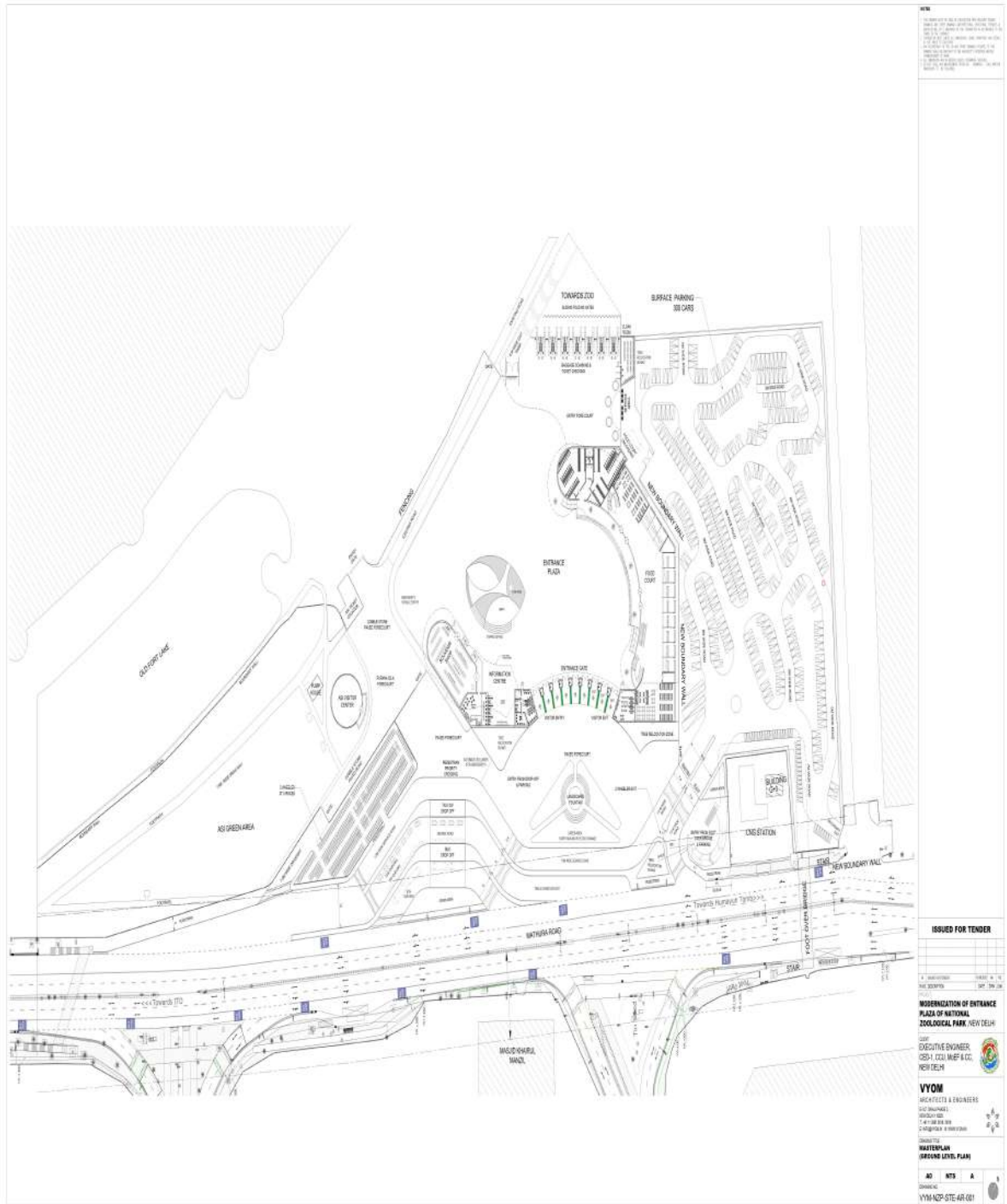
1. 2.

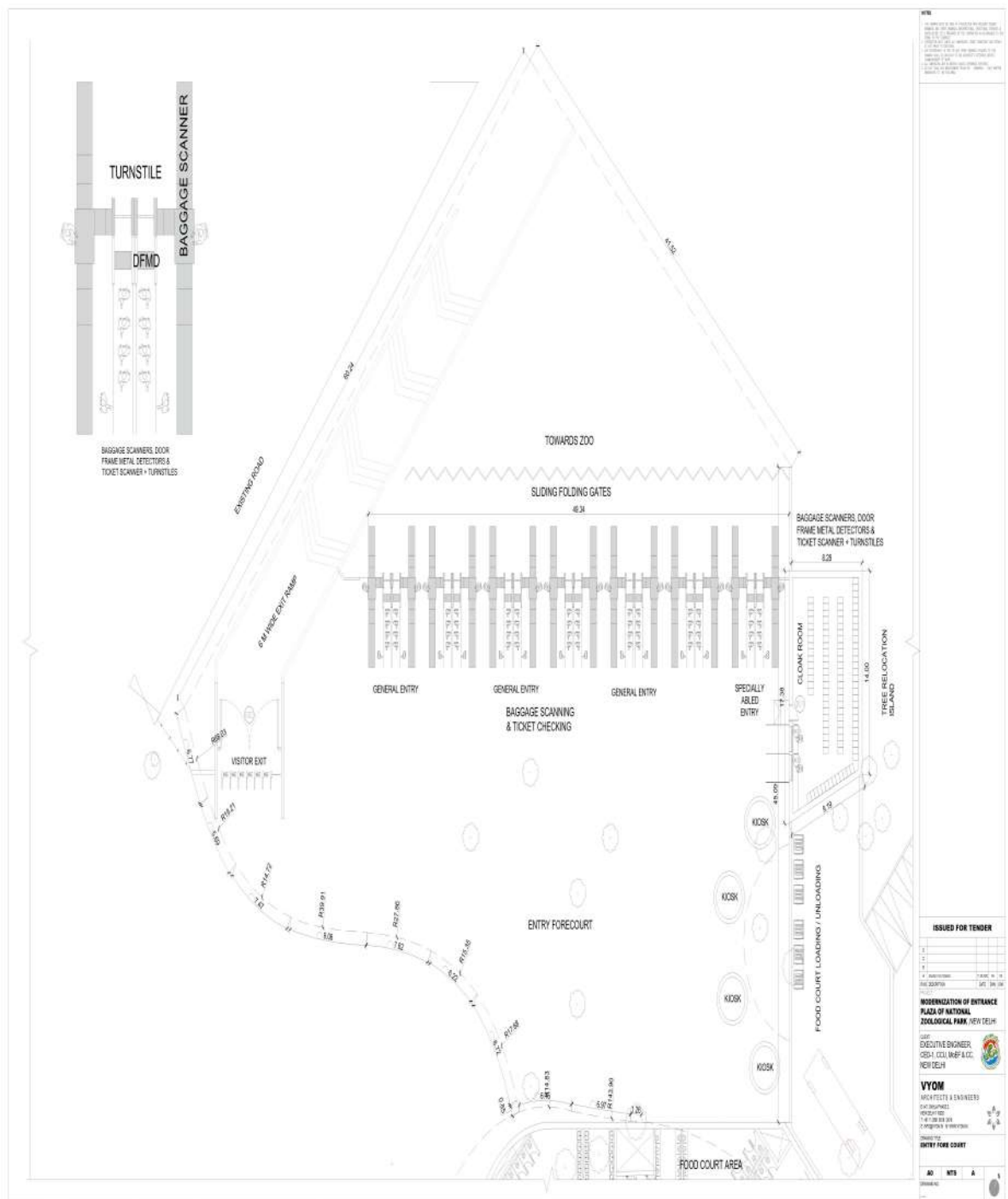
TENDER DRAWINGS

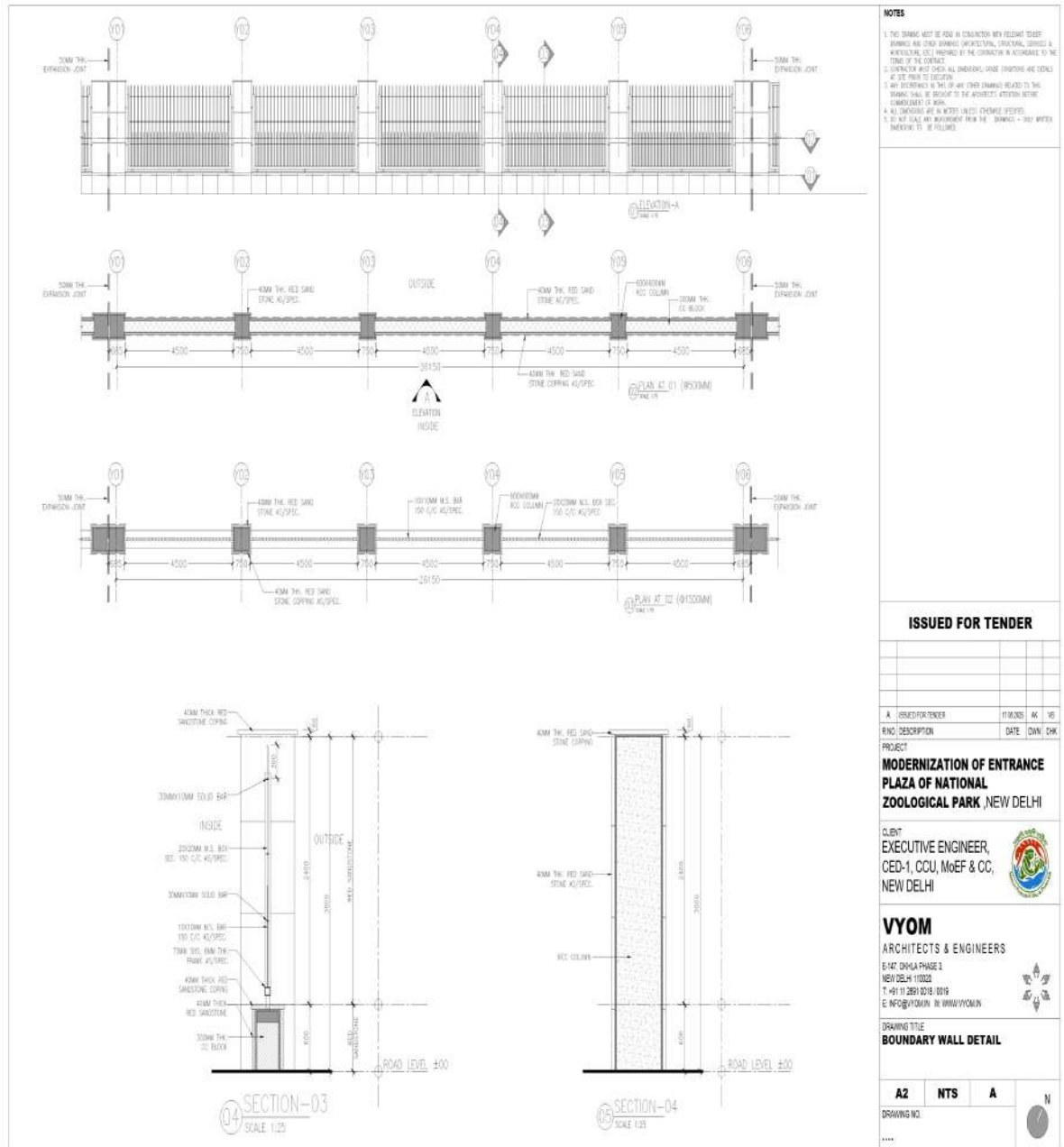
DRAWINGS LIST

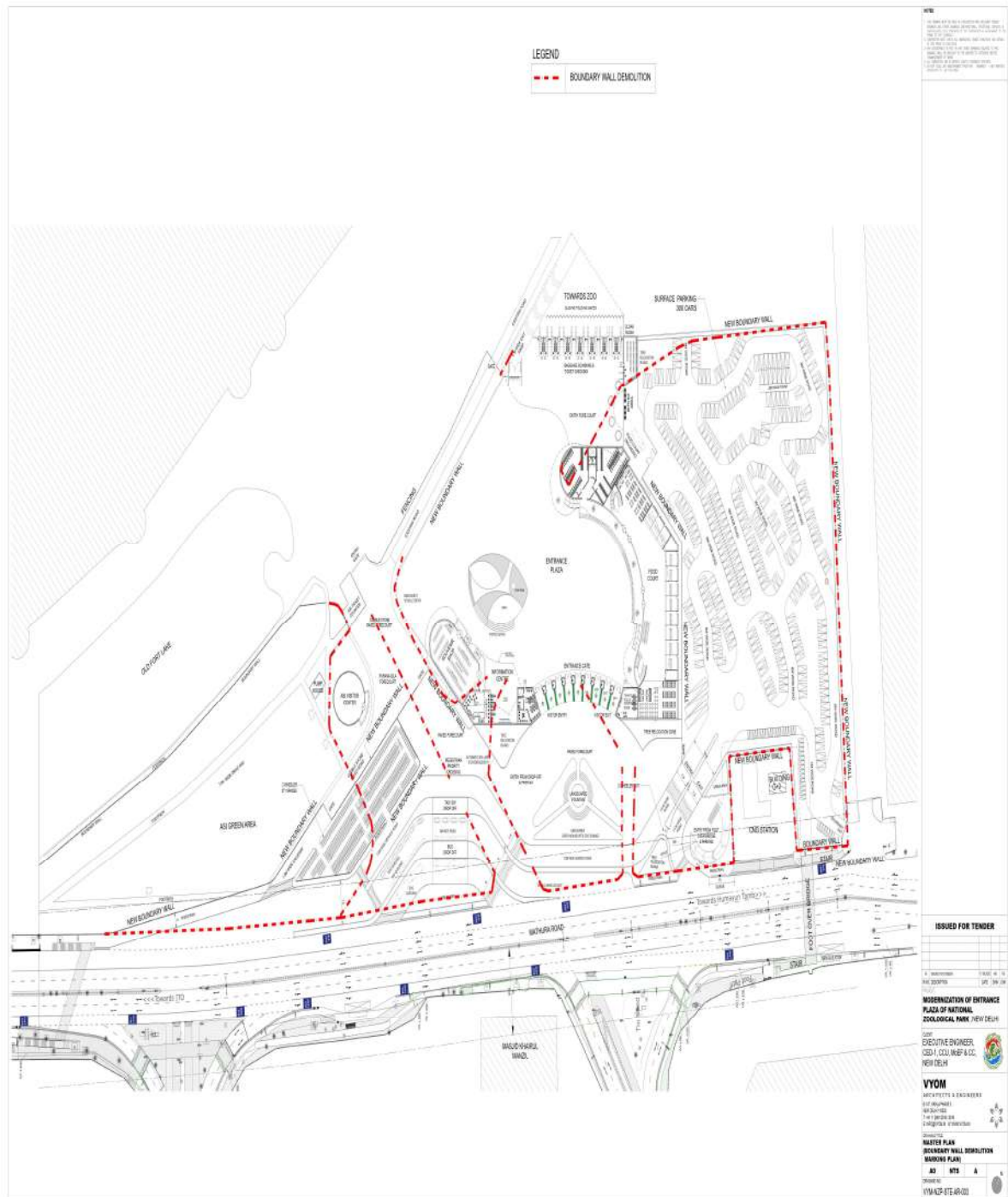
S. NO.	BRIEF DETAIL OF DRAWINGS
1	MAIN ENTRANCE GATE PLAN AND ELEVATION
2	FOOD COURT GROUND FLOOR PLAN AND ELEVATION
3	FOOD COURT FIRST FLOOR PLAN
4	INFORMATION CENTRE AND SOUVENIER SHOP PLAN AND ELEVATION
5	MAIN ENTRANCE GATE
6	ENTRY FORE COURT
7	INFORMATION CENTRE AND SOUVENIER SHOP
8	MASTER PLAN (BOUNDARY WALL DEMOLITION MARKING PLAN)
9	BOUNDARY WALL DETAIL
10	FOOD COURT GROUND FLOOR PLAN
11	MASTER PLAN (TRAFFIC MOVEMENT PLAN)
12	LAYOUT PLAN (GROUND LEVEL PLAN)

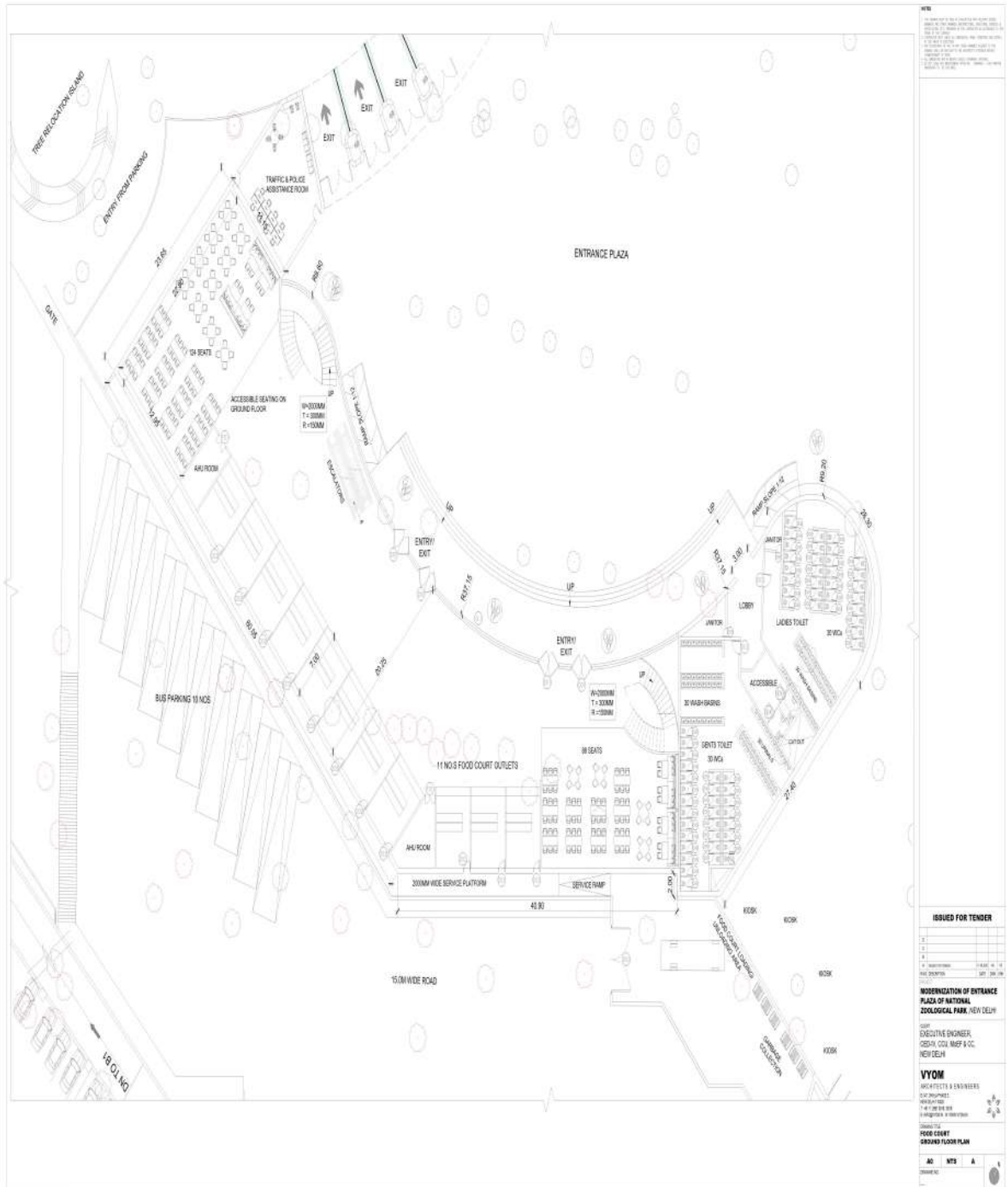


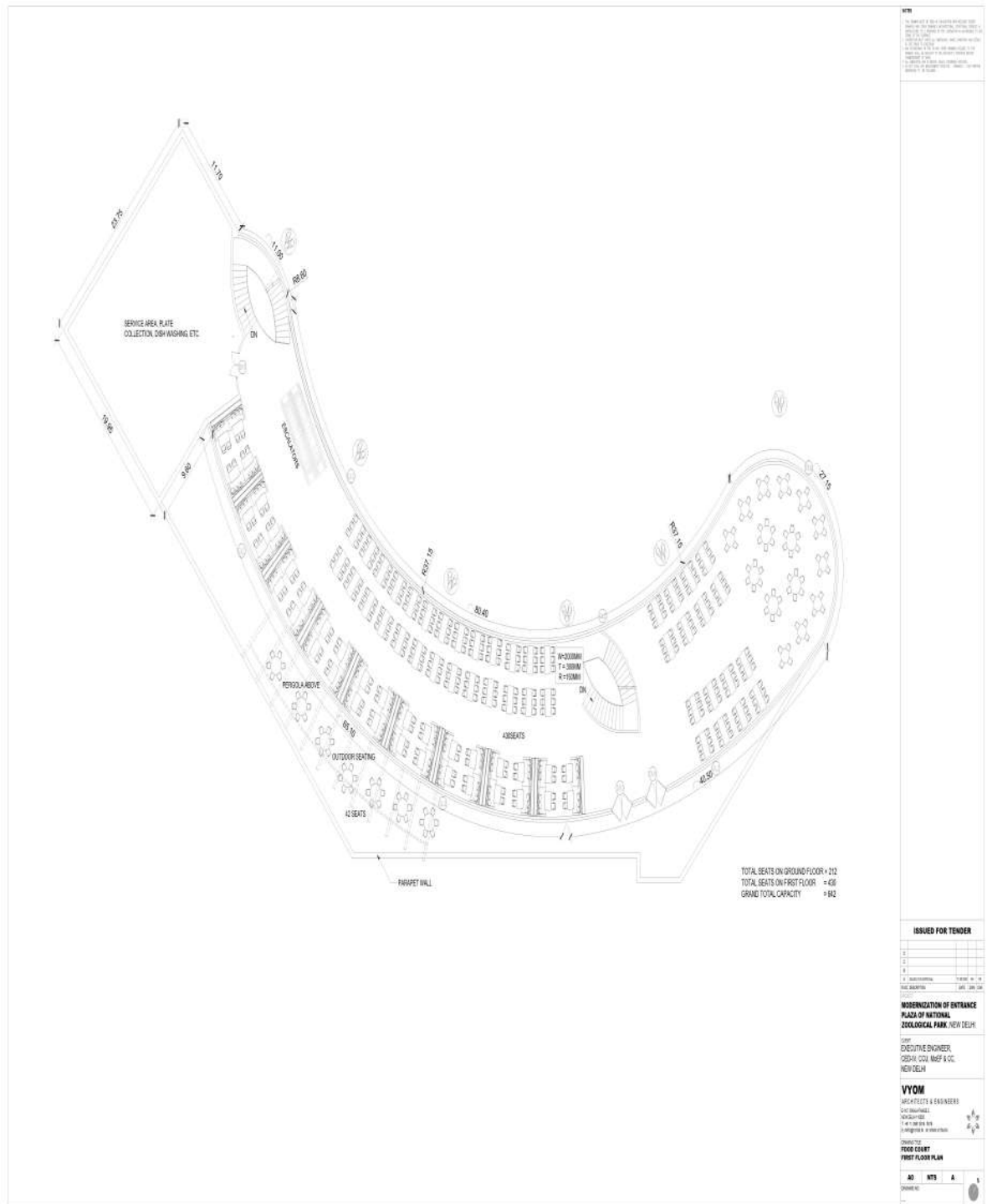












PART-C

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 (Wiring, DB, MCB, MCCB, LED Lights, Fans, Baggage Scanner, Door Frame Metal Detector, UPS, External Lighting etc.):

CPWD Enlisted Contractor in composite category having valid electric license
or

the main agency have to associate an agency having valid electrical contractor license and should have satisfactorily completed the similar works as mentioned below during the last 7 years ending last date of month previous to the one in which tender is invited.

Similar works shall mean “***Internal & External Electrical Installations Work***”.

D2: Electrical Sub-station:

Similar works shall mean “Supplying, Installation, testing & commissioning of Sub-Station” with minimum 80% capacity of transformer proposed in bid document.

D3: Diesel Generating Set

Similar works shall mean “Supplying, Installation, testing & commissioning of DG set/s” with minimum 80% capacity of individual DG set proposed in bid document.

D4: Solar Photo Voltaic Power Generation System:

Similar works shall mean “Supplying, Installation, testing & commissioning of Solar PV Generation Plant”, with minimum 80% capacity of Solar Photo Voltaic Power Generation Plant proposed in bid document.

D5: Passenger Escalator:

Similar works shall mean “Supplying, Installation, testing & commissioning of Passenger Lift.”

D6: Heating Ventilation and Air Conditioning (VRV/VRF System)

Similar works shall mean “Supplying, Installation, testing & commissioning of HVAC (VRV/VRF System)” with minimum 80% of total capacity of VRV/VRF System proposed in bid document.”

D7: Fire Fighting System (Wet riser, sprinkler system, Emergency Lighting, illuminated Signage & Fire Extinguisher)

Similar works shall mean “Supplying, Installation, testing & commissioning of Fire Fighting system.”

D8: Automatic Fire Alarm and Public Address System

Similar works shall mean “Supplying, Installation, testing & commissioning of Automatic Fire Alarm System and Public Address System.”

D9: IP Based CCTV Surveillance System and allied equipments:

Similar works shall mean “Supplying, Installation, testing & commissioning of IP Based CCTV Surveillance system and allied equipment ”.

D10: Sewage Treatment Plant:

Similar works shall mean “Supplying, Installation, testing & commissioning of STP (Sewage Treatment Plant) of SBR technology”, with minimum 80% capacity of Sewage Treatment Plant proposed in bid document.

D11: Hydro Pneumatic system with hydro pneumatic Pumps:

Similar works shall mean “Supplying, Installation, testing & commissioning of Hydro pneumatic system.”

D12: Automated Flap Barrier system:

Similar works shall mean “*Automated Flap Barrier system.*”.

1.2 For specialized E&M works and bulk services 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 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.

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 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 makes from manufacturer and get these installed from authorized agency/service provider of the manufacturer (OEM) or specialized agency as per criteria mentioned in bid document.

Estimated cost put to tender for above mentioned E&M works are as under: -

Sl. No.	Similar work	ECPT (Amount in Rs.)
1	Internal Electrical Installations and External Lighting	5,13,45,282/-
2	Electrical Sub-station	25,51,500/-
3	Diesel Generating Set	18,49,600/-
4	Solar Photo Voltaic Power Generation System	29,24,000/-
5	Passenger Escalator – 2 Nos.	50,38,764/-
6	Heating Ventilation and Air Conditioning (VRV/VRF System)	1,46,20,000/-
7	Fire Fighting System (Wet riser, sprinkler system, Emergency Lighting, illuminated Signage & Fire Extinguisher)	83,19,326/-
8	Automatic Fire Alarm and Public Address System	40,78,000/-
9	IP Based CCTV Surveillance System and allied equipment	1,10,48,100/-
10	Sewage Treatment Plant	37,50,000/-
11	Hydro Pneumatic Pumps Hydro Pneumatic system with hydro pneumatic Pumps	2,46,000/-
12	Automated Flap Barrier system	56,44,557/-

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 bid document 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.
- 1.10** If the calculated capacities of any equipment and services including bulk services as shown in this bid document is less than the minimum capacity mentioned in this bid document, the contractor shall provide the equipment and services including bulk services as per the capacity mentioned in this bid document. If calculated capacity is more than the minimum capacity mentioned in the bid document, the contractor shall provide each equipment and services including bulk services as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

MEMORANDUM OF UNDERSTANDING [M.O.U] BETWEEN

1] M/S [Name of the firm with full address] Enlistment Status
Valid up to:

[Henceforth called the main contractor] And

2] M/S [Name of the firm with full address]

Enlistment Status Valid up to:

[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 this agreement.

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 equipment, 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 employee 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) (Turnkey) 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 4-star GRIHA Rating and shall be in compliant to **ECSBC Plus** 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	Solar Photo Voltaic Power Generation Plant
D-5	Two Nos. Passenger Escalators
D-6	Heating Ventilation and Air Conditioning (VRV/ VRF System)
D-7	Fire Fighting System (Wet riser, sprinkler system, Emergency Lighting, Illuminated Signages & Fire Extinguisher)
D-8	Automatic Fire Alarm & Public Address System
D-9	IP Based CCTV Surveillance System
D-10	Sewage Treatment Plant
D-11	Hydro Pneumatic system with hydro pneumatic Pumps
D-12	Automated Flap Barrier system,

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 /Delhi 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.

- a. **The defect liability period of all E&M installation and bulk services of this section shall be as per GCC EPC Projects 2024 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.**

- i) **All Internal and External Electrical Installations**
- ii) **Electrical Sub-Station**
- iii) **Diesel Generating Set**
- iv) **Uninterrupted Power Supply**
- v) **Passenger Escalator**
- vi) **Heating Ventilation and Air Conditioning (VRV/ VRF System)**
- vii) **Fire Fighting System (Wet riser, sprinkler system, Emergency Lighting, illuminated Signage & Fire Extinguisher)**
- viii) **Automatic Fire Alarm and Public Address system**
- ix) **IP Based CCTV Surveillance System and allied equipments**
- x) **Sewage Treatment Plant**
- xi) **Hydro Pneumatic system with hydro pneumatic Pumps**
- xii) **Automated Flap Barrier system**

The defect liability period for Solar photo voltaic power generation plant and LED luminaire shall be twenty five years and five years respectively.

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.

2. 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.
3. The works shall be executed as per CPWD's General specification for Electrical Works:
- i) Part-I (Internal-2023); Part-II (External)-2023;
 - ii) Part-III (Lifts and Escalators)-2003,
 - iii) Part-IV (Substation)-2013,
 - iv) Part-V (Wet Riser and Sprinkler System)-2020,
 - v) Part-VI (Fire Detection and Alarm System)-2018,
 - vi) Part-VII (DG Set)-2013, HVAC works-2024,
 - vii) Part-VIII Gas based fire extinguishing system -2013,
 - viii) HVAC -2024

All as amended up to date, NBCS 2026, 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 Construction standards-2026, 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 2024, 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 strictly followed.)

4. All Electrical & Mechanical Installations shall meet the requirements of **minimum 4-star GRIHA Rating and ECSBC Plus of ECSBC 2024** as amended up to date. Equipment capacity/selection and design shall also be made as per good engineering practices, CPWD Specifications, National Building Construction standards-2026, Local body & Delhi Fire service rules.
5. All the equipment shall be delivered with (i) Manufacturer's test certificate, (ii) Manufacturer's technical catalogues and Installation / Instruction (O&M) manuals.

6. 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.), Escalator 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.

7. 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.

8. 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.

9. 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.

10. 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.

11. 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.

12. 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 4-star rating (where BEE certification is available) or ECSBC Plus (of **ECSBC 2024**) Compliant. Since, the proposed construction is for minimum 4-star GRIHA Rating, all fittings and fixtures shall be provided to ensure minimum 4-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/place 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.

13. Incidental Charges:

All incidental charges of any kind including cartage, storage, wastage and safe custody of material etc. shall be borne by the Contractor.

14. 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.

15. 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.

16. Quality Control and Testing of Materials:

- (a) Main contractor/Associate agency shall submit the required quantity of materials as sample for Testing from Govt. / NABL approved private Laboratory.
- (b) The decision on testing shall be as per E&M quality checklist of CPWD vide OM No. 51(4)/CE(E)/CSQ/2016/293 (H) dated 31.03.2016 as applicable and/or as per direction of Engineer in charge and shall be binding on contractor. Contractor shall submit the required size and quantity of samples for the testing.
- (c) Department shall send the samples to the testing laboratory & the test results shall be reported directly to department.
 - (d) All expenditure to be incurred for testing of samples e.g. packaging, sealing, transportation, loading, unloading etc. including testing charges shall be borne by the contractor.

17. 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.

18. 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.

19. 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.

20. 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.

21. 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.

22. 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 busbar trunking shall be painted in required shade with spray painting with two coats of anticorrosive primer paint at site.

23. 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.

24. 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.

25. Guarantee regarding LED light fixtures:

The 5 years guarantee shall be furnished on non-judicial stamp paper of value Rs.100/- or more, in prescribed proforma for LED light fixtures. 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, 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.

26. 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 for minimum period of 10 years.

27. Cable Laying:

The M30 grade precast RCC utility duct for HT cable from metering point of local electric supply company to the sub-station shall be provided in the entire development zone. For further distribution the DWC pipe/ HDPE pipe/ RCC Hume pipe/ GI pipe shall be used for cable laying in green areas and wherever required. These cables are to be laid below the ground as per CPWD specifications For LT cables and ELV cable laying in outdoor including Optical Fiber cable as well as CAT6 cable, DWC/HDPE/RCC Hume pipe/GI pipe are to be laid below the ground as per CPWD specifications. GI pipes are to be laid in road crossings. Suitable chambers to be provided on cable turnings in order to facilitate cable laying and drawing as well as for maintenance purpose. All the cables including HT, LT and ELV cables are to be laid from the place of service provider to the required places inside campus.

28. 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, if required.
- (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 approvals.

29. 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.

30. 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.

31. 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.

- 32.** Foundation of all equipment as per recommendations of OEM, Anti vibration isolators etc. as required shall be provided.
- 33.** 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.
- 34.** All support for exhaust & water pipes, chimney, busbar trunking, cables, anti-vibration pads etc. as required, shall be provided.
- 35.** 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.
- 36.** 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 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 outgoings etc. as required. Minimum 20% spare circuit with MCB shall also be available. Vertical Type TPDB will have MCCB as Incomer and TP MCB as Outgoing.
2. FRLSH Copper wiring in Mild 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. MS conduit shall be used for recessed/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/ entrance area for each 40 square meter area 1 no. 15/16 amp power outlet with switch and socket shall be provided. In offices/ other area, for each 15 sq meters area in general 1 no. 15/16 amp power plug with switch and socket and two number 5/6 light plug outlet with switch and socket shall be provided.
 - (ii) In addition to above for each computer work stations/Office chair/ executive table/ reception/ entrance/ control room/ souvenir shop/ food court 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 square. Feet shall also be treated as work station.
 - (iii) In addition to above for each machines like indoor unit of air conditioner, server, networking switches, Fire alarm panel 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, souvenir shop, food court etc.
 - 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 IP 65 LED fittings.
 - b. 15/5 Amp power plug socket as required but minimum two nos. for every room or for every 20 square. Meter.
 - 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 Entry forecourt near foot over bridge, bus drop off shelter, four wheeler drop off shelter, Parking Area, pond, Amphitheatre area - General lighting by suspended /surface/ outdoor 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. Main entry gate to be provided LED strip light, up and down light, heritage look post top lantern, bollard light in adjoining area.
 9. 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, LED Strip light, LED Profile Light, Stage 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 (Lux/watt), PF, Color temperature or any other parameter as required)
(1)	(2)	(3)	(4)	(5)
1	Entry Gate			
a.	Entry Gate	As per Design Finalized & Aesthetic of gate.	300	As per Illumination Schedule (Internal) & fulfilling the illumination criteria as mentioned in NBCS-2026.
b.	Control room near entry gate	As per Design Finalized.	300	
c	Manager Room	As per Design Finalized.	300	
d	Monitoring room	As per Design Finalized.	300	
e	Toilet	As per Design Finalized.	250	
f	Traffic Police assistant room	As per Design Finalized.	300	
g	Any other room as per drawing finalized	As per Design Finalized.	300	
2 (a)	Food court except Toilet and common area	As per Design Finalized.	300	
2 (b)	Food court Toilet and common area	As per Design Finalized.	250	
3 (a)	Souvenir Shop & Information Centre except Toilet and common area.	As per Design Finalized.	300	
3 (b)	Souvenir Shop & Information Centre Toilet and common area.	As per Design Finalized.	250	
4 (a)	Entry Forecourt except Toilet and common area.	As per Design Finalized.	300	
4 (b)	Entry Forecourt Toilet and common area.	As per Design Finalized.	250	

10. Ceiling fans will be provided in some selected air conditioned functional areas etc. and in all non air conditioned functional area as per design finalized. Wall fan to be provided in air conditioned area. 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 NBCS 2026/ as per provision laid down in CPWD specifications for internal EI work 2023. In common/ lobby area at each floor of each building minimum 1 no ceiling fans shall be provided.
11. 5-star rating BLDC type ceiling fans and compatible regulator (without remote), 5-star wall fan of 400 mm sweep type, 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

Serial 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)
1	Entry Gate							
b.	Control room near entry gate	Y	Ceiling/ Wall/ Pedestal	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
c	Manager Room	Y	Ceiling/ Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-

d	Monitoring room	Y	Ceiling/ Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
e	Toilet	Y	Exhaust system	Inline/ Exhaust	Y			As per NBCS 2026 design
f	Traffic Police assistant 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
g	Any other room as per drawing finalized	Y	Ceiling/ Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
2	Food court	Y	Ceiling/ Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-
3	Souvenir Shop & Information Centre	Y	Ceiling/ Wall	BLDC Fan-5 Star	Y		Y (Regulator)	-do-

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 4-star rating. Occupancy Sensor shall be designed as per below parameters –

If the calculated capacities and numbers of all the equipment mentioned above is less than the minimum capacities and numbers mentioned, the contractor shall provide all the equipment as per the capacities and numbers mentioned above. If calculated capacity is more than the minimum capacities and numbers mentioned above, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

- a. OS-1 (10 Amp, Coverage – 5m diameter, PIR Technology)
- b. OS-2 (10 Amp, Coverage - 5m x 20m, Microwave Based Technology)
- c. OS-3 (10 Amp, Coverage - 5m diameter, PIR Technology with Photo Sensor)
- d. Each toilet shall be provided with inline Exhaust system.
(Occupancy sensor for all area as per detailed engineering and as decided by Engineer-in-charge.)

12. MS Conduit with GI junction box for Telephone, Data network and CCTV. (Cat-6A cabling / telephone wiring and faces plate etc. as per requirement for CCTV etc.
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 One call bell point shall be provided in each building & red green indication lights for the office.

15. Energy conservation measures with Lighting automation i/c occupancy sensors as mentioned below shall be provided:
- (i) Arranging circuit and timer-based auto control based on occupancy to switch off 50% light in common area (Corridors, Staircase & Toilets in all Building) during lean hours.
16. Earthing system:
GI plate/Pipe 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 Escalator, CCTV, FAS and any other services as per OEM requirement.
 - (c) 2 Nos. Copper Earth pit along with copper strip for UPS Room.
 - (d) 2 Nos. Copper Earth pit along with copper strip for roof top solar power generation plant.
17. **Lightning arrester** system for complete lightning protection including walls protection for Food court and Entry Forecourt buildings as per IS/IEC-62305/ NBCS 2026 requirement.

**EXTERNAL STREET LIGHTING INCLUDING LANDSCAPE LIGHTING OF THE
CAMPUS AND BUILDINGS: -**

The EPC contactor shall do detailed designing for External Street Lighting including Landscape Lighting Of The Complex and Building as per the guidelines of lightning schedule and shall provide the infrastructure as required as per actual requirement of site. The photos of lighting luminaire are for guiding purpose.

Connections shall be done with minimum 4 x 16 sq.mm XLPE insulated PVC sheathed armoured Aluminum cable of 1.1 KV grade laid in DWC HDPE pipe in ground as per CPWD specifications between outdoor feeder pillar to termination box of pole etc. and three core 1.5 sq.mm **copper** wiring between termination box to fitting i/c their termination.

1. Lighting level as per **NBCS 2026** to be maintained in whole Campus including Entry gate, Entry forecourt, Foot over bridge, Bus drop-off shelter, four wheeler drop-off shelter, Landscape bridge, pond, Amphitheatre area etc. and there should be automation with 100% external lighting.
2. With lighting level of minimum 50 lux to be maintained with 100% external lighting in ON condition for all hardscape areas including Entry gate, Entry forecourt, Foot over bridge, Bus drop-off shelter, Four-wheeler drop-off shelter, Landscape bridge, pond, Amphitheatre area etc.
3. With the provision of alternate switching OFF lighting to achieve 10 and 20 LUX for all hardscape areas.
4. GI Octagonal Poles of minimum 6 Meter height is to be provided for 45/60-Watt LED Street Light Fittings.
5. Main entry gate to be provided LED strip light, up and down light, heritage look post top lantern, bollard light in adjoining area.
6. 3/ 4 Meter Decorative heritage look Poles to be used for Post Top Light.
If the calculated capacities and numbers of all the equipment mentioned above is less than the minimum capacities and numbers mentioned, the contractor shall provide all the equipment as per the capacities and numbers mentioned above. If calculated capacity is more than the minimum capacities and numbers mentioned above, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.
7. Following Energy conservation measures shall be followed:
 - a. Feeder pillar with programmable logic timer controller and astronomical timers.
 - b. Arranging circuit and timer-based auto control to switch off 50% lights during lean hours namely: Street lighting, path lighting and Bollard lighting

	EXTERNAL LIGHTING SCHEDULE				Minimum quantities.
I	L-1	BOLLARD	900MM TALL, 175-225 MM DIAMETER BOLLARD. IP 66, IK-10. THE LUMINAIRE MATERIAL SHOULD BE EXTRUDED ALUMINUM, POWDER-COATED FINISH, LUMINAIRE BODY COLOR SHOULD BE ANTHRACITE GRAY WHERE LUMINAIRE IS TO BE INSTALLED WITH ANTI-AGING AND ANTI-UV HIGH OPTICAL EFFICIENCY PMMA LENSES, CLEAR TEMPERED GLASS COVER. SYSTEM LUMEN PACK SHOULD NOT BE LESS THAN 1000 LUMEN 360° SYMMETRICAL OPTICS TYPE V. THE POWER CONSUMPTION SHOULD NOT BE MORE THAN 10 WATTS, CCT 3000K. IT SHOULD HAVE CRI>80, SDCM≤5, LIFE CLASS L70B50 > 50,000 HRS. THE POTTED DRIVER SHOULD BE INTEGRATED NON-DIMMABLE WITH PF>0.9 & THD<5%. POTTED DRIVER EFFICIENCY > 85% . ELECTRONIC POWER SUPPLY FOR LED MODULE, WHICH OFFERS PROTECTION AGAINST SHORT CIRCUIT, OVER- VOLTAGE & OVER-CURRENT, WITH IN BUILT SURGE PROTECTION > 4KV AND EXTERNAL SPD OF 10 KV FIXTURE SHOULD BE BIS CERTIFIED.	 	As per detail design
II	L-2	POST TOP	SINGLE PIECE WITH A CIRCULAR SHAPE MADE OF EXTRUDED ALUMINUM PROCESS, IP 66, IK-		As per detail design

			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		
III	L-3	LIGHT POLE	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	 	As per detail design

			POLE. THE GRADE OF GRAVITY DIE CAST MATERIAL SHALL BE LM6. A BASE COMPARTMENT WITH A DIE CAST bus 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 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. OCTAGON AL 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		As per detail design

			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.		
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. 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.		As per detail design

			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		
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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, Entry gate, Entry forecourt, Foot over bridge, Bus drop-off shelter, Four wheeler drop-off shelter, Landscape bridge, pond, Amphitheatre area, 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. Complete lighting of entry gate and surrounding area including fountain and its RGB lighting and associated equipment like cable, panel etc. are within the scope of work.
6. Fountain complete with its RGB lighting and associated equipment like cable, panel etc. in pond near Amphitheatre area are within the scope of work
7. All fixtures wire termination must have IP67 connector
8. All luminaires and their respective drivers must be BIS certified.
9. 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.
10. 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 NBCS 2026, **ECSBC 2024**, relevant IS codes shall 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 mild steel conduits and accessories. 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 DB's. 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 some areas points may be group controlled (not requiring separate switch) or as decided by Engineer-in-charge.
- e. 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. 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. For AC outdoor units copper cable of minimum size 4x16 sq.mm. will be required.
- 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 or fire survival cable shall be used for fire Alarm system, PA system.
- d. Voltage drop for feeders shall not exceed 2% at design load. Voltage drop for branch circuit shall not exceed 3% at design load.

6. 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 lumen /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 lumen /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 lumen /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 lumen /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

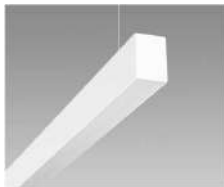
- a. Luminaires shall be in compliance with IS10322.
- b. Driver shall have over voltage, over current, open circuit and short circuit protection confirming to EN 61547. The driver should comply to IEC61000-3-2 ED.3.2, 2009 for harmonics, IEC61347 -2 -13, 2006 in conjunction with IEC61347-1 ED.2.0, 2007 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 Stretch 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 lumen /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 luminaires (LED type) shall be decided as per schedule, functional requirement, design and drawing approved.

c. Internal Lighting Schedules

S. N.	REFERENCE	DESCRIPTION / REFERENCE		PRODUCT IMAGE
	INETRNAL			
I	I-1		LINEAR CONNECTED	
II	I-2		DOWNLIGHTER	
III	I-3	-	DOWNLIGHTER	
IV	I-4	-	SUSPENDED DOWNLIGHTER _AESTHTETICS	
VII	I-7	STRETCH CEILING	UNIFORM LIGHT PLANE	
VIII	I-8	FALSE CEILING AREA		
IX	I-9	TRUE CEILING	SUSPENDED	
X	I-10	MEDIUM BAY		

7. Lightning Arrester

- a. 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.
- b. Detailed designing to be got done from professional and shall be submitted to Engineer-in-charge for approval.

8. Specification for Cable Tray

- a) 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.
- b) 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.
- c) Proper factory made Tee, Bend, cross, joints and other accessories shall be used
- d) Planning of cable tray and support system may be prepared using suitable software of the OEM of cable tray.
- e) 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.

9. Modular Type DLP Trunking:

- (i) Shall be made from very high quality of heavy duty PVC with very good strength.
- (ii) Shall be used to distribute power as well as LAN cables.
- (iii) 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.
- (iv) The different components involved are: DLP Trunking Base, Flexible Cover, Separation Partition, Clip On Partition (For creating separate compartments in 100*50 & above 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.)
- (v) 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

10. Floor Raceway:

- i) Floor race ways, if to be provided (in conference hall, auditorium stage) shall be as per document provided in schedules of documents.

11. Shifting of Transformer: Dismantling, shifting, re-installation, testing, and commissioning of the existing outdoor transformer, including disconnecting existing HT/LT cable terminations, bus-duct connections, neutral/body earthing strips, and structural fasteners etc. are within the scope of work.

12. Dismantling of existing street light poles approximately 50 numbers and stacking is also within the scope of work.

13. Conduiting for telephone and Data Networking system is to be done. Supplying and Laying of CAT6, optical fiber cable and telephone cable are to be done. Modular GI Box and accessories complete with RJ 45 and telephone sockets are to be installed as per design finalized and as per the instruction of Engineer in charge.

14. 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.

15. 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 ensured as per CPWD Specifications.
- h. Color 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.

16. Test:

- a. After completing the work, necessary test results as envisaged in CPWD General Specifications Part-I (Internal)-2023 & 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.

17. 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.

18. 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 equipment
- 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 up to 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 up to 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 up to and including 250 volts and rated current up to 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 up to 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 up to and including 33 KV rating (Second Revision)
IS : 1258 – 1987	Bayonet lamp holders(Third revision)
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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.

DOOR FRAME METAL DETECTORS & BAGGAGE SCANNERS

The scope of this sub head covers planning, designing, supply, installation, testing and commissioning of DFMD, baggage scanner etc. Work includes not only the items exclusively defined here under but also any other item required for commissioning 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.

If the calculated capacities and numbers of all the equipment mentioned above is less than the minimum capacities and numbers mentioned, the contractor shall provide all the equipment as per the capacities and numbers mentioned above. If calculated capacity is more than the minimum capacities and numbers mentioned above, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

1. DOOR FRAME METAL DETECTORS:

- (i) Providing minimum two sets DFMD at the entry gate of Zoo.
- (ii) Necessary hardware, software, Power and control cabling etc. as required.
- (iii) **Specification of Door frame metal detectors:**

20 zone or above door frame metal detector nominal size: 760 mm (W) x 2050 mm (H) x 700 mm (D) along with necessary software, power and control cabling etc. suitable for operation on 230 volts single phase supply +/- 10% AC, complete as required.

The metal detector set should be intelligent, microprocessor controlled & PC compatible. It should have the following features and controls: Latest technology like continuous wave; It should consist of minimum required number of zones, each zone should have facility of auto calibration. The unit should be active continuously.

It should be simple to operate; It should have keypad provision for all program settings; Detector should have self-test program and system fault indicators; Sensitivity, threshold & volume of each zone should be digitally controlled in steps from 0-99; There must be independent sensitivity setting of each zone;

The detector should have zone display on side panel of the frame along the length; The detector should have multimode counter i.e. IN, OUT, total IN & OUT; The detector should display the time, counter, program setting and sensitivity during setting; It should have IR occupancy sensor for traffic counter. Alarm should be active only when occupancy is there; It should be able to detect the objects as small as 15 mm ferrous or non-ferrous metal cubes; The walk-through door frame should be of FRP material and built in control unit to display different alarms and location of the metal; It should meet the test requirement as per relevant ASTM standards (ASTM C1309- 97, ASTM C1270- 97 etc.) or equivalent Indian standards.

Two numbers Hand Held Metal Detectors with charger to be provided with each DFMD is in the scope of work.

Note:- The suitable size online UPS with 30 minutes battery backup along with maintenance free battery for each Door frame metal detector is also in scope of work.

BAGGAGE SCANNERS:

- (i) Providing two numbers of Baggage scanner at the entry gate of Zoo.
- (ii) Operator console, necessary hardware, software, Power and control cabling etc. as required.

(iii) Specification for Baggage Scanner

X-Ray baggage scanner, suitable for operation on 230 V single phase supply, 50 Hz (170 V to 260 V), complete with X-Ray source/ generator, sensors, video display, features of multi energy X Ray image facility, compliant to Radiation safety standards, Lead impregnated safety screen, Threat Image Protection (TIP) system software, required computer with CPU, hard disk, mouse, keyboard, CD -RW Drive: DVD Drive etc. compete as required.

The X-Ray Baggage Inspection System shall be suitable for indoor use and the radiation level should not exceed accepted health standard (0.1 R/Hour at a distance of 5 cm from external housing). (Relevant certificate from AERB) It shall be as per QR/specification for 'X-RAY BAGGAGE INSPECTION SYSTEM', approved by MHA vide letter No. F/No. W-42011(494)/QRs/CISF/Tech/2008/MHA - Prov-I-1422 Dated 08th September, 2016.

Computer based multi energy X-Ray baggage inspection system mounted on castor wheels capable of passing through bags of nominal dimensions 540mm(W) x 350mm(H), belt height 750mm to 850mm, 22"/24" LCD monitor, Input/Output rollers with frames etc. as required.

Note: - The suitable size online UPS with 30 minutes battery backup along with maintenance free battery for each baggage scanner is also in scope of work.

1. 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 various system to be installed.
- (ii). SLD's
- (iii). Any other drawings relevant to the work.

2. 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). Warranty Certificates
- (iii). OEM Manuals of Equipment
- (iv). Any other information the Engineer-In-Charge may deem fit.

Uninterrupted Power Supply (UPS)

Scope of Work:

The scope of work includes the design, supply, installation, testing, and commissioning of all necessary equipment and systems to ensure a fully operational UPS capable of meeting the specified power demands of the Entry Gate, Food court, Souvenir Shop & Information Centre, Entry Forecourt. The system should be capable of supporting the power needs during outages or power fluctuations, ensuring the safety and continuity of servers. Develop a comprehensive design for the load capacity, redundancy, battery backup time, scalability, including single-line diagrams (SLDs), electrical schematics and detailed layout plans and submit the design for approval to engineer-in-charge, after that supply, installation, testing, and commissioning of components including UPS units, batteries, battery cabinets, bypass switches, distribution panels, and associated electrical components and all other necessary associated components to ensure a fully operational system that meets all relevant safety standards and regulations etc. Provide a warranty for the UPS installed systems covering a period of 1 (One) years against any defects in materials or workmanship.

Minimum 30 KVA UPS System is to be provided for Entry Gate, Food court, Souvenir Shop & Information Centre, Entry Forecourt.

3 Phase input, single phase/three phase output, with 30 minutes backup along with housing of batteries, its cabling, 2 Nos. copper earthing & associated electrical panels complete etc. as required.

The UPS panel shall be taking 3 phase input power from the Main LT panel and distributed to all UPS units. The UPS outgoings shall be terminated to the UPS DBs at various locations.

The UPS / Battery rooms shall be air conditioned with split Acs with timer provision (N + 1 combination).

Power Back- Up

- Power back up UPS with minimum 30 minutes Backup with the help of maintenance free batteries should be installed to provide continuous, uninterrupted power to life safety circuits comprising of:
 - 25% lighting in staircases and Corridors.
 - All computer points and ELV system.
 - 100% Exit signage's

Part lighting load of following areas (At least 25% fittings subject to minimum one fitting on UPS)

Corridors, work stations in administrative block, Lobbies, waiting area, Escalator lobbies & Escape corridors, all buildings, Electrical Rooms, LT Panel Room, Pump room, Fire pump room, Fire control room (lighting and all socket outlets), Security room, Traffic & Police Assistance Room, Manager room, CCTV Monitoring room, Control room, STP etc.

Minimum Inventory to be followed in designing of UPS system:

Sl. No.	Location	Backup	Rating	Qty in Nos.
1	Entry Gate, Food court, Souvenir Shop & Information Centre, Entry Forecourt.	30 minutes backup	30 KVA	1 set

NOTE:

- The above capacity of the system is indicative (minimum). Bidders are requested to evaluate the capacities of actual system considering the UPS load requirements of the building. If the calculated capacity of UPS is higher than the mentioned capacity in the above table, then the higher capacity, as evaluated by contractor, shall be installed in the scope of Contractor. Bidders are requested to quote accordingly.
- If the calculated capacities of UPS is less than the minimum capacity mentioned in the above table, the contractor shall provide all the UPS as per the capacity mentioned in the above table. If calculated capacity is more than the minimum capacity mentioned in the above table, the contractor shall provide the UPS as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.
- Separate battery banks shall be provided for each working and parallel UPS system.

Specifications:

This specification describes a three-phase input and three/single phase output (based on requirement), modular hot swappable type, on-line, continuous operation, solid-state uninterruptible power supply system (UPS) providing at least level-2 power backup.

The Modular UPS shall be installed in a single UPS room/any designated place and shall operate as an active power control system, working in conjunction with the building electrical system to provide power conditioning and on-line power protection for the critical loads.

System description

Each UPS module must have the following built-in parts / features: IGBT PWM Rectifier based input charger (float cum equalizing), IGBT technology based Inverter. Automatic Bi-directional Static switch; Inbuilt Manual Bypass Switch;

K13 rated Copper Wound Galvanic Isolation transformer at UPS Output after the static Galvanic inverter output isolation transformer (inbuilt/external). switch as per IEEE 1100-2005 in a separate cabinet (inbuilt);

Fully Microprocessor Controlled Circuitry;

Inverter with stipulated Switching Frequency with PWM controlled using DSP logic. Analog control shall not be acceptable;

A UPS shall be tested against EMC (Electromagnetic compatibility) category C2; Inbuilt/External Back Feed protection shall be provided.

Input phase reversal protection & Correction (The system should run in mains operation in spite of phase sequence reversal) & same should be shown is SLD.

Provision for separate Input for rectifier and for Bypass.

Event Monitoring & Diagnostics Last 100 events with exact date & time should be monitored from the front LCD panel of the UPS & up to 900 events from UPS system memory using Laptop.

The UPS system shall be continuous duty, highly reliable and solid state. The system shall be modular in design so that any individual unit can be easily isolated / taken out for repair or any additional added in future for increasing the capacity;

The UPS shall be fully microprocessor controlled till the level of rectifier / inverter;

UPS system output must be independently brought out to the UPS and synchronized (voltage, phase angle and frequency must be equal). The provision of parallel operation and automatic bypass shall be provided as per the site specific requirements.

The design manufacture, inspection, testing and installation of the UPS System covered under this specification shall conform to the latest international standards such as:

EN 62040-1 - General Safety Regulations.

EN 62040-2 - EMC Regulations

Battery:

Battery should be designed to provide 30 minutes back up or more as required. Battery should be 12V lead acid sealed maintenance free type. The UPS module shall have the Battery Circuit breaker mounted in the battery Rack. When this breaker is opened no battery voltage should be present in the UPS enclosure. The UPS module should be disconnected automatically when the battery reaches to the minimum discharge voltage level or when signaled by other control functions.

Each UPS must have minimum 30 minutes power backup.

Technical Specification for Online UPS System:

SL. NO.	DESCRIPTION	SPECIFICATION
1	CAPACITY	Suitable capacity as per design
2	INPUT	
a)	Input facility - Phases / Wires	As per OEM Design.
b)	Nominal Input Voltage	380 / 400 / 415V AC
c)	Input Voltage Range	-20% +15%
d)	Input Current Harmonics (THDi)	<3% @ 100% load
e)	Nominal Input Frequency	50Hz $\pm$ 1 %
f)	Input Power Factor	> 0.99 on Full resistive load Load
g)	Generator Compatibility	Compatibility to genset supply required
h)	Individual Module Protection	Micro Switches with modules
3	OUTPUT	

a)	OUTPUT VOLTAGE	220/240/380 / 400 / 415V AC
b)	Output Voltage Regulation	+/- 1%
c)	Nominal Output Frequency	50 / 60 Hz
d)	Output Frequency Regulation	+/- 0.05 Hz (Free Running / Self Clocked Mode) + / - 5 % (Synchronized to Mains Mode, Selectable)
e)	Load Power Factor Range	0.9 Lag to Unity
f)	Output Over Voltage Protection	Built in Protection required
g)	Output Under Voltage Protection	Built in Protection required
h)	Over load capacity	OEM specifications shall be accepted
i)	Total Harmonic Distortion	Less than 2% for linear load, Less than 5% for non-linear load
j)	Short Circuit protection	Soft Shut down occur without blowing any fuse
k)	Wave form	Pure sine Wave
l)	Battery Backup	30 Min backup @ full load considered. Calculation shall be as per IEEE 485 Standards
m)	VAH	Suitable capacity as per design
4	ISOLATION	
a)	Manual Bypass switch	Required
b)	Isolation Transformer	Required.
5	INDICATIONS	
a)	Over temperature	Required
b)	Load on Battery	Required
c)	Battery On charge	Required
d)	Battery Low	Required
e)	Mains on	Required
f)	DC on	Required
g)	Inverter on	Required
h)	Inverter Tripped	
	1. Output Over Voltage	Required
	2. Output Low	Required
	3. Over Load System	Required
6	EFFICIENCY	
a)	Overall Efficiency	>90 % (Including Transformer Loss)
b)	Inverter Efficiency	>92%
7	LCD MONITORING	
a)	Input/output voltage	Required
b)	Frequency	Required

c)	load%	Required
d)	Battery %	Required
8	BATTERY	
a)	Minimum Charger Rating (Including internal / external)	10% of Battery Ah rating offered
b)	Battery recharge time (After complete discharge) to 90% capacity	8 to 10 hours to 90% capacity
c)	Battery Protection (Vendor to specify the rating)	External Battery Isolator / Breaker
d)	Battery Housing (Vendor to provide the GA drawings of the offered Battery Rack)	Should be compact and space saving MS steel open racks complete with interconnectors / Battery fuse box or isolator (in case of external protection)
9	Audible Alarm for Following Conditions	
a)	Battery Low	Required
b)	Mains Failure	Required
c)	Inverter Under-Voltage	Required
d)	Inverter Over Voltage	Required
e)	Over temperature	Required
f)	Inverter Overload	Required
	Restart / Testing Capability	
	Cold start facility	UPS should be capable of start up on battery mode (when charged) even if Mains power is not available
	Battery Indication	User Friendly Battery Indications with indicative colors shall be provided
	Parallel	UPS should be capable of paralleling minimum four numbers of similar rating UPS where in if communication connection failure ups still continue to work in right way without any repercussions on the load.
10	Environmental	
a)	Operating Temperature	0 - 40 Deg C
b)	Humidity	10-90% (non-condensing)
c)	Noise level	<65 Db at full load from 1 meter distance
d)	Altitude	< 1000 meters
11	Cabinet	CRCA sheet with powder coated finish
12	Protection	IP-20
	Mandatory Certifications	

13	BIS Certificate	Required
14	Company Certifications	ISO 9001:2015, 14001:2015, 45001:2018
15	Type Test Report	Required
16	Communication interface	
a)	Display	LCD Display, LED Indication
b)	Required as Standard	RS232, Mod-Bus RS485, SNMP-Ethernet
17	Dimensions (mm) (W x D x H)	To be Specified
a)	Weight	To be Specified
b)	Color	To be Specified
c)	Input / output terminals	Cables input from bottom
18	Service center	Company Owned Company Operated After Sales Support centers should be required with Toll free Customer care Number
19	BMS Compatibility	BMS Compatible protocol shall be provided for each UPS System.

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 work from Sub-station to all Panels 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 equipment, like transformer, HT Panel, cable, MCCB, ACB, Bus bar etc. mentioned hereunder are minimum. EPC contractor shall do detailed design and calculations and provide the capacity of equipment like transformer, HT Panel, cable, MCCB, ACB, Bus bar etc. accordingly, subject to minimum capacities mentioned hereunder.

If the calculated capacities of all the equipment mentioned below is less than the minimum capacity mentioned, the contractor shall provide all the equipment as per the capacity mentioned below. If calculated capacity is more than the minimum capacity mentioned below, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

1. 11KV HT cable of size minimum 3 core x 180 sq.mm. 11 KV HT XLPE (E) Cable from supply company termination point to HT panel and also from metering panel to HT panel. All required works from supply agency termination point are in the scope of work.
2. One source of electric connection will be taken from local electric supply agency.
3. HT VCB Panel having one number incomer and minimum 2 numbers of outgoings.
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 1x315 KVA, 11 KV/433volt Dry type Transformer with ON load tap changer and RTCC and AVR.
6. HT panel and transformers shall be connected through 3 core 11 KV HT XLPE(E) Cable of minimum size 180 sq.mm.
7. Transformer and main LT panel will be connected with sandwich type bus duct of minimum 650 amps 50ka.
8. Main LT panel (normal supply) and sub-LT panel (normal supply) for receiving supply from Transformers having incomers EDO/MDO 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/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. 1 no APFC Panel each of minimum 135 KVAR with 7% detuned filters.
11. 1 sets of outdoor type bus trunking of minimum 300 A 50 KA or cable of suitable size from DG sets to Main essential Panel/AMF Panel
12. Cable of suitable size (for AC panel) from normal panel to main VRV/ VRF panel.
13. Load up to 100 KW is to be taken on existing substation transformers. Suitable size panel shall be compatible with the existing LT panel. Cable and panel works are within the scope of work.
14. Minimum 01 no of suitable size XLPE insulated PVC sheathed aluminum conductor armoured 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 E&M services.
15. Minimum 01 no. of suitable size XLPE insulated PVC sheathed aluminum conductor armoured Cables for power supply from sub-LT panels and sub emergency panel (of ESS) to various sub-LT panels of individual E&M services.
16. Minimum 01 no of suitable size XLPE insulated PVC sheathed aluminum conductor armoured Cables for power supply from main emergency panel (of ESS) to firefighting panels.
17. Minimum 01 no of suitable size XLPE insulated PVC sheathed aluminum conductor armoured Cables for power supply from main emergency panel (of ESS) to different water supply pump panel/hydro pneumatic pump panel, Escalator etc.
18. Minimum 01 no suitable size XLPE insulated PVC sheathed aluminum conductor armoured Cables for power supply from main Emergency panel (of ESS) to STP panel.
19. Minimum 01 no suitable size XLPE insulated PVC sheathed copper conductor armored Cables for power supply from sub distribution panel to each of the outdoor units..
20. Firefighting system, water supply system, STP, Escalator etc. including their connection /inter connection.
21. Sub LT panels as required for any service covered in the scope of E&M works.
22. Escalator 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
23. HVAC VRV/VRF System Main Panels and sub-panels if required etc.
24. UPS power distribution Panel/ vertical TPDB near UPS and UPS DB's
25. Earthing sets as per CPWD Specifications and as per OEM requirements.
26. Lighting arrestor work.

D2.2 DESIGN BASIS, SPECIAL REQUIREMENTS

- Scheme for the substation shall be as under.
 - a. Ono number indoor dry type transformers.
 - b. HT Panel and transformers will be connected through three core 11 KV HT XLPE(E) of appropriate size sq.mm.
 - c. Transformer and main LT panel will be connected with sandwich type bus duct.

- d. Transformer and LT panel (main supply) will be connected with sandwich type bus duct, having current rating 25% more than the calculated capacity.
 - e. Main Sub LT Panel for supplying power to smaller loads having MCCB's as outgoing.
 - f. Main LT panel for receiving supply from Transformers, from Solar Power Plant and Bus coupler and ACB's & MCCBs as outgoing.
 - g. Main Sub LT Essential Panel for supplying power to smaller loads having MCCB's as outgoing.
 - h. Escalator panel/ DB shall be provided for escalator at required places. This shall receive supply from respective building.
 - i. Power supply to Fire pump panels through cables.
 - j. UPS power distribution panel/ DBs (for critical services) shall be installed near UPS, while UPS DB's shall be provided near UPS load in each building.
 - k. External lighting feeder pillar, STP plant panel, some AC load, pump house panel shall be provided power supply from Essential Main Sub Panel.
 - l. One number APFC panel shall be provided on main LT panel and having tripping arrangement in case of DG supply in the main panel.
 - m. 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, External EI, Firefighting equipment, fire alarm system, Escalator, Air conditioner, STP, Automatic flap barrier system, baggage scanner, metal detector, ELV system, etc. and any kind of connected (or proposed to be connected) equipment 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 - 50%
 - (iii) Diversity factor for air-conditioning load - 80%
 - (iv) Diversity factor for pumps of any type– 60%
 - (v) Diversity factor for escalator load – 60%
 - (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 – 0.9
 - (ix) 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 S t a t i o n 2013, Part-II External 2023, Part VII DG Set 2013. 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 number.
- (b) Size: Appropriate size based on actual load calculation
- (c) Type of cable: steel armoured, Aluminium Conductor flat strip armoured XLPE 11 KV E Bearing IS 7098 (II)-1985 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) - 1973 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) 1973 amended up to the date.

3. HT Panel

- (a) HT cable from that meter room shall be brought to main HT panel. Minimum 1 number and 2 number of outgoing in HT panels with VCB, metering (in all panels and suitable for net metering) and protection equipment 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 : 3 (1 incomer + 2 outgoing)
 - (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 / tri vector 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 set) :

- (i) 1 set (each of 3 numbers) 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

- (i) 2 numbers 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 appropriate size of aluminum armoured XLPE(E) cable. 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.

4. Transformer

- (a) Type: Dry Type indoor with OLTC, RTC, AVR
- (b) Rating: Minimum 315 KVA, 11 KV/ 0.433 KV Transformer, 3 phase, 50 Hz, Dyn -11, vector group copper wound
- (c) Other criteria like, various indicators, % impedance, tap changer, cable end box, and other accessories shall have maximum losses at 50% at Full Load as per table of ECSBC 2024 code with amendments if any for ECSBC plus. The entire work shall comply with the latest CPWD specifications for electrical works, substation part-IV 2013.
- (d) The transformers shall be installed in substation Room.
- (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 appropriate size 11KV 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 within 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.

- (i) The transformer shall be suitably designed so that total maximum allowable losses shall be as per ECSBC plus.
- (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 650 Amp. from the top of the Transformer.

H.T. sides of the transformers shall have cable end boxes to receive 11 KV appropriate size 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 recorded 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 ECSBC plus compliant at 50% and full load rating.

5. Bus trunking and rising mains

- a. 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.
- b. 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.

- c. Major bus trunkings shall be as follows (Minimum capacity):
 - (i) Between each Transformer and main MV panel (normal supply) 650 A
 - (ii) MV Panel to Essential Panel 300 A – 1 set
 - (iii) DG set to Essential Panel 300 A – 1 set
 - (iv) Inside the building from panel to various floors(if required)

All Bus Bars of panels, Bus trunking and Rising Mains shall be of minimum 25% more capacity than the Ampere rating required.

- d. 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. Panels

(a) LT Distribution – GENERAL

- (i) LT Cabling from LT Panel to Buildings is in the scope of contractor.
- (ii) All the switchgears must have Motorized operation and shall be electrical Draw out/ MDO type. In order to ensure the same, the required number of potential free NO/NC contacts for both input and output shall be provided with each switchgear.
- (iii) **Earthing:** Earthing system consisting of earth electrode, earth conductor, earth bus, protective conductor etc. for the building shall be as per provision laid down in NBCS 2026 / BIS Standards IS 3043:2018 and IS 732:2019 and CPWD specifications. Earthing system should be designed such as to maintain required earth resistance as specified in the above standards.
- (iv) The energy meters for monitoring as per GRIHA norms are required to be with IBMS compatibility and shall be having provision of meter reading by RS485/Ethernet/TCP/IP communication port which shall be communicating required parameters to a required DCU or gateway feeding the IBMS software. The energy meters of each panel shall be looped with RS 485 ports, and the communication shall be done by laying CAT 6A cables which will be terminating to the GATEWAY required for wireless/wired communication. Near every panel where communication via RS 485 is required, a LAN port shall be provided for ethernet connectivity to gateways.

The GA drawings of panel boards must be approved from Engineer in charge before fabrication work. The panel board shall consist of ACB/MCCB as incomer and outgoing, bus bar, digital type ammeter, voltmeter OR multifunction meter, selector switches, LED type indication lamps etc. as per standard sound engineering practice. As part of GRIHA 4-star requirement for calculating energy consumption of every service, all the outgoings

shall be provided with Energy Meter with a communication port. Every switchgear, energy meter / multi-function meter shall have RS 485 port.

The following are the main items to be provided. The configurations / specifications are the minimum required and any modifications as per requirement of norms and local authorities may be made.

7. APFC Panel-

- (i) One no APFC panels for Main LT panel shall be provided. Panel shall have 100% Automatically (ON/OFF) arrangement of connected Capacitors.
- (ii) Capacity: To be Designed of required capacity to maintain overall P.F. of the system between 0.98 to 1.00
- (iii) CT's: 3 no CT's to be provided in incomer feeder of Main Panel
- (iv) Relay: 3 CT operated minimum 12 steps with display of Amp, power factor etc.
- (v) Incomer: Microprocessor controlled 3 pole ACB of designed capacity
- (vi) Bus bar : Copper or aluminum of suitable rating
- (vii) Type of capacitor:
 - Heavy duty 525 V,
 - Dielectric self healing type shunt capacitor
 - Capacitor type HA type resin banded low loss terminal less without oil
 - Capacitor should be housed in a cylindrical aluminum to assure better heat dissipation and compact size.
- (viii) Detuned filter
 - The aluminium conductor used either have dual coat enamel insulation or are provided with insulation of nomex paper, capable of withstanding temperature exceeding 180 0C.
 - High linearity ($L > 0.95 \times L_n$: 200%) for 7% detuned reactor.
 - H- class insulation.
 - Vacuum impregnated.
 - Tolerance of inductance should not be more than 5%.
 - For the temp, protection a Temp sensor should be there.
- (ix) Contactors: Capacitor duty contactor of 50% more than required ratings
- (x) Other accessories and metering instruments like
 - power factor digital meter,
 - APFC relay,
 - 24 V DC Shunt trip coil,
 - Three Phase Under voltage relay,
 - Three Phase Over voltage relay,
 - ON /OFF push button with controlling MCCB of 25 KA fault capacity for each capacitor (MCB not allowed) ,
 - Digital Ammeter with selector switch with CTs, ON/OFF/TRIP indicating lamps etc. shall be as per CPWD specifications and

applicable IS codes.

- 2 amp MCB shall be used for protection of indication lamps

Note: -

1. 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 IBMS on Ethernet, selector switches, LED type indication lamps, cable alleys, gland plate, supported by angle iron frame etc. as per standard sound engineering practice.

8. ACB:

- (a) All ACB's shall be 4 pole/3 pole MDO/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 IBMS/SACADA/monitoring purpose.

9. MCCB:

- (a) 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.
- (b) 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.
- (c) All MCCBs should be provided the Rotary Operating Mechanism. The ROM should be door interlock (defeat feature) & padlock facility.
- (d) MCCB should have Spreader links & Phase barriers as standard feature.
- (e) MCCB of more than 400 A shall not be used, in such case ACB shall be used
- (f) The MCCB should have double break, positive isolation current limiting, load line reversibility & horizontal cum vertical mounting features.
- (g) 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
- (h) 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.
- (i) All MCCB's above 100 A shall have RS 485 port for IBMS/SACADA/monitoring purpose.

10. 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

11. 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.

12. 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 Equipment
- (iv) Any other information the Engineer-In-Charge may deemed fit.

13. 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. Impedence 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

	When starting	After Running
Load	Cold(in hours)	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 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. 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 equipment like cable, MCCB, ACB, Bus bar etc. mentioned hereunder are minimum. EPC contractor shall do detailed design and calculations and provide the capacity of equipment like DG set, cable, MCCB, ACB, Bus bar etc. accordingly, subject to minimum capacities mentioned hereunder.

If the calculated capacities of all the equipment mentioned below is less than the minimum capacity mentioned, the contractor shall provide all the equipment as per the capacity mentioned below. If calculated capacity is more than the minimum capacity mentioned below, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

1. Outdoor Silent type (with outdoor acoustic enclosure) Diesel generating set one number of minimum capacity of 160 KVA (CPCB IV+) Prime Power rating at 0.8 power factor, turbo charged water cooled, secondary cooling through top mounted radiator, Power Command Supervisor (PCS)/C&I panel with arrangements for auto load sharing and synchronizing of DG sets.
2. PLC based system to ensure:
 - (i) Auto Synchronization of DG sets through synchronizing panel.
 - Either Grid supply incomer breakers or DG supply incomer breaker only are made in main essential Panel
 - Only required no. of DG sets are made depending on Electrical Load
 - Programmable selection of outgoing feeders based on priority set, to control load.
3. LT panel with ACB/MCCB for local control/isolation of DG set, to be provided with in sound proof enclosure for emergency operation.
4. AMF panels for DG set.
5. Complete Electrical and control wiring for various accessories etc
6. Earthing system etc as per CPWD specifications.
7. Foundations for equipment's including vibration isolation springs/pads.
8. POL i.e. HSD oil and lubrication 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 lubrication oil for trial run of each 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. Stack height will be as per CPCB/CPWD norms.

11. All pipes or cable connections.
12. Painting of all exposed metal surface of equipment's and components in appropriate color.
13. 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.
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 1 year 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.
2. All internal and external lighting of Campus.
3. 100% escalator of all the buildings.
4. STP, hydro pneumatic system & drinking water pumps.
5. All Computer Working Stations of all buildings.
6. Firefighting system.
7. All ELV services like fire alarm, CCTV, Baggage scanners, DFMD, Automated Flap Barrier System.
8. Air conditioning load as desired by client department during designing stage.

The selection of DG Set rating shall be done after taking all above factors in consideration. The bus duct between DG set and Main Essential Panel shall have 25% more capacity than required Ampere rating of DG set.

DG set shall be installed at ground PCC foundation. 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.

1. Inspection And Testing of DG Sets of Capacity More Than 200 KVA

- i) The successful tenderer will arrange staff/POL/for test run at his cost.

- ii) For DG sets of capacity more than 200 KVA, testing shall necessary be carried out at Factory/manufacturing premises in presence of representative of the Department.
- iii) 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.
- iv) The department also reserves the right to inspect the fabrication job at factory and the successful tenderer has to make arrangements for the same.
- v) 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
- vi) 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.

2. 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.

3. Safety Measures

All equipment shall incorporate suitable safety provision to ensure safety of the operating personal as per manufacturers' standard practice.

4. 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.

5. Drawings for Approval & Completion Drawings

Drawings for approval on award of the work

- i) 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.
- ii) 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.
- iii) Drawings including section, showing the details of erection of entire equipment's.
- iv) Drawings including section and elevation showing the details of erection of Chimney
- v) Dimensioned drawing of Acoustic enclosure/Engine-Alternator set and Electrical control panel.
- vi) Drawings showing details of support for pipes, cable trays, ducts etc.
- vii) Any other drawings relevant to the work.

6. Drawings / Documents to be furnished on completion of installation.

As built drawings as below shall be submitted

- i) 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 DG set room where synchronization panel/auto load sharing panel is installed. 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:
- ii) DG set installation drawings giving complete details of all the equipment's, including their foundation.
- iii) Line diagram and layout of all electrical control panel giving switchgear ratings and their disposition, cable feeder sizes and their layout.
- iv) Control wiring drawings including all control components and sequence of operation to explain the operation of control circuits in Synchronization panel/PCC.
- v) Manufacturer's technical catalogues of all equipment's and accessories.
- vi) Operation and maintenance manual of all major equipment's, detailing all adjustments, operation and maintenance procedure.
- vii) Test Certificate Routine and Type Test for Alternator, Engine and Acoustic Enclosure

7. 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.

8. 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-160 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: SOLAR PHOTO VOLTAIC POWER GENERATION PLANT

D4.1 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.

If the calculated capacities of all the equipment mentioned below is less than the minimum capacity mentioned, the contractor shall provide all the equipment as per the capacity mentioned below. If calculated capacity is more than the minimum capacity mentioned below, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

1. Minimum capacity of Solar Power Generation Plant shall be 50 KWp, grid interactive (on shed at scattered places)/ Roof Top of Buildings. High efficiency PV cells with high efficiency invertors shall be used. **Minimum power output guarantee offered for the SPV Module shall be for minimum 25 years.**
2. Inverters/Power conditioning unit (PCU suitable for mains as well as DG supply) as required, however capacity of each inverter minimum 50 KWp.
3. AC collection Panel with metering to monitor generation and AC cabling from Panel to
4. receiving switch.
5. Tap off boxes with 4 pole 63A/ 100A/200A MCCB for receiving solar power in Essential bus trunking or whatever required by local electric supply company.
6. 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 Busbar trunking by providing necessary tap off boxes
7. Mounting structure on ground and terrace, protection of system for external / internal causes and from all kind of surges etc.
8. Earthing and Lightning protection of Solar system
9. Approval of scheme before start of work from local electric supply company.
10. Including installation of net metering local electric supply company.

S.	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 any shed area & Roof Top area of Buildings 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	

D4.2 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 area available for its installation.
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 any shed and Roof top Solar structure considering 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 that, generated output shall not deteriorate by less than 90% at the end of 10 years and 80% at the end of 25 years. Minimum Guaranteed Generated output (units/year) for 50 KWP system have been calculated as under:

- a. Minimum capacity of Roof Top Solar System: 50 KWP
- b. Minimum guaranteed Generation required = 1,00,000 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.

D4.3 SPECIFICATIONS AND DESIGN

1. Module mounting structure

- a) The indicative layout of array structure is shown above for the guidance of EPC contactor. 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, $E_{f,c}$ - $>23\%$
 - ii) Efficiency of module, $E_{f,m}$ - $>23\%$
- 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

±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

- a) Toughened, anti-reflective, low iron content, high transmissivity front glass. Anodized Aluminum Frame.
- b) Ethyl Vinyl Acetate (EVA) encapsulant
- c) Silicon edge sealant around laminate
- d) Tedlar / Polyester trilaminate back surface
- e) IP 67 rated ABS plastic terminal box for the module output termination with gasket to prevent water moisture.
- f) IP 68 rating for water abrasion, hail impact, humidity & other environment factor for the worst situation at site.
- g) 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:

- a) Combine groups of modules into independent charging sub-arrays that shall be wired to the controller.
- b) Provide arrangement for disconnection for each of the groups.
- c) Provide a test point for each sub-group for quick fault location.
 - i) To provide group array isolation.
 - ii) The rating of the JB's shall be suitable with adequate safety factor to inter connect the Solar PV array.
 - iii) 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:

- a) Combine groups of modules into independent charging sub-arrays that shall be wired to the controller.
- b) Provide arrangement for disconnection for each of the groups.
- c) Provide a test point for each sub-group for quick fault location.
- d) Provide group array isolation.
- e) The rating of the JB's shall be suitable with adequate safety factor to inter connect the Solar PV array.
- f) By-pass Diode
- g) 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.
 - i) 415V AC $\pm$ 5% 50Hz, 3 Phase
 - ii) Overload capacity – 150% for 60sec.
 - iii) Output wave shape: sine wave with <3% total harmonic distortion (THD).
 - iv) Adjust the Voltage and Frequency Levels to suit the Grid in normal case
 - v) 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 FRLSH type copper conductor as per IS694:2010. All the cables shall be supplied conforming to IS7098 (Part-1)-1988 with up-to-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 optimize 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. 40 KWp.

c) The Inverter shall have following features:

- i) Auxiliary 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 current and 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.

19. STANDARDS FOR SOLAR PHOTOVOLTAIC (PV) POWER PLANTS/SYSTEMS

A. PV MODULES:

The PV modules must conform to the latest edition of any of the following IEC/equivalent BIS standards for PV module design qualification and type approval:

Crystalline Silicon Terrestrial PV modules	:	IEC
61215/ISI 14286 Thin Film Terrestrial PV modules	:	IEC 61646
Concentrator PV Modules & Assemblies	:	IEC62108

In addition, the modules must conform to IEC 61730 Part1-requirements for construction & Part2 – requirements for testing, for safety qualification.

PV modules to be used in a highly corrosive atmosphere (coastal areas, etc.) must

quality. Salt Mist Corrosion Testing as per IEC 61701.

B. BALANCE OF SYSTEM (BoS) ITEMS/COMPONENTS:

The BoS items/components of the SPV power plants/systems deployed under the work must conform to the latest edition of IEC/equivalent BIS standards as specified below:

BoS Item/component	Applicable IEC/equivalent BIS standard	
	Standard Description	Standard Number
Power conditioner/ Inverters*	Efficiency Measurements Environmental Testing	EN61000–6-3 EN 50178
MPPT units*	Design Qualification Environmental Testing	EN 50178 UL 1741 CSA 107.1
Cables	General test and measuring methods XLPE insulated and PVC sheathed cables for	IEC 60189 IS 694 / IS 1554 IS/IEC 69947
	working voltage up to and including 1100 V- Do-UV resistant for outdoor installation	
Switches/Circuit Breakers/Connectors	General Requirements Connectors – Safety	IS/IEC 60947 part I, II & III, EN 50521
Junction Boxes/ Enclosures	General Requirements	IP 65 (for outdoor)/IP 21 (for indoor) IEC 62208
SPV System Design	PV Stand-alone Systems Design verification	IEC61215 IEC61730 IEC61701
Installation Practices	Electrical installation of buildings requirements for SPV power supply Systems	IEC 61730

*Must additionally conform to the relevant national/international electrical safety standards.

Any other accessories required for installation, testing and commissioning of whole photo voltaic solar plant are within the scope of work.

D-5: PASSENGER ESCALATOR

D5.1 SCOPE OF WORK:

Scope of this sub head covers planning as per traffic analysis, designing, supply, installation, testing and commissioning of passenger Escalator in food court/ souvenir shop in accordance with NBCS 2026 and CPWD General Specification Part-III (Lifts & Escalators) 2003 as amended up to 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.

If the calculated capacities and numbers of all the equipment mentioned below is less than the minimum capacity mentioned, the contractor shall provide all the equipment as per the capacity mentioned below. If calculated capacity is more than the minimum capacity mentioned below, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

Two number of passenger Escalator is to be installed in food court /souvenir shop and information centre building.

Required civil work etc. are in the scope of work. Required electrical works such as interconnections from Panels, Cables, Control Panel, MCCB, lighting, earthing etc.

The CMC of all escalator for 1 (One) year 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 Escalator and shall submit to Engineer-in-charge.

D5.2 SPECIFICATIONS AND DESIGN CONCEPT:

All the works shall be carried out as per CPWD General specification for Electrical Works, Part-I (Internal-2023); Part-II (External) 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.

D5.3 TECHNICAL PARAMETERS

The complete Escalator shall comprise of all parts and accessories, which are necessary for its efficient operation, whether specifically mentioned or not. The requirements mentioned herewith are the minimum to be provided. Key parts and accessories along with their functions and features are listed as follows:

Power supply	AC 3-phase,50 or 60Hz
Lighting power supply	AC single phase,50 or 60Hz
Rated speed	0.5m/sec

Control system	Inverter (VVVF)
Transport capacity (persons/hr)	4500 (minimum)
inclination	30 / 35 degree
Environment	Indoor
Automatic oiler	Required
Step width (mm) - minimum	800 mm
Escalator Width	1500 mm
Numbers	2 numbers
Safety features	Stop-Buzzer Key Switch Step with Anti-Slip Grooves Comb Light Anti-Slip Floor Plate Step Demarcation Lighting Demarcation Line Three Horizontal Steps Warning System on Moving Handrail Inlet (Inlet Sensor) Warning System on Outer Deck (Outer Deck Sensor) Tiered Demarcation Line Directional Indicator on Handrail Inlet Cap (Handrail Inlet Cap LED Indicator)
Finish and decorative components	Balustrade - Transparent tempered glass panel Skirt Guard - Stainless steel hairline with skirt guard lighting Deck Board - Stainless steel hairline Step - Aluminium alloy Step Tread with Yellow Demarcation Line Floor Plate - Decorative Panel (Embossed stainless steel) with Comb Moving Handrail - Rubber

D5.4 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 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 Machines and Electrical supply
- v) Any other drawings relevant to the work.
- vi) Data Sheet

D5.5 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) Warranty Certificates
- iii) OEM Manuals of Equipment
- iv) Any other information the Engineer-In-Charge may deem fit.

D-6: HEATING VENTILLATION AND AIR CONDITIONING (VRV/VRF SYSTEM)

SCOPE OF WORK

The scope of work involves design, supply, installation, testing and commissioning of 250 HP VRV/VRF air conditioning system for functional requirement of the food court, souvenir shop and information centre, control room, manager room, monitoring room, traffic police assistant room, and in any room as per design finalized and as per design calculation as per guidelines issued by ASHRAE, BIS, CPWD specifications, NBCS 2026 and additional specifications applicable and also as per direction of Engineer in charge. VRF/VRV system functional including indicating and protection equipment, related civil and E&M works are included in the scope of the work.

The contractor shall calculate heat load of the building based on Light, Power, Equipment Load and occupancy of Staffs, Visitors etc. Temperature, Humidity & Air Changes requirements in museum, aquarium and marine interpretation centre and it should be as per CPWD Specification for HVAC 2024, NBCS 2026, ASHRAE, Guidelines etc. This design shall be checked by CPWD & client Department and shall be vetted by IIT/any other premier engineering institute as referred in the agreement or as per decision of engineer in charge.

Design, supply, installation, testing and commissioning of fans and necessary equipment for pressurization of lobbies, staircases, and smoke extraction system, exhaust system in all toilets, kitchen and pantry in all buildings shall be in the scope of contractor. Analysis and design required for pressurization in absence of natural ventilation shall be done to arrive at adequate numbers, capacity and type of fans and other necessary equipment. Bidders shall quote accordingly.

The outdoor units of VRV/VRF units shall be kept on terrace or on ground floor after making suitable foundation or stand.

Area / Rooms to be air conditioned using VRV/VRF System - All Areas except service shafts, Toilet area and common area. Hi wall Type and/or cassette type indoor units shall be provided. COP of the System shall be for ECSBC plus building. Ductable AC to be used in areas as per design and requirement.

NOTE:

- The above capacity of 250 HP of the system is indicative. Bidders are requested to evaluate the capacity of actual system considering the actual areas of rooms to be air conditioned, heat load, ducting requirement (wherever necessary), heat dissipation etc. If the calculated capacity of VRF/VRV system is higher than the mentioned capacity, then the higher capacity, as evaluated by contractor, shall be installed and nothing extra payment shall be paid. Bidders are requested to quote accordingly.
- Ensure that all the insulation used in the building envelope are CFC and HCFC free.
- Ensure that the refrigerant used in the systems and refrigeration equipment is CFC and HCFC free.

Additional points to be considered in designing of system:

- Designer may design the system with duct or ductless keeping requirement of fresh air.
- Treated Fresh Air System (with indoor and outdoor units) shall be taken in designing.
- DOAS (Dedicated Outdoor Air System shall also be taken in designing if required.
- Sufficient number and capacity of 5-star inverter wall mounted/ cassette split ACs shall be considered in smaller rooms if required other than VRV/VRF system. Ductable AC to be used in areas as per design and requirement.
- If the calculated capacities of all the equipment mentioned above is less than the minimum capacity mentioned, the contractor shall provide all the equipment as per the capacity mentioned above. If calculated capacity is more than the minimum capacity mentioned above, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

Schedule for VRV/VRF AC system, Mechanical Ventilation and Smoke Extraction System: For areas to be air conditioned

Sl No.	Description	Parameter	Parameter values	Remarks
1	Building/ project details indicating: a. Location: NZP, New Delhi			All the parameters are given is reference only. Actual value shall be arrived as per the standard design practice /NBCS 2026/ CPWD specifications for HVAC
2	Outside Conditions applicable for Building / project			
	i) Summer	DBT	43	
		WBT	25	
		RH	25-30%	
	ii) Winter	DBT	4-10	
		WBT	3-8	
		RH	50%	
	iii) Monsoon	DBT	35-38	
		WBT	24-30	
		RH	60-80%	

3	Inside conditions required for the building / proposed project (area wise / room wise / building wise)			
	i) Summer	DBT	24	
		WBT	18	
		RH	60%	
	ii) Winter	DBT	24	
		WBT	18	
		RH	60%	
	iii) Monsoon	DBT	24	
		WBT	18	
		RH	60%	
	Air Quality Parameters	Fresh Air requirement/ Air changes	6 ACPH (Final requirement shall be as per the NBCS-2026 amended up to date and CPWD General Specifications for Heating, Ventilation & Air- Conditioning (HVAC) Works-2024 for HVAC)	
		area wise as required)		
		Acceptable level of CO2	1000PPM	
		Acceptable level of CO	35PPM	
	Any other parameter applicable	NA		
4.	Design Consideration for Special Purposes to be indicated for e.g.			
	a. UPS Room	NA		
	b. Server Room	NA		
	c. Special equipment rooms	NA		
	d. Storage Rooms	NA		
	e. Any other room/ area as per site requirement			
5.	Any Other Design			

	Consideration			
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Ventilation requirements for Non-air conditioned area (in Normal and Fire Condition) to be indicated:

Ventilation & Fresh Air Requirement for

Sl. No.	Location / rooms /spaces/ equipment room (as applicable)	Air changes/ Fresh air requirement (under normal condition)	Air changes/ Fresh air requirement (under Fire condition)
a.	Toilets	6 ACPH (Final requirement shall be as per the NBCS- 2026 amended up to date and CPWD General Specifications for Heating, Ventilation & Air- Conditioning (HVAC) Works-2024 for HVAC)	12 ACPH (Final requirement shall be as per the NBCS- 2026 amended up to date and CPWD General Specifications for Heating, Ventilation & Air- Conditioning (HVAC) Works-2024 for HVAC)
b.	Staircase	Do	Do
c.	Fire Exit Route	Do	Do
d.	Sub Station Rooms	Do	Do
e.	STP Plant Rooms	Do	Do
f.	Electrical Panel Rooms	Do	Do
g.	Fire Fighting Plant Room/pump house	Do	Do
h.	Water Supply Plant/Pump Room	Do	Do
i.	Storage Rooms	Do	Do
j.	Fire Shafts	Do	Do
k.	Any other room/ area as per site Requirement –	Do	Do

Pressurization and smoke extraction requirement to be indicated for

Sl. No.	Location	Applicable parameters for normal condition	Applicable parameters For Fire condition
1.	Lobby	6 ACPH (Final requirement shall be as per the NBCS-2026 amended up to date and CPWD General Specifications for Heating, Ventilation & Air-Conditioning (HVAC) Works-2024 for HVAC)	12 ACPH (Final requirement shall be as per the NBCS-2026 amended up to date and CPWD General Specifications for Heating, Ventilation & Air-Conditioning (HVAC) Works-2024 for HVAC)
2.	Staircase	Do	Do
3.	Staircase Lobby	Do	Do
4.	Fire Shafts	Do	Do
5.	Fire Exit Routes	Do	Do
6.	Any other room / area as per site requirement		

Sl No	Name of Equipment / item (as applicable)	Location	Name of Parameters	Value of Parameters	Details of spare / stand by required
1.	TFA	As per Design finalized.	As per Design finalized.	As per Design finalized.	As per Design finalized.
2.	Unitary Window/split Unit	As per Design finalized.	As per Design finalized.	As per Design finalized.	As per Design finalized.
3.	Smoke Extraction Fans	As per the NBCS-2026 amended up to date and CPWD General Specifications for Heating, Ventilation & Air-	Fresh Air Fan – 6 ACPH in normal condition	Fresh Air Fan – 12 ACPH in fire condition	Spare is required for the Fresh Air fan

		Conditioning (HVAC) Works-2024 for HVAC)			
4.	Ventilation Fans	As per the NBCS-2026 amended up to date and CPWD General Specifications for Heating, Ventilation & Air-Conditioning (HVAC) Works-2024 for HVAC)	As per Design finalized.	As per Design finalized.	As per Design finalized.
5.	Pressurization Fans	As per the NBCS-2026 amended up to date and CPWD General Specifications for Heating, Ventilation & Air-Conditioning (HVAC) Works-2024 for HVAC)	As per Design finalized.	As per Design finalized.	As per Design finalized.
6.	Heat Recovery Wheel	As per Design finalized.	As per Design finalized.	As per Design finalized.	As per Design finalized.
7.	Ducting	As per Design	As per Design finalized.	As per Design finalized.	As per Design finalized.

		finalized.			
8.	Copper Piping	As per Design finalized.	As per Design finalized.	As per Design finalized.	As per Design finalized.
9.	Any other equipment / systems as per site requirement	As per Design finalized.	Fresh Air Fan – 6 ACPH in normal condition	Fresh Air Fan – 12 ACPH in fire condition	Spare is required for the Fresh Air fan

BASIS OF DESIGN:

- The VRV/VRF system is to be designed for the indoor temperature of minimum 16⁰C (though 21⁰-24⁰ C shall be maintained in normal conditions) with the air changes as per provisions contained in ASHRAE, BIS, CPWD specifications, NBCS 2026 and additional specifications.
- Refrigerant to be used: R-134a/R-32/R-600a/R-290/ R-410a or any other eco-friendly refrigerant.
- The copper refrigerant piping shall directly pass through the indoor units, ductable units.
- Outdoor unit modular type variable refrigerant flow/variable refrigerant volume air cool outdoor units suitable for cooling and heating having all hermetically sealed inverter type Scroll Compressor(s), minimum two compressors for above 14 HP modules shall be used in designing & supplying of the units. The unit shall deliver the rated capacity at AHRI Conditions and work even at 50°C ambient temperature without tripping. The unit shall be suitable to work on 400V +/- 10%, 3 Phase, 50Hz AC power supply. The unit shall be filled with first charge of the refrigerant and ready for use as required.
- Indoor units: Ceiling mounted cassette type unit / High wall type / ductable type (where required)

1.1 Indoor Unit:

- ✓ **Cassette type :** Supply, installation, testing and commissioning of 4- way flow **2' x 2' compact** VRV/VRF Cassette Type Indoor ceiling mounted unit equipped with synthetic washable media pre-filter, fan section with low noise fan/dynamically balanced blower, multispeed motor, coil section with DX Copper coil, electronic expansion valve, outer cabinet, drain pump, grill, necessary supports, vibration isolation, cord less remote control etc., suitable for operation on single phase 230 V ± 10%, 50Hz AC supply, complete, as required.
- ✓ **High wall type:** Supply, installation, testing and commissioning of

VRV/VRF High wall type Indoor unit equipped with washable synthetic media pre-filter, fan section with low noise fan/dynamically balanced blower, multispeed motor, coil section with DX copper coil, electronic expansion valve, outer cabinet, cord less remote control, drain pan, necessary accessories etc., suitable for operation on 230 V $\pm$ 10%, 50 Hz, single phase AC supply, complete as required.

- ✓ Ductable type (High/Medium Static Ductable type): Supply, installation, testing and commissioning of external static pressure VRF/VRV ceiling mounted ductable type Indoor unit equipped with washable synthetic media pre-filter, fan section with low noise fan/dynamically balanced blower, multispeed motor, coil section with DX copper coil, electronic expansion valve, corded remote control, outer cabinet, vibration isolators, drain pan, diffuser, grille and other necessary supports etc., suitable for operation on single phase AC supply 230 V $\pm$ 10%, 50 Hz complete as required.
- The soft/hard drawn copper refrigerant piping shall be used for the designing installation testing and commissioning of VRV/VRF system.
- Drain pipes shall terminate in toilets/ outside drain etc. and with the help of drain pumps wherever required.

TECHNICAL SPECIFICATION

- The scope of this tender comprises the design, supply, erection, testing and commissioning of inverter technology-based Scroll Type VRV/VRF type system of air conditioning conforming to these specification/ Explanatory Note. The contractor shall calculate equipment capacity based upon design parameters specified for the system design & verify all the quantities and sizes of copper refrigerant pipe, fitting, cables, control cable, pipes, insulation, indoor units, and outdoor units etc. before installation to avoid any shortfall or surplus. The tenderer shall also include all necessary civil work and MS framework for installation of outdoor and indoor units in VRF based air conditioning system. The work includes the refrigerant gas & its charging for proper & specified functioning of air conditioning system.
 - ✓ The scope of work of the contractor also includes:
 - ✓ Cutting of walls and floors/ceiling.
 - ✓ Making holes.
 - ✓ Sleeves.
 - ✓ Foundations
- Civil work & MS frame work for indoor and outdoor units related to VRV/VRF equipment, all cuttings should be properly finished as existing surrounding. The scope in the tender schedule also includes detailed designing of complete air-

conditioning system based on inverter technology base Scroll VRF air conditioner with air cooled outdoor units system capable of cooling and heating (reverse cycle) as per individual or season requirement suitable for operation on 415 V, 3 Phase, 50 Hz AC electric supply. The outdoor units shall have both cooling & heat pump mode, consisting of one/ multiple outdoor unit with single circuit of refrigerant piping and multiple indoor units of various types. Each indoor unit should have capability to cool or heat as per seasonal weather changes. This shall also include complete capacity calculation for indoor and outdoor units complete with CAD drawing, designing & layout of following:

- ✓ Outdoor units.
 - ✓ Indoor units.
 - ✓ Refrigerant piping
 - ✓ Condensate water piping & disposal
 - ✓ Power & Control Cables between Outdoor units & Indoor units.
 - ✓ Cable tray layout
- While designing the system, the care should be taken to select outdoor units of suitable capacity based on design data & to economize on available floor area for installation of outdoor units as well as optimum utilization of outdoor units. The indoor units should be designed based upon the heat load calculations for individual rooms/ areas to be air-conditioned and over capacities should be avoided. The design should also specifically take care of disposal of condensate drain water so that there is no leakage of condensate water inside the room as well in the route of condensate water pipe line. The lay-out of refrigerant piping is to be designed in such a way so that it should not disturb the aesthetic of the building/ room, inadvertent damage in the route of pipe should not occur in future & optimum length of pipe line for efficient air conditioning. After completion of the work four sets of “as erected/ commissioned drawing” of activities listed above shall be submitted. Suitable size GI cable tray shall be provided for laying of cables on terrace for outdoor units.
 - **Outdoor Unit**
 - ✓ The outdoor unit shall be factory assembled, weatherproof casing (Material of casing shall be vendor's standard design), constructed from heavy gauge GI sheets steel panels and coated with baked enamel finish. The outdoor unit shall be completely factory wired, tested with all necessary controls & filled with first charge of refrigerant before delivering at site.
 - ✓ The inverter technology based on Scroll type VRV/VRF equipment should be capable so that refrigerant piping between indoor units and outdoor unit shall be extendable up to 165m of equivalent length with maximum height difference between outdoor & indoor unit of 90m & level difference between two indoor units shall be maximum up to 15m. All the outdoor

units comprising of multiple modules should have all inverter type compressor in each module.

- ✓ The outdoor unit shall be factory tested and filled with first charge of refrigerant before delivering at site. Any extra refrigerant filling for proper cooling shall be done by the contractor only without any extra cost whatsoever.
- ✓ It should also be provided with duty cycling for D.C inverter Scroll compressors capable of changing the 'rotating speed of compressor by inverter controller to follow variation in cooling & heating loads & switching starting sequence for better stability and prolonging equipment life.
- ✓ The unit shall be provided with its own microprocessor control panel with provision for integration with the building management system for Air-conditioning system.
- ✓ The machine must have a sub cool feature to use coil surface more effectively through proper circuit bridge so that it prevents the flushing of refrigerant from long piping due to this effect thereby achieving energy savings.
- ✓ The outdoor unit should 'be fitted with low noise level and should not be more than 67 db (A) at normal operation at a horizontal distance of 1 mtr when measured at 1.5m vertical distance from ground level.
- ✓ The outdoor unit should be fitted with low noise aero spiral design fan with aero fitting grill for spiral discharge airflow to reduce pressure loss and should be fixed with DC/AC fan motor for better efficiency.
- ✓ In case of trouble occurs in an indoor unit(s), the continuous operation of system should be possible.
- ✓ The outdoor unit shall be designed in such a way that cleaning of drain Pan should be easy & inspection/ replacement of compressor should be easy.
- ✓ The condensing unit shall be designed to operate safely when connected to multiple fan coil units.
- ✓ The outdoor units shall be provided in such a fashion that these do not affect the overall aesthetics and ambience of the building. If required these units shall be suitably camouflaged to give good aesthetic look.

- **Compressor**

- ✓ The compressor in inverter based D.C Twin Scroll System shall be highly efficient. The system should response efficiently in accordance to the variation in cooling or heating load requirement.
- ✓ All outdoor units shall have multiple steps of capacity control to meet load fluctuation and indoor unit individual control. All parts of compressor shall be sufficiently lubricated stock. Forced lubrication may also be employed.
- ✓ Oil heaters shall be provided in the compressor casing or as per manufacturer standard equipment.

- **Oil Recovery system**

Unit shall be equipped with an oil recovery system to ensure stable operation with long refrigeration piping lengths. The system must be provided with oil balancing circuit to avoid poor lubrication.

- **Refrigerant Circuit**

- ✓ The refrigerant circuit shall include liquid and gas shut-off valves and a solenoid valves at condenser end. The equipment must have inbuilt refrigerant stabilization control for proper refrigerant distribution.
- ✓ All necessary safety devices shall be provided to ensure the safe operation of the system.

- **Heat Exchanger**

- ✓ The heat exchanger shall be constructed with copper tubes mechanically bonded to aluminium/Copper fins to form a cross fin coil. The aluminium/Copper fins shall be covered by anticorrosion resin film.
- ✓ The unit shall be provided with necessary number of direct driven low noise level propeller type fans arranged for vertical discharge. Each fan shall have a safety guard.

- **Safety Devices** - All necessary safety devices shall be provided to ensure safe operation of the system. Following safety devices shall be part of outdoor unit: high pressure switch, fuse, fan drive overload protector, fusible plug, crankcase heater, over load relay, overload protection for inverter based technology & digital based technology.

- **Indoor Units** - All indoor units as specified shall have, in general, noise levels less than 46 db. For critical applications noise levels below these limits may, however, be specified during design stage.

- ✓ Each unit shall have electronic control valve to control refrigerant flow rate respond to load variation of the room.
- ✓ The address of the indoor unit shall be set automatically or through central controller in case of individual and group control.
- ✓ The fan shall be dual suction, aerodynamically designed, Turbo, multi blade type, statically & dynamically balanced to ensure low noise and vibration free operation of the system. The fan shall be direct driven type, mounted directly on motor shaft having support from housing.
- ✓ The cooling coil shall be made out of seamless copper tubes and having continuous aluminium/Copper fins. The fins shall be spaced by collars forming an integral part. The tubes shall be staggered in the direction of airflow. The tubes shall be hydraulically/ mechanically expanded for minimum thermal contact resistance with fins. Each coil shall be factory tested at 21 kg/square.meter air pressure under water.

- ✓ Indoor unit shall have cleanable type filter fixed to an integrally moulded/ moulded plastic frame. The filter shall be slide in and neatly insertable type. It shall be possible to clean the filters either with compressed air or water.
 - ✓ Each unit shall have Electronic control expansion valve for variable refrigerant Flow Effect.
 - ✓ Each indoor high wall, unit shall be with corded/cordless remote controller as standard features. The controller shall be able to change fan speed as per requirement.
- **Ref net Joints / Header Joints**

The system shall use V-Joint/ Ref-net separation refrigeration pipe joints and headers in the appropriate orientation to enable correct distribution of refrigerant. The Distribution Joints should be factory insulated with pre-formed sections of Expanded Polystyrene/Equivalent
 - **Refrigerant Piping with insulation and with UV protection coating**
 - ✓ Refrigerant piping for the air-conditioning system shall be up to 19.1 mm diameter of soft seamless copper tubes & for above 19.1 mm diameter the pipe material shall be of hard seamless copper tubes with pipes material being hard drawn copper pipe. Forged copper fittings shall be used for the refrigerant piping. The refrigerant piping arrangements shall be in accordance with good engineering practices as applicable to the air-conditioning industry, and shall include charging connections, suction line insulation and all other items normally forming part of proper refrigerant circuits except Y joint/separation tubes.
 - ✓ Before joining any copper pipe or fittings, its internals shall be thoroughly cleaned by passing a clean cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. while constructing the joints. Subsequently it shall be thoroughly blown out using nitrogen gas.
 - ✓ After completion of installation of the refrigerant piping, the refrigerant piping system shall be pressure tested using nitrogen gas at a suitable pressure as specified by OEM (Original Equipment Manufacturer). Pressure shall be maintained in the system for 48 hours. The system shall then be evacuated to vacuum of not less than 700 mm Hg and held for 24 hours.
 - ✓ The supplier of air-conditioning system shall choose sizes as designed and erect proper interconnections of the complete refrigerant circuit. The thickness of copper piping shall be as per DSR (items for VRF/VRV air conditioning system) – 2025.
 - ✓ The suction line pipe size and the liquid line pipe sizes shall be selected according to the manufacturer's specified diameter. All refrigerant pipes shall be properly supported and anchored to the building/structure using

steel hangers, fasteners, brackets and supports which shall be fixed to the building/structure by means of inserts or expansion shields or anchor fasteners of adequate size and number to support the load imposed thereon.

- ✓ The refrigerant piping should be laid in such a way that it should not distort the interior of the room, wherever the refrigerant pipe has to be laid across the room, it should be laid in a concealed. All associated minor Civil Engineering works (like chasing on wall, ceiling & re-plastering & repainting etc.) related with the above items are included in the scope of work. The above scope does not include false ceiling wherever required.
- ✓ To protect Nitrile rubber insulation of outdoor installed copper piping from degradation due to ultra violet rays and atmospheric condition, it shall be covered with poly shield coating of at least two coats of resin and hardener (poly bond make or equivalent). Fiber glass tape shall be helically wound with adequate overlap & coated with two coats of resin with hardener to give smooth & plain finish.
- ✓ Entire liquid and suction refrigerant pipe lines including all fittings, valves and strainer bodies, etc. shall be insulated as per DSR (items for VRF/VRV air conditioning system) – 2025.
- ✓ UV protection coating on existing copper pipes (with insulation) shall be done with the help of star bond and 7mm cloth etc. UV protection coating shall be done on all the pipes irrespective of size of pipes.

- **Treated Fresh Air Units**

The outdoor unit shall be factory assembled, weather proof casing (Material of construction of casing shall be vendor's standard design), constructed from heavy gauge GI sheets panels and coated with baked enamel finish. The outdoor unit shall be completely factory wired tested with all necessary controls before delivering at site.

DX Cooling coil shall be deep, as per manufacture's standards, made of copper tubes of minimum 0.5 mm thickness fins of minimum 0.15mm thickness, mechanically bonded to the coils. No. of fins per cm of tube shall be 4 to 5. The coil shall be thoroughly evacuated, dried and pressure tested to 21 kg / sq.cm.

U bends shall be of copper, joined to the tubes by brazing, soft soldering shall not be used. The depth of the coil shall be such as to suit the requirements, viz re-circulated air applications, or 100% fresh air applications and the bypass factor required shall be specified in the tender specifications. Pan type humidifier shall be complete with stainless steel sheet (minimum 2mm thick) tank duly insulated, stem outlet nozzle, top open able with stainless steel bolts, immersion heaters, low level cut out, humidistat, thermostat; safety that, float valve, i/c first charge of

refrigerant.

The fins shall be aluminium/Copper. The minimum thickness of the fins shall be 0.15mm nominal. The no. of fins shall not be less than 4.7 per cm length of coil. Fins may be of either spiral or plate type. The tubes shall be mechanically expanded to ensure proper thermal contact between fins and tubes. The fins shall be evenly spaced and upright. The fins bent during installation shall be carefully realigned. For coastal areas fins shall be phenolic coated and for 100% F.A. application fins shall be hydrophilic type.

The coil shall be suitable for use with the refrigerant as specified. Refrigerating coil shall be designed for the maximum working pressure under the operating conditions. The unit must be suitable for three phase A/C power supply and have their control panel.

- **Drain Piping duly insulated**

The drain pipe connection of each fan coil unit to the main header should be 25 mm dia/32 mm dia as required. The header pipe should be of 40 mm dia/32 mm dia as required. The drain-pipe should be heavy PPR pipe ISI marked and conforming to relevant IS complete with fitting as required whereas the connection of the fan coil unit to the PPR pipe should be with flexible braided pipe. The drain piping should be insulated with 6 mm thick tubular nitrile rubber insulation.

For proper drainage of condensate U trap shall be provided in the drain piping wherever required. Drainage arrangement shall be concealed as far as possible. If it is not possible due to some technical constraint, then all pipe supports shall be prefabricated and pre-painted slotted angle supports, properly installed with clamps. The condensate drain pipe arrangement for disposal of condensate water be made in such a way that there should not be any leakages of condensate water inside rooms as well in the route of drain water pipe line & water should be discharged in the ground/ rain water harvesting system at the location jointly decided with Engineer-in-Charge of work or his representative. All associated Civil Engineering works, if required, as per requirement at site in above connection like making chase in the wall & restoring its original shape by re-plastering & repainting, etc. are included in the scope of work. The arrangement of drain- pipe shall be made in such a way that it should not affect the aesthetic of the building as well as is maintenance friendly & easily accessible.

Various Sizes PVC Insulated Copper Conductor Wiring

Cables- PVC insulated FRLSH multi stranded copper conductor wiring cable for working voltage up to & including 1100 Volts, ISI marked conforming to IS 694/1990 (Latest Version). Wiring of installation shall be in conformity with IS 732/1989 (Latest Version), IS 4648/1968 (Latest Version)

Rigid MS Conduit Pipe Laying conduit shall be in conformity with IS:732/1989 (Latest Version), IS 4648/1968 (Latest Version) and other relevant IS codes and accessories shall conform to relevant IS

- **Duct Insulation & Duct Lining**

- ✓ SCOPE

The scope of this section comprises the supply and application of insulation conforming to CPWD Specifications for HVAC.

All ducts shall be site fabricated. Supply Air Ducts shall have acoustic lining, insulation.

Pressurization of Stair case, Lift shafts and lobbies with pressurization fans, ducting, Control Panels, cabling etc. shall be provided as per NBCS 2026 and Delhi Fire Service requirements. Smoke Evacuation and ventilation System on all floors shall be provided. It shall be actuated by Fire alarm Panel/System and shall be integrated with BMS System if required.

All Toilets shall be provided with Exhaust System with pressurization fans, ducting, Control Panels, cabling etc.

1.2 Precision AC for Server Room

Air-conditioning units should be designed to achieve the specific environmental operating requirements published by the OEMs. The design shall ensure that their devices will function properly by maintaining the minimum and maximum operating temperature at the server intake, and the quantity of airflow measured in CFM required at the server's intake. 2 Bypass of airflow (conditioned air supplied from the precision air conditioning units is delivered directly back to the air conditioner's intake) like penetrating of air through cable cut-outs, holes under enclosures, or misplaced perforated tiles etc should be completely blocked. The indoor unit shall be floor mounted type consisting of Compressor, Cooling Coil, and Indoor fan. The casing shall be double skin design. The outer skin shall be minimum 18G sheet or better as per manufacturer standards The front panels are attached to the framework by means of rapid-coupling "fasteners".

The standard panels shall be lined up with minimum 15mm thick PUF insulation. Fiber glass is not acceptable in place of insulation.

The energy consumption of the building should be minimum but without affecting the functional requirements of the building. So, the equipment selected must be energy efficient.

D-7: FIRE FIGHTING SYSTEM (WET RISER, SPRINKLER SYSTEM, EMERGENCY LIGHTING, ILLUMINATED SIGNAGE & FIRE EXTINGUISHER)

SCOPE OF WORK:

Scope of this sub head covers planning, designing, supplying, execution, testing, commissioning and obtaining approvals from Delhi Fire Services for all works required to complete Fire Fighting System as per CPWD Specifications Part-V Wet Riser and Sprinkler System-2020, guidelines of the National Building Construction Standard -2026, relevant BIS Codes, local bye laws and requirements of Delhi Fire Services. This includes not only the items exclusively defined hereunder but also any other item required for 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 (including jockey, main pump and diesel engine pump) of required Head and discharge and 1 set of Panels along with all accessories for following systems:
 - 1. Wet riser system in Food court and Souvenir shop & information centre etc.
 - 2. Yard Hydrant system with ring mains in whole campus around all the building, structure.
 - 3. Wet Riser with Sprinkler System in Food Court and Souvenir Shop & Information Centre etc.
 - 4. Layout of Pumps and panel shall be as per CPWD specification.
 - 5. FBC connection at main gate and outside each building, etc.
- B. C class Heavy duty MS Piping for wet riser, hydrant, sprinkler system along with all type of PN 1.6 rating valves, flanges, Gauges, pressure switch, 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, branch pipe, Fire Brigade inlet and outlet connections, Draw out valve, Pressure vessel, Air release valve, fire shaft door for each riser.
- C. C class Heavy duty MS Piping for Automatic Sprinkler system with all required valves, drain pipe, Gauges, all type of valves, flanges, Gauges, pressure switch, Sprinkler heads and flow switches, Sprinkler Annunciation panels, associated wiring from flow switches to Sprinkler Annunciation panel for monitoring Flow switches and sending signal to affected zone.

Note for B, C 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.

D. Pump House

There shall be following minimum installations in the pump house: -

- a. Main Electric Fire Hydrant Pump (2280 LPM minimum)- 1 no.
- b. Diesel Engine Driven Stand by Fire Pump (2280 LPM minimum)- 1 no.

The exhaust pipe of Diesel Pump shall be galvanized steel pipe and sized in accordance with the manufacturer's recommendations. The exhaust pipe shall be insulated with 50 mm of fiber glass with aluminum jacket for its entire length and shall be provided above the height of the roof pump house

- c. Terrace pump- 1 no on each building (if required as per NBCS 2026).
- d. Jockey Pump for hydrant System (180 LPM minimum)- 1 no.
- e. Flexible groove coupling to be provided at both sides of all above pumps
- f. Air vessels separate for sprinkler and wet riser system :2nos in each pump house and 1 no.at terrace.
- g. Sprinkler Annunciation Panel: 1 no. linked with Flow switches.
- h. Electrical Control panels: 1 no. i/c cabling 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.
- i. All pipes and valves in pump house as per requirement at site.

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.

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.

If the calculated capacities and numbers of all the equipment mentioned above is less than the minimum capacities and numbers mentioned, the contractor shall provide all the equipment as per the capacities and numbers mentioned above. If calculated capacity is more than the minimum capacities and numbers mentioned above, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

D7.1 DESIGN CONCEPT AND SPECIFICATIONS

The Design of firefighting system shall meet the requirement of NBCS 2026 and requirement of Delhi 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 of sprinkler and hydrant system to comply with CPWD Specifications, NBCS-2026, Relevant BIS Codes, NFPA Standards and to the requirements of Delhi Fire Services.
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. **Sprinkler system**
 - a. Automatic sprinkler system (quick response type) will be installed.
 - b. Installation control valve shall be comprising of main stop valve, alarm valve with accessories, strainer and water motor gong inside fire pump house.
4. **Fixed Type Fire Extinguishers**
 - a. Minimum 2 sets of Fire Extinguishers (ABC-6kg, CO₂-4.5 kg capacity) complete with MS box painted in post office red in Substation Room, Electrical rooms, near electrical panels, pump house, STP, Server room, security room, in all FHC shaft on each floor etc. All Staircase in each building & corridor at each floor in each building as per locations approved by the engineer in charge. Food court, Entry forecourt, Entry gate, control rooms, Traffic police assistance rooms and Souvenir shop & Information centre etc. as per norms.
5. **FBC (Fire Brigade Inlet Connection)**
 - a. One No. four way Fire Brigade Inlet Connections and one no 3 way FBC outlet at fire sump 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.
 - c. Drawing out valve near fire sump
6. **TESTING**

Hydrant System:

- a. Pressurize the fire hydrant system by running the main fire pump and after attaining the required pressure shut off the pump.
- b. Open by-pass valve and allow the pressure to drop in the system. Check

that the jockey pump cuts-in and cuts out at the pre-set pressures. If necessary adjust the pressure switch for the jockey pump. Close bye-pass valve.

- c. Open hydrant valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump should cut-in at the pre-set pressure and should not cutout automatically on reaching the normal line pressure. The main fire pump should stop only by manual push button. However, the jockey pump should cut-out as soon as the main pump starts.
- d. Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump.
- e. When the fire pumps have been checked for satisfactory working on automatic controls, open fire hydrant valves simultaneously and allow the hose pipes to discharge water into the fire tank to avoid wastage. The electrically driven pump should run continuously for eight hours so that its performance can be checked.
- f. Check each landing valve, male and female couplings and branch pipes for compatibility with each other. Any fitting which is found to be incompatible and does not fit into the other properly shall be replaced by the contractor. Landing valves shall also be checked by opening and closing under pressure.

Sprinkler System:

- a. Start the sprinkler pump and develop the required pressure in the sprinkler pipes.
- b. Open the test valve to test the automatic starting of the pump. If necessary, make necessary adjustments in the setting of pressure switch. The sprinkler installation valve and associated water gong alarm shall also operate when the test valve is open. This operation is to be done for each and every section of the sprinkler system and the alarm for each section (via flow switch) shall be checked for operation.
- c. After satisfactory operation of the pump the Contractor shall set up mock fire and test the system.
- d. Check all annunciations by simulating the alarm conditions at site.

7. 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.

8. Painting:

Painting of all exposed metal surfaces of equipment and component with appropriate color as per relevant para of CPWD general specification.

D7.2 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 equipment (hydrants, sprinkler) along with hydraulic calculations and data sheets of pumps, sprinklers and other fittings.
- (ii) Layout drawings of the Sprinkler and water curtain Flow switches, wiring, Annunciation Panel etc. as required.
- (iii) Layout of equipment's to be installed in pump house including power and control cables, Cable trays etc.
- (iv) Arrangement of Diesel engine chimney.
- (v) Electrical Panel GAD and control wiring along with write up of logic of operation of pumps.
- (vi) Earthing
- (vii) Drawings showing details of support for pipes, cable trays etc.
- (viii) Any other drawings relevant to the work.

D7.3 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) Warranty Certificates
- (iii) OEM Manuals of Equipment
- (iv) Any other information the Engineer-In-Charge may deem fit.

D7.4 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. Diesel Engine Driven Fire Pump:

Sl. No.	Description	Parameters
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	

B. Engine for Diesel Pump:

Sl. No.	Description	Parameters
1.	Quantity	
2.	Make	
3.	Model	
4.	Horse Power	
5.	Engine	
6.	RPM	
7.	Engine over speed setting	
8.	Operating Cycle	
9.	Number of Cylinder	
10.	Accessories	
11.	Dynamically balanced fly wheel	
12.	Flexible coupling and coupling guard	

13.	Electrical standing equipment and starting System	
14.	Governer	
15.	Fuel pump and water pump	
16.	Lubricating oil pump	
17.	Fuel, Air and Lubrication Oil Filter	
18.	Instrument and Protection Device complete as per Engine Model	
19.	Lubricating oil pressure	
20.	High Cooling Water Temperature	
21.	High Lubricating Temperature	
22.	Engine Cooling and Oil System	
23.	Capacity of Diesel Tank	
24.	Detail of Batteries	
25.	Battery Charger	
26.	Other necessary accessories as per Model No in order to make the Diesel Engine Functional	

C. Electrical Motor Driven Fire 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 (m3/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				

D7.5 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

EMERGENCY LIGHTING & ILLUMINATED SIGNAGES

SCOPE OF WORK:

The scope of work includes the design, supply, installation, testing, and commissioning of LED Exit signages with 4 hours battery backup with bicolored LED status indicator at all conspicuous locations to indicate Exit, staircase location, toilet location, handicapped toilet location, lift location, server room, fire control room, AHU room, Electric room etc. as per NBC norms. All exit signages in staircases, exit path and in critical areas shall be on UPS DB etc.

Emergency Lighting provided for use when the supply to the normal lighting fails.

- 1) This part of the emergency lighting which is provided to ensure that the escape route is illuminated at all material times, for example, at all times when persons are in the premises, or in the event of power failure, either for the whole building or for the means of egress required areas shall be illuminated.
- 2) The light shall be self-contained emergency luminaire and powered from a circuit from UPS units coming per floor connected through wiring to several escape lighting luminaries.
- 3) The escape lighting shall be provided at required corridors, common areas, staircases and routes to staircases, sub-station, pump house, STP.
- 4) The item requirement will be LED light having same specifications as what provided for corridor, staircases, and other common areas with important entry exit points with not less than 5% to be connected with UPS backup supply as mentioned above.

1.0. Signage

- 1.1 The sign and design of signage required for the building shall be as per NBCS 2026 and as amended up to date.
- 1.2 The size, color and formatting shall be as per IS: 9457 and IS: 12349.
- 1.3 The fixing of Signage should be with SS screws drilled wherever required with clean finish complete with chain etc. The quantity requirement of building is as follows.
- 1.4 Each cluster and exit corridors shall be provided with LED glow fire exit signage with inbuilt as per NBCS-2026.
- 1.5 Supply and fixing of LED sign display of minimum size 12"x 6" hanging Fire Exit lights in the lobby area for displaying "**Fire Exit**" including all accessories complete etc. as required. The signage shall be equipped with DC battery of suitable capacity sufficient to backup of 2 hours in case of power cut off.

EXIT AND OTHER SAFETY SIGN BOARD

- a) LED type Exit Sign Boards IP-42, single / Double sided shall be provided near staircase, lift lobby, fire hydrant, Toilets, Water cooler location, Sub Station, STP, DG Set, CCTV Room, Fire Control Room, Entrance, Exit required as per NBCS-2026 with self-contained rechargeable LED lit Laser ETCHED Acrylic signage Emergency board with super bright Red, Green LED's having inbuilt rechargeable battery backup of at least 4 hours having wattage less than 2 watts LED lamp fitting housed in Epoxy polyester powder coating acrylic sheet of thickness 8mm with recharging period of 16 - 24 Hrs. with constant

current charger having current through LED's under all conditions $20 \text{ mA} \pm 20\%$ and Voltage $3.5\text{V} \pm 10\%$, input supply single phase 230 V 50 HZ incorporating indicators showing following features (A) normal supply connected (B) Battery is being charged.

- b) Circuit continuity exists and confirming to IS:9583-1981, with suitable hanging arrangement with SS chain / directly on wall/ false ceiling as per site requirements. UPS supply shall be given to all Sign Boards system.
- c) If the calculated capacities and numbers of all the equipment mentioned above is less than the minimum capacities and numbers mentioned, the contractor shall provide all the equipment as per the capacities and numbers mentioned above. If calculated capacity is more than the minimum capacities and numbers mentioned above, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

D-8: AUTOMATIC FIRE ALARM AND PUBLIC ADDRESS SYSTEM

1. SCOPE OF WORK

The scope of work includes the design, engineering and conduct a detailed site survey to assess the building's fire alarm system requirements as per NBCS norms and develop a comprehensive design for the automatic fire alarm system and PA system, including detailed layouts showing the location of detectors, manual call points, alarm sounders, strobes, control panels, and other components and submit the design for approval to engineer-in-charge after that supply, fabrication, installation, testing, and commissioning of automatic fire alarm system PA system, including smoke detectors, heat detectors, beam detector, repeater panel, response indicator, manual call points, alarm sounders, strobes, zone panels, fire alarm control panels, batteries, speaker, amplifier, voice controller and associated cabling, MS conduit for the fire alarm system & PA system, including power and communication cables, conduits, cable trays and all other necessary components alarm notification devices, including sounders, strobes, and visual indicators, to ensure clear and effective communication of fire alarms throughout the building.

Provide backup power systems to ensure the fire alarm system remains operational during power outages, integrate the fire alarm system with other building systems, and provision for integrate with building management systems, all necessary components to ensure a fully operational fire protection system that meets all relevant safety standards and regulations of NBCS-2026, local fire norms etc.

If the calculated capacities and numbers of all the equipment mentioned above is less than the minimum capacities and numbers mentioned, the contractor shall provide all the equipment as per the capacities and numbers mentioned above. If calculated capacity is more than the minimum capacities and numbers mentioned above, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

1.2 References for installation.

- (i) CPWD General Specification for Electrical Works Part-VI Fire Detection and Alarm System 2018.
- (ii) Indian Standard IS / NBC and Fire Bye Laws issued by local Fire Authorities.
- (iii) British Standard Institute / European Standards / all applicable codes and standards including EN 54 / NFPA- 72 National Fire Protection Association.
- (iv) All major components of fire alarm system shall be product of a single manufacturer as per the list of approved make and shall conform to the requirement of EN54 / VDS / UL / IS approved and designed according to DIN VDE-14675 and VDE- 0833 Fire Alarm Systems, code of practice for system design, installation and servicing.

Sl. No.	Description	Requirement	Remarks
1	Requirement of Fire Alarm system (Automatic) & Public Address system as applicable	Fire Alarm system: Automatic operated Electric Fire Alarm system – Required. Public Address system: Required.	Based on requirements of NBCS 2026 and UBBL code / local body bye laws and requirements / local fire service and site details.
2	Details of required integration with different services like: a) Ventilation system b) Air conditioning system c) Sprinkler system and firefighting system	Integration with Following services is required. 1. Ventilation system 2. Air conditioning system 3. Sprinkler system and firefighting system	Based on requirements of NBCS 2026 and UBBL code / local body bye laws and requirements / local fire service and site details.
3	Zoning of Fire Alarm system and public address system on each floor / area.	Required	Based on requirements of NBCS 2026 and UBBL code / local body bye laws and requirements / local fire service and site details.
4	Scope of firm for getting approval and NOC from local body and local fire authorities.	Included in the scope of Work	Based on requirements of NBCS 2026 and UBBL code / local body bye laws and requirements / local fire service and site details.

The scope of work includes the following:

- Automatic Fire alarm system complete with various type of detectors, devices, addressable fire alarm panel, repeater panel, copper wiring/ fire survival cable in MS conduits recessed in ceiling/ wall/ surface cabling as required, integration with PA system.
- Public Address System for building evacuation, by selecting a particular zone, floor, all areas.
- Each floor of the building shall be considered as one zone. The term one zone shall stand common for PA system and Fire alarm system i.e. each floor of the building shall be having all FAS equipment in single loop and similarly having all PA system equipment in single loop. Both the systems shall be integrated with each other considering the same concept.
- Repeater panels shall be installed on each floor including ground floor, Guard room etc. and the panel shall be integrated with the Main Fire Alarm Panel and PA System.

- In case of any fire alarm in system, it can be announced automatically in PA system and Access control of that floor/all floor can be deactivated automatically without any manual intervention.

Sl. No.	Building	Manually operated electronic fire alarm / Automatic detection and alarm system
1	Food Court	Required with PA and Two way communication Talk back as per NBCS 2026 norms.
2	Souvenir shop & Information centre	Required with PA and Two way communication Talk back as per NBCS 2026 norms.
3	Control room/ Traffic Police assistance room/ Manager room.	Required with PA and Two way communication Talk back as per NBCS 2026 norms.

TECHNICAL SPECIFICATION:

The system shall be provided with Addressable fire alarm initiating, annunciating and control devices. The addressable and intelligent system shall be such that smoke sensors detectors, thermal sensors, manual call points, speaker etc., can be identified with point address. The system shall be capable of:

- Setting smoke sensor sensitivity remotely to either high sensitivity manually or on a pre-programmed sequence e.g. occupied/unoccupied period. The FAS shall be able to recognize normal and alarm conditions, below normal sensor values that reveal trouble condition, and above normal values that indicate either a pre-alarm condition or the need of maintenance.
- Read-out or address an actual space temperature at thermal detector points. The operator shall also be able to adjust alarm and pre-alarm thresholds and other parameters for the smoke sensors.
- Provide a maintenance / pre-alert alarm capability at smoke sensors to prevent the detectors from indicating a false alarm due to dust, dirt etc.
- Provide alarm verification of individual smoke sensors. Systems that perform alarm verification on a zone basis shall not be acceptable.
- Provide local numeric point address and LED display of device and current condition of the point. Local annunciation shall not interfere with annunciation from the Fire Control System.
- Provide outputs that are addressable, i.e. outputs shall have point address. The operator shall be able to command such points manually or assign the points to Logical Point Groups (Software Zones) for pre- programmed operation.

- g) In the event of a fire alarm, but not in a fault condition, the following action shall be performed automatically.
- h) The System Alarm LED on the main fire alarm control panel shall flash.
- i) A local piezo-electric sounder in the control panel shall be sounded.
- j) The LCD display on the main fire alarm control panel shall indicate all information associated with Fire Alarm condition including the type of alarm point and its location within the premises.
- k) Printing and history storage equipment shall log the information associated with the Fire Alarm Control Panel condition, along with the time and date of occurrence.
- l) All system output programs assigned via control-by-event programs that are to be activated by a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
- m) The audio portion of the system shall direct the proper signal (tone or voice) to the appropriate speaker circuit.
- n) Pre-recorded alarm messages shall be played through interface with Public Address system. Public address system is capable to get alarm message from USB port etc as when required.
- o) Announcing message through mike/ cord less mike shall be played through interface with public address system.
- p) Public address system should have DVC interface (Digital voice command) with addressable fire system.
- q) Undertaking from OEM shall be provided by contractor in Proforma in the following page.

1.0 PUBLIC ADDRESS SYSTEM

1.1 Scope of work

Design, supplying, installation, testing and commissioning of the public address system in the building. Each floor of the building shall be considered as 1 zone and every equipment of PA system coming in that particular zone shall be in that Zone only. Each zone of fire alarm system shall be in sync with each zone of PA system. Integration of the system shall be done accordingly, and all hardware components, converters, relays, software components etc. required for the same shall be included in the scope of contractor.

The system shall be fully redundant, scalable, completely supervised and flexible. It shall consist of IP based PA controller, Amplifiers, Call station, speakers and communication cable i.e. the system bus. The system shall be fully IP-network based. The features like audio processing, communication using MODBUS protocol and control functions shall entirely be in the digital domain. The sound quality shall be improved by providing Digital signal processing (DSP) in every equipment.

- 1.1.1 **Control Panel:** The control Panel shall be IP based on a minimum 4 zone Panel with features like voice alarm controller with USB, MP3 player (including 4 zone touchscreen paging station) with Rack Mounted expandable up to 3 times zone panel. The required zones can be integrated with the FAS panel and all hardware and software components required for the same are included in the scope. The voice alarm controller should be able to connect directly over Ethernet having seamless integration facility with main fire alarm panel for Zone wise voice evacuation complete as required. All system devices such as system controller, amplifiers and call stations shall communicate via IP, using an Audio over IP (AoIP) protocol which supports the controller for control with optional encryption and authentication to prevent unauthorized access, misuse and modification of data.

The speaker loops shall be directly fed from the controller instead of amplifier in order to provide effective control and monitoring of speakers and coming devices.

- 1.1.2 **Amplifier:** The amplifiers shall be of minimum with 2 speaker circuits with 1 channel and should have inbuilt feature like protection against re-settable overcurrent, overload, overheating, overvoltage, under-voltage and DC protection and should have 100V/70 Output, with 100 - 240 VAC input and 24 VDC backup with UPS power supply complete etc. as required.

- Each amplifier shall not be loaded more than 80% of its rated capacity.
- Every alternate speaker shall be connected with two different amplifier circuits to provide speaker line redundancy for each zone.
- All amplifier channels shall supervise the integrity of connected loudspeaker lines without interruption of audio distribution.
- Every amplifier shall have an independent spare channel for redundancy or one separate spare amplifier for providing channel wise redundancy for a cluster of N main amplifiers, where $N \leq 7$.

- 1.1.3 **Speakers:** The speakers required for PA system shall be of recessed type with metal box in ceiling/wall with minimum power rating of 6W and shall be tapped to 3W/1.5W as per the requirement of the system.

- 1.1.4 **System Management Software:** Supply, Installation, programming customization as per site conditions, testing & commissioning of System Management software compatible with IBMS software with one server & client license of **minimum 10 years**. It should connect with suitable size capacity of controllers. Administrator can decide No. of users and define user authorities freely. It shall display all equipment status and indicate fault alarm location, record and read history of operation and fault logs. It shall support Text-to-Speech (TTS) function. The flexibility of accessing Audio files stored on the server from any zone on the system network etc as required.

- 1.1.5 The components of PA system shall be neatly installed in sufficient sized Rack assembly of not less than 10 U made of aluminum channels, side & rear panels made up of 16 SWG powder coated steel sheet, front transparent perplex door bearing with rails & rollers, 2 fans at the top for ventilation. The ventilation requirement shall be varied with the size of rack used. The rack assembly shall be designed for proper mounting of amplifiers, system

controller & all accessories etc. as required. The rack assembly shall provide a dedicated arrangement for cable management system and all network racks shall be powder coated with guarantee of not less than 10 years.

- 1.1.7 The wiring of the PA system shall be done with suitable grade FRLSH PVC insulated twin core, shielded, copper conductor flexible cable in the recessed MS (mild steel) conduit laid in wall/ slab including connections and interconnections etc. as required.

If the calculated capacities and numbers of all the equipment mentioned above is less than the minimum capacities and numbers mentioned, the contractor shall provide all the equipment as per the capacities and numbers mentioned above. If calculated capacity is more than the minimum capacities and numbers mentioned above, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

Approvals and Standards

The FAS must be of a type submitted to, tested, approved, and/or listed to the Standards mentioned below by a Nationally Recognized Testing Laboratory (NRTL):

- a) UL268 and UL268A: UL (Underwriters Laboratories Inc), USA
- b) UL268: ULC (Underwriters Laboratories Canada), Canada
- c) Category 7259: CSFM (California State Fire Marshal), USA

Codes, Standards or Regulations

The FAS shall be installed to comply with one or more of the following codes or standards:

- a) NFPA Standards, US
- b) NEC Standards, US
- c) Fire Industry Association (FIA), Code of Practice for Design, Installation, Commissioning & Maintenance of Aspirating Smoke Detector (ASD) Systems
- d) NZS 4512 : 2003
- e) Local codes and standards

Quality Assurance

Manufacturer

- a) The manufacturer shall have a production experience in the design and manufacture of smoke detection systems.
- b) The manufacturer shall be certified as meeting ISO 9001:2008 for manufacturing.

Installer

- a) The equipment installer shall be authorized and trained by the manufacturer and shall have the ability to design a system based on code requirements.

- b) The installer shall be capable of providing calculations, design, and testing documents upon request.

Training

- a) The manufacturer and their representatives shall make available adequate accreditation training to all personnel involved in the supply, installation, commissioning, operation and maintenance of the FAS system.

Documentation

The following documentation shall be supplied.

- a) Product data and site drawings shall be submitted and shall include pipe layout, operational calculations and performance criteria. Software validated by OEM should be used to generate this material.
- b) A copy of the manufacturer's installation, operation and maintenance manuals shall be supplied upon completion of the installation.
- c) System commissioning data shall be supplied (in a format recommended by the manufacturer and per the instructions provided by the manufacturer) within 15 days of completion of the installation.
- d) PC-based, Android-based or iOS-based hardware
- e) A dedicated monitoring device mounted remotely from any detector

System Commissioning

Detector commissioning

The detector shall incorporate a push button to invoke self-learning modes to simplify commissioning including:

- a) A learning mode that ensures the best selection of appropriate alarm thresholds during the commissioning process
- b) A learning mode that determines the optimum flow fault thresholds based on environmentally induced flow changes during the commissioning process.

Additionally, there shall be a provision for a PC software tool to configure all user modifiable parameters of the all-system devices.

Commissioning Tests

- a) The contractor shall allow for the manufacturer's representative to attend commissioning of the entire installation in the presence of the owner and/or their representative.
- b) All necessary instrumentation, equipment, materials and labor shall be provided by the Contractor.

- c) The Contractor shall record all tests and system configuration and a copy of these results shall be retained on site in the System Log Book.

Final Tests

The contractor shall:

- a) Introduce smoke into the detector assembly to provide a basic Go / No-Go functional test.
- b) Verify that the transport time from the farthest sampling hole does not exceed the local code requirements using a smoke signal rise displayed in VSC / VSM or the LCD display.
- c) Activate the appropriate Fire Alarm zones and advise all concerned that the system is fully operational. Fill out the logbook and commissioning report accordingly.

D-9: IP BASED CCTV SURVEILLANCE SYSTEM

D9.1 SCOPE OF WORK

Scope of this sub head covers planning, designing, supply, installation, testing and commissioning of IP Based CCTV System for Building Security with PTZ, Fixed Cameras, cabling and allied works to Monitor and supervise the entire area for security purpose as well as record and inform officials on unwanted, untoward incidents. It is also essential to have recorded videos/images to be stored for minimum 90 days of all critical areas to facilitate investigations of reported incidents. The hardware required for the system including servers VMS & recording, workstations, monitors, CAT-6A, OFC Cable Patch Cable to connect the camera to nearest POE switch, Cables, connectors, MS conduits, power supplies etc. and rack in CCTV control room. 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 all locations as per design finalized and all activities, identifications in the area. The camera and its accessories must be STQC (Standardization Testing and Quality Certification) certified. The certification given by Ministry of Electronics and IT:
 - a. Outdoor areas entry forecourt, Entry gate: 5MP@ 20 fps, Bullet camera at a maximum distance of 30 meter. 100% coverage of outdoor area with combination of 2MP PTZ camera (for patrolling) @ 50/60 fps and 5MP Bullet cameras (for continuous surveillance) @ 20fps, minimum distance of 30 meter.
 - b. 100% coverage of indoor area in entry gate, souvenir shop and information center, food court, control room, manager room, monitoring room, traffic police assistant room, common areas except toilets with combination of 5MP Dome camera @ 20 fps and 5MP Bullet cameras @ 20 fps
 - c. Substation, DG Set room, Pump Room, STP Plant Room 5MP @ 20 fps, Bullet camera
 - d. Terrace, and other common areas at suitable intervals 5MP @ 20fps, Bullet camera
 - e. Main Entry/ Exit & Auxiliary Entry/ Exit gates. 5MP @ 20fps, Bullet camera
2. 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 in the scope of work.

3. Minimum 90 days recording per camera with hard disk shall be scope of work.
4. Establishing CCTV Monitoring Station at control room having minimum two numbers high resolution 65" professional LED display.
5. The whole CCTV system shall have provision of compatible VMS system (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.
6. 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.
7. The networking rack, all network switches, all NVR shall have minimum 20% spare space for future provisions.
8. The outdoor cameras power requirement shall be met from POE+ switches.
9. The CCTV Network shall be Design with Two-Tier Architecture i.e. with access network POE switches and distribution network POE switches plus NVR etc.
10. Dedicated Lan System for CCTV, 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 base T with 2 SFP Port. Layer 3 switch with 24 port Base T and 4 No 10G SFP+ port etc. is scope of work.
11. The online UPS of suitable capacity with maintenance free batteries with 30 minute backup for above system shall be scope of work.
12. The mounting arrangement for outdoor cameras likes: - Pole, box, hook etc. shall be scope of work.
13. CCTV areas coverage analysis and drawings, band width calculations for PoE switches shall be done by contractor.
14. It will be the responsibility of the Contractor/bidder to make the entire system fully functional as per the specifications. Vendor/bidder shall consider any equipment/devices required to make the system functional if not mentioned herewith.
15. Contractor/Agency shall calculate the camera quantity as per the scope of work and full coverage requirement. All the backend system must be designed as per the min specification.

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 and get that approved from Engineer in charge.

D9.2 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+/ Insta stream, 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, 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 × 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 LEDs with effective distance up to 40 Metre or better with the help of External/ Integrated IR.
11	Video Compression (Minimum)	H.265+/ Insta stream, 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, PP PoE, 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 (up to 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+/ Insta stream, 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, PP PoE, 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 Nos. 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	Heat map 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 Block list	100
14	ANPR Event with Picture	12 per second
C	Map functionality	
1	Hierarchy Map with Sub maps	8 hierarchy Maps and 32 sub maps 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 sub map.	
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, heat map 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/matrix 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 Base T POE+ with 2x10G SFP+ and 2x10G Base-T uplink/stacking support & POE+.
- Access Switch 2: 8x1G Base T 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 x 1/10G Base-X SFP+ Port
	4 x 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
	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
	Diff Server 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)

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 Base T 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, v lan, 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, v lan, 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 system log & 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.

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

D9.3 MINIMUM REQUIREMENT OF CCTV

Minimum one bullet camera for every 30 meter distance in corridor and outdoor areas like main entrance etc. as per design finalized and as per instruction of Engineer in charge. Minimum one dome camera for every 30 meter distance as well as in every room/areas as per design finalized and as per instruction of Engineer in charge. Sufficient numbers of PTZ cameras (minimum 4 numbers) to be provided in outdoor to cover every corner of the area as well as entry gate and as per design finalized and as per instruction of Engineer in charge. If the calculated capacities and numbers of all the equipment mentioned above is less than the minimum capacities and numbers mentioned, the contractor shall provide all the equipment as per the capacities and numbers mentioned above. If calculated capacity is more than the minimum capacities and numbers mentioned above, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

D9.4 SAMPLE

The contractor shall bring sample of materials for approval of the Engineer-in-charge. (For Equipment Model and makes shall get 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.

D9.5 DRAWINGS FOR APPROVAL ON AWARD OF THE WORK

The contractor shall prepare and submit two sets of hard copy of following drawings and two 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.

D9.6 DRAWINGS AFTER COMPLETION OF WORK

The contractor shall submit Two 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:

- a. Test Certificates
- b. Warranty Certificates
- c. OEM Manuals of Equipment
- d. Any other information the Engineer-In-Charge may deem fit.

D-10: SEWAGE TREATMENT PLANT:

D10.1 SCOPE OF WORK :

Scope of this sub head covers planning, designing, supply, installation, testing and

commissioning of SBR based STP for the complex based on the norms of local body, CPCB, MoEF&CC, NBCS 2026. 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 equipment mentioned here under are minimum. EPC contractor shall do detailed design and calculations and provide the capacity of equipment, accordingly, subject to minimum capacities mentioned hereunder

2. Providing STP Plant of minimum 1 x 50 KLD based on norms of local body, CPCB / UPPCC, MoEF&CC, NBCS 2026.
3. Heavy duty required class of PVC piping.
4. De-watering pumps (with automation) as required with 50% standby pumps.
5. VFD based pumping system for transfer of water from/to various chambers.
6. Sensors and Automatic operations
7. IBMS connectivity for remote monitoring and controlling.

If the calculated capacities and numbers of all the equipment mentioned above is less than the minimum capacities and numbers mentioned, the contractor shall provide all the equipment as per the capacities and numbers mentioned above. If calculated capacity is more than the minimum capacities and numbers mentioned above, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

Civil work:

1. Following tanks made out of minimum 6mm thick MS sheet coated with 3mm thick FRP (Fiber Glass Reinforce Thermosetting Plastic)

(a). Equalization Tank	-1 no.
(b). Sludge Holding Tank	-1 no.
(c). Anoxic Tank	- 1 no.
(d). Moving Bed Bio Reactor Tank	-2 nos.
(e). Tube Settler Tank	-1 no.
(f). Clear Water Tank	- 1 no.
(g). Treated Water Tank	- 1 no.
(h). Bar Screen	- 2 Nos
2. Various sleeves / pipes between Tanks made out of MS sheet coated with FRP for connection.

E&M Works

E&M equipment: 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 No.
3	Mixer for each Anoxic Tank	01 No.
4	Twin type Rotary Air Blower coupled with TEFC motor of required HP suitable for 3 phase 415 $\pm$ 10 Volt, 50 Hz. AC supply.	02 Nos. (1 Working + 1 Standby)
5	Coarse and Fine Bubble Membrane type Air Diffuser complete with valve and air distribution grid.	LOT
6	3 Ph. Sewage Submersible, non clogging type Pump set for Raw Sewage Transfer having solid handling 15 – 20mm,	02 Nos. (1 Working + 1 Standby)
7	3 Ph. Non-clogging type horizontal centrifugal, monobloc pump set for Sludge Recirculation having solid handling min.7mm..	02 Nos. (1 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.	1 Lot
9	Filter Press Feed Pump Screw Type	2 No (1 Working +1 Standby)
10	3 Ph. Monobloc Pump Set for Filter Feed Pump	02 Nos. (1 Working + 1 Standby)
11	3 Ph. Monobloc Pump Set for Balance Treated Water Transfer Pump	02 Nos. (1 Working + 1 Standby)
12	3 Ph. Monobloc Pump Set for Plant Room Drainage Pump	02 Nos. (1 Working + 1 Standby)
13	SBR Media (400 square meter/ Cu meter)	1 Lot
14	Tube Deck Media 11m ² /m ³ (60° Slope) 13m ² /m ³ (55° Slope)	1 Lot
15	Ozonator System with Multigrade Filter and Activated Carbon Filter	1 set
16	Electro Magnetic Water Flow Meter	1 No.
17	Filters (Pressure sand filter and activated carbon filter), UV sterilizer, chlorine dosing pumps and softener as tertiary treatment	1 set

Sl. No.	Description of item	Qty.
18	Bulk Water Meter	1 No.
19	Butterfly valve, NR valve, Motorized valves etc.	1 Lot
20	GI Pipe / UPVC pipe	1 Lot
21	Sensors, switches, wiring etc. required for automation	1 Lot
22	Floor mounting type cubical indoor type compartmentalized Control Panel suitable for operation on 3 phase 415 $\pm$ 10 Volt, 50 Hz. AC supply, fabricated from 2mm CRCA sheet steel of suitable size, complete with 4 pole suitable size and capacity of aluminum bus bar, suitable size and capacity of incoming FP MCCB and required number of suitable size and capacity of outgoing TP MCCBs / SP MCB, VFD's automation PLC etc. for controlling the all electrical equipment + Spare 4 nos.(2 TP MCCB & 2 SP MCB) outgoing of required rating.	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

D10.2 DESIGN CRITERIA:

1. Capacity and duration

- Capacity - 50 KLD (minimum)
- Operation : Sewage (round the clock)

2. Treated water

- pH - 6.5 -8.5
- BOD3 –@ 27 deg. C. - less than 10 mg/L
- COD - less than 30 mg/L
- Total Suspended solids (TSS) - less than 10 mg/L
- Oil & grease (after grease trap) - less than 5 mg/L
- Turbidity - less than 1 NTU
- E-Coli Removal - Greater than equal to log 6 removal
- Ammoniacal Nitrogen [NH₄-N] - Less than 5mg/L
- Total Nitrogen(N-Total) - Less than 10mg/L
- Phosphate (PO₄-P) - Less than 1mg/L
- Fecal coliform - Less than 100MPN/100ml

3. Salient Features

- The plant should be suitable for low/peak flow in line.
- The plant should not create any noticeable noise, Noise level shall be less than 70 decibel at 2 meter away from boundary of plant, with no nuisance on fly or mosquito and no foul odour.
- 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).

D10.3 TECHNICAL SPECIFICATIONS

1. Compliance

The capacity/ rating of pumps and equipment etc. shall hold good for the capacity of 1 plant of minimum 50 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:**

SBR Tank : Sewage shall be retained in the tank for a minimum of 7-8 hours and subjected to biochemical oxidation by fine bubbles aeration. The tank shall have high surface area @ 400 Sq.metre /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.

Tube Settler Tank : The sewage after 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 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 60⁰ 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.

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 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 50 KLD i.e. of 63 KLD.

An aeration system similar to the SBR tank shall be provided for mixing and aerating the sewage.

(e) Sewage Pumps and sludge cutter

1 no Working and 1 no 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 63 A 25 KA & 2 SP MCB 32A 10KA) spare outgoings for future use.

(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.

D10.4 PIPE SUPPORTS

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.

D10.5 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.

D10.6 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.

D10.7 Drawings for approval on award of the work

The contractor shall prepare and submit three sets of hard copy of following drawings and Two 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 equipment
- (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 Two 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 Equipment
- (iv) Any other information the Engineer-In-Charge may deem fit.

D10.8 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-11 : HYDRO PNEUMATIC SYSTEM WITH HYDRO PNEUMATIC PUMPS

D11.1 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 equipment mentioned hereunder are minimum. EPC contractor shall do detailed design and calculations and provide the capacity of equipment accordingly, subject to minimum capacities mentioned hereunder:

1. Hydro pneumatic water supply system of suitably designed capacity pumping system for portable water with minimum three pump sets (each of suitable capacity flow rate minimum 10 CMH with residual pressure of 1.5 kgf/sq.cm at farthest point) for potable water including three number or 50% standby capacity with one number pressure tanks each of minimum 1000 liter 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 three pump sets (each of suitable capacity flow rate minimum 10 CMH with residual pressure of 1.5 kgf/sq.cm at farthest point) including three number or 50% standby capacity with one number pressure tanks each of minimum 1000 liter 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 three pump each of suitable capacity flow rate minimum 5 CMH flow with residual pressure of 1.5 kgf/sq.cm at farthest point) including one number 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 suitable capacity flow rate minimum 15 CMH flow with residual pressure of 1.5 kgf/sq.cm at farthest point) as required for sumps with minimum 100% standby pumps (i.e. in

each sump two numbers pump 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

If the calculated capacities and numbers of all the equipment mentioned above is less than the minimum capacities and numbers mentioned, the contractor shall provide all the equipment as per the capacities and numbers mentioned above. If calculated capacity is more than the minimum capacities and numbers mentioned above, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

D11.2 Specifications and Design concept:

- a. All pump motors shall be of minimum IE4 efficiency rated (except dewatering pumps, where IE3 is acceptable) to achieve ECSBC plus as per ECSBC 2024. Each pump shall have an efficiency of more than 70% at selection point.
- b. 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.
- c. Impeller of pumps shall be bronze or Stainless steel.
- d. All pumps (except dewatering pumps) shall have VFD drive instead of starter.
- e. Complete system (consisting of pumps, VFD, control panel, suction and discharge headers, pressure tanks) shall be procured from OEM of pumps.
- f. 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.
- g. 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.

D11.3 DRAWINGS FOR APPROVAL ON AWARD OF THE WORK

The contractor shall prepare and submit three sets of hard copy of following drawings and two 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.

D11.4 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, following shall also be provided:

- a. Test Certificates
- b. Warrantee Certificates
- c. OEM Manuals of Equipment

Any other information the Engineer-In-Charge may demand.

D-12 : AUTOMATED FLAP BARRIER SYSTEM

The scope of this sub head covers planning, designing, supply, installation, testing and commissioning of Automated Flap Barrier 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.

If the calculated capacities and numbers of all the equipment mentioned below is less than the minimum capacities and numbers mentioned, the contractor shall provide all the equipment as per the capacities and numbers mentioned above. If calculated capacity is more than the minimum capacities and numbers mentioned above, the contractor shall provide all equipment as per the calculated capacity for which no extra cost for the same shall be paid. Bidders are requested to quote accordingly.

1. FLAP GATE:

- (i) Providing nine numbers Flap gate at Ticket check counter or suitable place as decided by Engineer-in-charge and as per design finalized.
- (ii) Operator console, necessary hardware, software, Power and control cabling, all associated electrical work, panel etc. as required.
- (iii) **Specification for Flap Gate**

Housing made of corrosion-resistant AISI 304 / 316 Stainless Steel (minimum thickness 1.5mm to 2.0mm), equipped with brushless DC motor-driven retractable/swing flaps (suitable blocking height), network interface, integrated microprocessor controller, an array of minimum 6 pairs of safety infrared optical sensors for anti-tailgating and direction detection, throughput of 35-40 persons per minute, 3000000 MTBF times, card capacity up to 60000, event capacity up to 180000, operating temperature -20 to 65 Degrees, up to 240V AC. fail-safe mechanism automatically opening flaps during power loss or fire alarm override, including necessary civil anchoring, internal control wiring, and termination etc. as required.

Infrared sensor to prevent pinch pedestrian, counting function LED indication with sound prompt, invalid entering alarm, drop arm function during emergency.

Mode of access: EM card/ Magnetic card/ Barcode Ticket/ Biometric Machine/ Palm Vein Reader/ IRIS scanner/ Plastic or Metallic coin etc.

Note: - The suitable size online UPS with 30 minutes battery backup along with maintenance free battery for each flap gate is also in scope of work.

DRAWINGS FOR APPROVAL ON AWARD OF THE WORK

The contractor shall prepare and submit three sets of hard copy of following drawings and two 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.

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, following shall also be provided:

- (i). Test Certificates
- (ii). Warranty Certificates
- (iii). OEM Manuals of Equipment
- (iv). Any other information the Engineer-In-Charge may deem fit.

LIST OF PREFERRED MAKES OF MATERIALS FOR E&M WORKS

SL. NO.	ITEMS	MAKES
	ELECTRICAL INSTALLATIONS & GENERAL	
1	WIRES AND CABLES a)PVC INSULATED FRLS COPPER CONDUCTOR SINGLE CORE CABLE b) 1.1 KV GRADE XLPE POWER CABLE AND CONTROL CABLE c) FIRE SURVIVAL CABLE d) 11 KV GRADE XLPE POWER CABLE e) COMMUNICATION CABLE	POLYCAB/ KEI/ HAVELLS/ FINOLEX
2	a) MS CONDUIT/ PVC CONDUIT AND ITS ACCESSORIES b) GI PERFORATED CABLE TRAY c) GI RACEWAY	AKG / BEC / NIC
3	MODULAR SWITCH & SOCKET	MK -ORNA /HAVELLS (CRABTREE MURANO) / SCHNEIDER LIVIA OR MILUZ LARA
4	ANCHOR FASTENER	HILTI/ 3M/ FISCHER
5	CABLE LUGS AND BRASS GLAND	GRIPWEL / DOWELL/ COMET
6	CAT-6 UTP CAT-6A, UTP UTP PATCH CORD FIBRE OPTICS CABLE	PANDUIT/ BELDEN / 3C3 / DERWISER
7	UPVC / HDPE PIPE/DWC	DURALINE/ REX/ TIRUPATI
8	RACK FOR ALL (EPABX / AUDIO VIDEO / CCTV etc.)	PANDUIT/ APC INDIA / 3C3 / IMPULSE / NEXXUX / BELDEN
9	PAINT, PRIMER	ASIAN PAINT/ NEROLAC / BERGER/ ICICI
10	MS PIPE, GI PIPE	SAIL/ TATA/ JINDAL (HISSAR)/ JINDAL STAR
11	SERVER / DESKTOP	DELL/IBM/ HP
12	WI- FI SYSTEM & NETWORK SWITCHES	CISCO/ JUNIPER/ NEXXUUS / IMPLUSE / BELDEN
13	STRUCTURAL STEEL	TATA/ SAIL/ JINDAL HISSAR / APL- APOLLO
14	WATER SUPPLY, STP, DRAINAGE, SUBMERSIBLE PUMPS/ HYDRO PNEUMATIC PUMPS	KIRLOSKAR /KSB/ GRUNDFOSS/ WILO/ XYLEM/ ARMSTRONG
	<u>DG SET</u>	

SL. NO.	ITEMS	MAKES
1	DIESEL ENGINE	CUMMINS/ CATERPILLER/ PERKINS/ KIRLOSKAR OIL ENGINE LTD.
2	ALTERNATOR	STAMFORD/ KIRLOSKAR ELECTRIC/ CROMPTON
3	PROTECTION RELAYS & CT'S	L&T/ SIEMENS/ SCHNEIDER ELECTRIC
4	BATTERY	EXIDE / AMARON/ AMARAJA/ LUMINOUS
5	DG SET - ACOUSTIC ENCLOSURE & ASSEMBLER	KIRLOSKAR (JACKSON) / SUDHIR/ CUMMINS INDIA
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
	<u>SUB-STATION</u>	
1	11 KV VCB PANEL	ABB / SCHNEIDER ELECTRIC/ SIEMENS/ TRICOLITE
2	a) DRY TYPE (11KV/433 VOLT)	KIRLOSKAR/ VOLTAMP/ ABB/ CROMPTON GREEVES
	b) OIL TYPE TRANSFORMER (11KV/433 VOLT)	
3	COMPACT SUB STATION	SCHNEIDER ELECTRIC/ ABB/ SIEMENS
4	ACB	SCHNEIDER ELECTRIC – MASTERPACT NW (6.0A)/ L&T - U POWER OMEGA (MTX3.5)/ SIEMENS 3WL (ETU 45B)/ ABB EMAX (PR122)
5	MCCB	SCHNEIDER – COMPACT NSX/ L&T DU/ ABB TMAX
6	MCB/ RCCB/ ISOLATOR	SCHNEIDER - ACTI9/ HAGER-H3/ SIEMENS BETA GUARD 10KA/ ABB SB200M
7	MCB DB	HAGER (H3) / SIEMENS (BETAGARD) /SCHNEIDER (ACTI-9)/ABB (ITUS)
8	MAIN LT PANEL/ SUB LT PANELS/ CAPACITOR PANEL/ SYNCHRONIZING PANEL WITH ACCESSORIES/ STARTER PANEL	NEPTUNE/ ADVANCE PANELS & SWITCHGEAR (P) LTD/ ADLEC/ ASPL/ APPLICATION CONTROL PVT. LTD

SL. NO.	ITEMS	MAKES
9	BUS DUCT, AIR INSULATED COMPACT RISING MAINS, END FEED UNIT, TAP-OFF BOX (PLUG-IN TYPE)	SCHNEIDER ELECTRIC/ LEGRAND / L&T/RR
10	OUTDOOR BUS TRUNKING	SCHNEIDER ELECTRIC/ RR/ NAXSO BBT
11	HT, LT JOINTING KIT & TERMINATION KIT	REYCHEM / 3M / ABB
12	SOFT STARTERS	SIEMENS/ SCHNEIDER/ ABB / L&T
13	CT, PT	ADVANCE / KAPPA / AE
	UPS	
1	UPS	SCHNEIDER (APC)/ EATON/ EMERSON (VERTIV)/ PEGASUS/ ABB / NUMERIC
	LIGHTING, FIXTURES & FANS	
1	CEILING FAN / EXHAUST FAN / KITCHEN FRESH AIR/ WALL FAN	HAVELLS/ CROMPTON/ USHA /BAJAJ/ ORIENT
2	LED EXIT SIGNAGE	MR. LITE/ PROLITE/ WIPRO/ AGNI
3	a) LED INDOOR LUMINAIRES b) LED DECORATIVE LIGHT LUMINAIRES c) LED STREET LIGHT d) BOLLARDS & OUTDOOR FITTINGS	PHILIPS/ REGENT/ LIGHTING TECHNOLOGY
4	MS DECORATIVE POLE	PHILIPS/ BAJAJ/ HI-LITE/ HAVELLS/ LUSTER/ UTKARSH/ ILEN
5	POLYCARBONATE JUNCTION BOX WITH CONNECTOR	HENSEL / RITTAL/ SCHNIEDER
6	SENSORS & TIMER FOR LIGHT CONTROL	PHILIPS / HONEYWELL/ SCHNEIDER ELECTRIC/ HAVELLS
	EPABX	
1	IP-PBX SYSTEM / IP PHONE	CISCO / CORAL / TADIRAN
	FIRE ALARM SYSTEM	
1	a) ADDRESSABLE FIRE ALARM CONTROL PANEL b) ADDRESSABLE DETECTORS c) GRAPHIC USER INTERFACE SOFTWARE d) MONITOR & CONTROL MODULE e) RESPONSE INDICATORS f) MANUAL CALL BOXES & HOOTERS	NOTIFIER (HONEYWELL)/ BOSCH/ SCHNEIDER/ EATON/ NOHMI

SL. NO.	ITEMS	MAKES
	g) INPUT /OUTPUT DEVICES	
	PUBLIC ADDRESS SYSTEM	
1	a) PUBLIC ADDRESS SYSTEM CONSOLE AND ALL ACCESSORIES b) P.A. SPEAKERS c) AMPLIFIERS	BOSCH/ BIAMP/ HONEYWELL
	FIRE FIGHTING SYSTEM	
1	a) 2-WAY/4-WAY FIRE BRIGADE CONNECTION b) AIR RELEASE VALVE c) LANDING VALVE d) BRANCH PIPE e) FIRST AID HOSE REEL AND DRUM f) RRL HOSE PIPE g) FIRE MAN AXE	SAFEX/ NEWAGE/ LIFE GUARD/ EXFLAME
2	DIESEL ENGINE (FIRE-FIGHTING)	CUMMINS/ KIRLOSKAR / CATER PILLER
3	FIRE EXTINGUISHERS	CEASEFIRE/ MINIMAX/ NEWAGE / SAFEX / KANEX / EXFLAME
4	FLEXIBLE DROP & FLEXIBLE COUPLINGS	LIFE GUARDS / VICTAULIC/ TYCO
5	a) INSTALLATION CONTROL VALVE b) DELUGE VALVE c) SPRINKLER HEADS	TYCO / VICTAULIC / HD / HONEYWELL
6	SPRINKLER PANEL, CURTAIN SYSTEM PANEL PRESSURE RELEASE VALVE ZONE CONTROL VALVE (ZCV)	TYCO / HONEYWELL / HD
7	ALL FIRE FIGHTING PUMPS	GRUNDFOSS / WILO / MATHER PLATT / KIRLOSKAR
8	ELECTRICAL MOTOR	ABB/ KIRLOSKAR ELECTRIC CO./ SIEMENS INDIA LTD
9	THERMAL INSULATION FOR EXHAUST PIPE	UPTWIGA/ LLOYD INSULATION/ OWENS CORNING/ KIMMCO
10	M.S. FITTINGS	VS / DRP / VICTAULIC / UNIK
11	WELDING RODS	ADORE / ESAB/ MARGLAM
12	BUTTERFLY (MANUAL, GEAR OPERATED) VALVES, NON-RETURN VALVES, SLUICE VALVES	AUDCO / ZOLOTO / SANT / HONEYWELL

SL. NO.	ITEMS	MAKES
	Y-TYPE STRAINER FOOT VALVE WITH STRAINER AIR RELEASE VALVE BALL VALVES	
13	TAMPER SWITCH FOR BUTTERFLY VALVE	HONEYWELL/ POTTER/ RAPID CONTROL/ SYSTEM SENSOR/ PACIFIC FIRE
14	PRESSURE SWITCH FLOW TEST METER	DANFOSS/ INDFOS/ VIKING/ DELTA CONTROL
15	PRESSURE GAUGE LIQUID FILLED	FEIBIG/ H. GURU/ EMERALD/ WAAREE
	HVAC	
1	SPLIT TYPE AC	HITACHI/ MITUSBISHI/ O-GENERAL
2	REFRIGERANT PIPING	MANDEV / MEXFLOW / RR SHRAMIK
3	CLOSED CELL NITRILE RUBBER INSULATION/ EPDM INSULATION	ARMAFLEX /AEROCCELL / ALP
4	INLINE FANS	SYSTEMAIR/ KRUGER/ GREENHECK/ HUMIDIN/ NICOTRAAIR
5	CHILLER	TRAIN/ YORK/DAIKIN
6	CHILLER PUMP	ARMSTRONG/ GROUND FOSS/ XYLEM
7	AIR HANDLING UNITS/ TREATED FRESH AIR UNITS	SYSTEMAIR/ EDGETECH/ TRANE/ BALANCE/ ZECO / WAVES
8	AIR WASHER	SYSTEMAIR/ EDGETECH / TRANE/ BALANCE/ ZECOW/ WAVES
9	AIR SEPARATOR	XYLEM/ EMERALD/ ANERGY/ KD AGENCIES
10	COOLING TOWERS (CTI/ CERTIFIED)	ADVANCE/ MARLEY/ PAHARPUR/ BELL
11	GI SHEETS DUCTING ETC	SAIL/ TATA/ JINDAL
12	CO2 SENSOR	SCHNEIDER/ HONEYWELL/ SIEMENS
13	PPR PIPE	JINDAL HISSAR / ASTRAL / FUSION
14	CENTRIFUGAL & AXIAL FANS VANE AXIAL IN-LINE FANS AND THEIR MOTORS	KRUGER/ GREENHECK/ NICOTRA/ BALANCE/ TRISTAR WITH MOTOR FROM THEIR APPROVED OEM
15	VIBRATION ISOLATOR RUBBED PAD DUCT SUPPORT ARRANGEMENT	DUNLOP/ RESISTOFLEX/ GERB
16	GRILL DIFFUSER FIRE DAMPERS	SYSTEM AIR/ CARRYAIRE/

SL. NO.	ITEMS	MAKES
	LOUVERS VOLUME CONTROL DAMPER	COSMOS/ TRISTER / GREENHECK/ BALANCE
17	FLEXIBLE GROOVED FITTINGS COUPLINGS	VICTAULIC/ TYCOGRINNEL/ VIKING
18	PRE-FABRICATED DUCT DUCT FLANGE (WITH GI SHEETS OF MAKES)	ZECO/ ROLLASTAR/ DUCTOFAB/ WAVES
19	VARIABLE FREQUENCY DRIVE	DANFOSS/ ABB / HONEYWELL/ SIEMENS / SCHNEIDER
20	ALUMINUM TAPE	JOHNSON/ BIRLA-3M/ NIPPON INDUSTRIES
21	VRV/VRF SYSTEM INCLUDING INDOOR & OUTDOOR UNITS	DAIKIN/ HITACHI/ MITSUBISHI/ O-GENERAL/ CARRIER/ TOSHIBA
	LIFT/ ESCALATOR	
1	ESCALATOR/ LIFT	KONE ELEVATORS INDIA PVT. LTD./ MITSUBISHI / SCHINDLER/ OTIS ELEVATOR
	SOLAR POWER	
1	POWER CONDITIONING UNIT (PCU)/ SOLAR INVERTERS	ABB FIMER/ SOLAREEDGE/ FRONIUS
2	SOLAR PV PANEL	TATA SOLAR/ WAAREE ENERGY/ ADANI SOLAR
	STP/ETP/WTP	
1	PLANT MANUFACTURER	ION EXCHANGE / ZETA4/ SPECTRUM ENGINEERING TECH PVT. LTD.
2	AIR BLOWER	EVEREST / BETA / ROBUSCHI
3	AIR DIFFUSERS	REHAU / SSI AERATION / MM AQUA
4	RAW SEWERAGE TRANSFER PUMP / SLUDGE RECYCLE PUMP / FILTER FEED PUMP / NON CLOG HORIZONTAL CENTRIFUGAL PUMP/ DE WATERING PUMP / DOSING PUMP/ SBR FEED PUMP/ FILTER FEED PUMP/ SLUDGE PUMP/ CHLORINE DOSING PUMP	ARMSTRONG / XYLEM / GRUNDFOS/ / WILO
5	FILTER PRESS	SACHINFILTECH / PHARMATECH / HITECH
6	TUBE SETTLER MEDIA /SBR MEDIA	WELBRICK / PHARMATECH / MM AQUA
7	M.S. FILTER	WELBRICK / ION EXCHANGE / ASTHA / THERMAX / ZETA4

SL. NO.	ITEMS	MAKES
8	OZONATOR	CREATIVE/ OZONICS/ ORAPL/ CHEMTRONICS / FARADAY
9	NON CLOGG HORIZONTAL SCREW TYPE FILTER PRESS PUMP	ROTO/ POSITIVE/ ROTAMAC/ TUSHACO
10	CENTRIFUGE	APOLLO/ WELBRICK/ GWSPL/ PHARMATECH / GEA
11	PRESSURE GAUGE	H GURU / FEIBIG / GLUCK / BAUMER
12	BUTTERFLY / DUAL PLATE CHECK VALVES	AUDCO / ZOLOTO / ADVANCE / CASTLE /SANT
13	PLC	DELTA/ SIEMENS/ SCHNEIDER
	AUDIO-VIDEO	
1	LED VIDEO WALL / LED DISPLAY	SAMSUNG/LG/ PANASONIC / SONY
2	PROJECTOR	CHRISTIE / BARCO / NEC / PANASONIC
3	WIRELESS AND WIRED MICROPHONE BOUNDARY MICROPHONE GOOSNECK MICROPHONE WIRELESS CHARGER FOR WIRELESS GOOSNECK MICROPHONE ANTENNA & SPLITTER/ COMBINER	SHURE / SENNHEISER / AUDIO TECHNICA
4	DIGITAL PODIUM	AHA/ UNI/ MAXHUB/ TECCOM
5	NETWORK VIDEO ENDPOINT	QSC/KRAMER/EXTRON/ LIGHTWARE/ CRESTRON/ LUMENS
6	FULL RANGE CEILING SPEAKERS 2 WAY SPEAKER – TYPE 1 & 2 SUBWOOFER SURROUND SPEAKER PASSIVE COLUMN ARRAY LOUDSPEAKER – TYPE 1 & 2	QSC/ BOSE / TW AUDIO
7	AMPLIFIER	QSC/ LAB GRUPPEN / POWER SOFT
8	DIGITAL SIGNAL PROCESSOR	QSC/ BOSE / SYMETRIX
9	DIGITAL IP BASED CHAIRMAN UNIT DIGITAL IP BASED DELEGATE UNIT WIRELESS DELEGATE UNIT WIRELESS CHAIRMAN UNIT WIRELESS CONFERENCE CONTROLLER	SENNHEISER/ SHURE / TELVIC
10	MATRIX SWITCHER DISTRIBUTION AMPLIFIER,	LIGHTWARE/ EXTRON/ CRESTRON

SL. NO.	ITEMS	MAKES
	TRANSMITTER & RECEIVER	
11	TABLE MOUNT ENCLOSURE	KRAMER/CRESTRON/ LOGIC
12	PTZ CAMERAS	SONY/ LUMENS/ QSC/ PANASONIC
13	RECORDER & STREAMING SYSTEM	LUMENS/ MEDIA POINTE/ PANASONIC/ SONY
14	CONTROL TOUCH PANEL AND CONTROL SYSTEM	CRESTRON/QSC/EXTRON
15	SPEAKER & MICROPHONE CABLE	KRAMER / BELDONE / KRYSTAL
	CONTROL CABLE	
16	HDMI CABLE ACTIVE USB CABLE	CRESTRON/ EXTRON/ LIGHTWARE
17	VIDEO CONFERENCE SYSTEM	CISCO/ POLYCOM/ CRESTRON
	CCTV	
1	PTZ, BULLET, DOOM CCTV CAMERA, NVR	AXIS / HONEYWELL ENTERPRISES/ MOBOTIX IMPULS
	BOOM BARRIER	
1	BOOM BARRIER	DESIGNA / NEPTUNE / GODREJ
	BAGGAGE SCANNER	
1	BAGGAGE SCANNER	VEHANT/ RAPISCAN/ SMITH
	DOOR FRAME METAL DETECTOR	
1	DOOR FRAME METAL DETECTOR	VEHANT/ RAPISCAN/ SMITH
	FIRE SUPPRESSION SYSTEM	
1	FIRE SUPPRESSION SYSTEM	SVS BUILDWELL/ SAFEX / LIFEGUARD
	EV CHARGING	
1	EV charging	ABB/SCHNEIDER/NEPTUNE
	ACCESS CONTROL SYSTEM	
1	ACCESS CONTROL SYSTEM/ AUTOMATED FLAP BARRIER SYSTEM	SIEMENS/ SCHNEIDER/ GODREJ/ HONEYWELL/ BOSCH
	BIKE PARKING	
1	BIKE PARKING SYSTEM	iPARK/ TAR PARKING/
	BUILDING MANAGEMENT SYSTEM(BMS)	
1	CENTRAL CONTROL BMS SERVER	IBM/ HP/ DELL/ SIEMENS / HONEYWELL EBI/ SCHNEIDER
2	PRINTER	HP/ CANON/ EPSON
3	BUILDING MANAGEMENT SYSTEM	SIEMENS/ CARRIER ALC/ HONEYWELL EBI/ DELTA/ SCHNEIDER

SL. NO.	ITEMS	MAKES
4	BUILDING MANAGEMENT WEB BASED SERVER SOFTWARE	SIEMENS/ CARRIER ALC/ HONEYWELL EBI/ DELTA/ SCHNEIDER
5	PROGRAMMABLE & APPLICATION SPECIFIER CONTROLLER (DDC)	SIEMENS/ CARRIER ALC/ HONEYWELL COMFORT POINT/ DELTA/ SCHNEIDER
6	SYSTEM INTERGRATION UNITS FOR 3RD PARTY SOFTWARE INTEGRATION	SIEMENS/ CARRIER ALC/ HONEYWELL COMFORT POINT/ DELTA/ SCHNEIDER
7	ENCLOSURE FOR DDC CONTROLLER	RITTAL/ SIEMENS/ BCH/ DELTA
	SENSOR & FIELD DEVICES	
8	IMMERSION TYPE TEMPERATURE SENSORS	SIEMENS/ HONEYWELL COMFORT POINT/ALC/ DELTA
9	ULTRASONIC BTU METER/FLOW METER	SIEMENS/ HONEYWELL/ BELIMO/ DELTA
10	OUTSIDE T+RH SENSOR	SIEMENS/ HONEYWELL COMFORT POINT/ALC/ DELTA
11	DIFFERENTIAL PRESSURE SWITCH AIR	SIEMENS/ HONEYWELL COMFORT POINT/ ALC/ DELTA
12	DIFFERENTIAL PRESSURE SWITCH WATER	SIEMENS/ HONEYWELL/ DWYER/ DELTA
13	DIFFERENTIAL PRESSURE SENSOR-AIR/WATER	SIEMENS/ HONEYWELL COMFORT POINT/ ALC/ DELTA
14	ROOM/DUCT TYPE TEMP SENSOR	SIEMENS/ HONEYWELL COMFORT POINT/ ALC/ DELTA
15	ROOM/DUCT TYPE TEMP + RH SENSOR	SIEMENS/HONEYWELL COMFORT POINT/ ALC/ DELTA
16	PRESSURE SENSOR WATER	SIEMENS/HONEYWELL COMFORT POINT/ ALC/ DELTA
17	CO2 SENSOR/VOC SENSOR/ PM2.5&10	SIEMENS/HONEYWELL COMFORT POINT/ ALC/ DELTA
18	WATER LEVEL SWITCHES	VEKSLER/ FLIPRO/ OMICRON/ DWYER
19	FLAME PROOF LEVEL TRANSMITTER	VEKSLER/ FLIPRO/ OMICRON/ DWYER
20	DC VOLTAGE / CURRENT/ POWER FACTOR TRANSDUCER	L&T/ABB/ DWYER/ MECO
21	CURRENT RELAY	L&T/ABB/ DWYER/ MECO
22	VFD DRIVES	SCHNEIDER/ SIEMENS/ ALLEN BRADELY
	WIRING & CONDUCTING	
23	SIGNAL CABLE, PVC INSULATED,	POLYCAB/ SKYTON/ FINOLEX/

SL. NO.	ITEMS	MAKES
	TINNED COPPER	BONTON/ LAPP
24	LAN CABLE	BELDEN/ MOLEX/ PANDUIT
25	NETWORKING PASSIVE	PANDUIT/ AVAYA/ LEGRAND/ HP
26	NETWORKING ACTIVE	CISCO/ HP/ JUNIPER/ EXTREME/ AVAYA/
27	LAN PASSIVE (CABLE /IO'S/ PATCH CORDS/ FACE PLATE/ JACK PANEL) & OFC COMPONENTS	LEVITON/ SYSTIMAX/ PANDUIT/ POLYCOM / LEGRAND
28	CONTROL SOFTWARE, CONTROLLERS	HONEYWELL / SCHNEIDER ELECTRIC /SIEMENS/ ALC/ SAUTER/ JOHNSON CONTROL
29	TEMP GAUGE, PRGAUGE, FLOW SWITCH, PR SWITCH, ACTUATORS, ROOM THERMOSTAT, HUMIDSTAT, WATER FLOW METER, HARDNESS ANALYSER, PH, CHLORINE, TDS,CO,CO2 SENSORS ETC.	HONEYWELL/ SCHNEIDER ELECTRIC /SIEMENS / JOHNSON CONTROL/ KELE/ VEKSLER/ L&T/ DANFOSS/GE/ TRANE/ AZBIL
	MISC. ITEM	
1	PVC TAPE	ANCHOR/ STEEL GRIP/ANY ISI MARKED
2	FAN BOX (WITH ROD & HOOK ASSEMBLY)	FOR CONCEALED: CAST IRON/GI CONTINUOUSLY WELDED / PVC SAME AS PIPE MAKE
		FOR OPEN: ANCHOR FASTENER WITH HOOK
3	JOINTING KIT/ TERMINATION	RAYCHEM/ DENSONS/ MAHINDRA-3M / ABB
4	RO	BLUE STAR/ EUREKA FORBES/ KENT/ AO SMITH/ CROSSFIELD WATER PURIFIER
5	WATER COOLER	VOLTAS/ BLUE STAR/ USHA/ CROSFIELDS WATER PURIFIER
6	ELECTRICAL GEYSERS	HAVELLS / CROMPTON /AO SMITH (NOTE- GEYSER SHALL BE BEE 5 STAR RATED)
7	PVC TAPE	ANCHOR/ STEEL GRIP/ANY ISI MARKED
8	PIXEL LIGHT WITH CONTROLLER, DRIVER ETC.	PHILIPS/ REGENT/ OSRAM/ TRAXON
9	OCTAGONAL GI POLE	BAJAJ / VOLMOUNT / BPP/ TRANSRAIL/ HILITE /UTKARSH
10	MANUAL FIRE ALARM	AGNI, ASES SECURITY, SIEMENS,

SL. NO.	ITEMS	MAKES
		NOTIFIER
11	ALUMINIUM SHEETS	HINDALCO/ BALCO/ NALCO
12	ALL TYPE OF VALVES INCLUDING SLUICE VALVE, BALL VALVE, NRV, BUTTERFLY VALVE, STRAINER, FOOT VALVE, GLOVE VALVE, AIR RELEASE VALVE, NON RETURN VALVE ETC.	SAME AS FIRE FIGHTING SL. 25
13	COOLING TOWERS (CTI/ CERTIFIED)	ADVANCE/ MARLEY/ PAHARPUR/ BEL/ MIHIR
14	FAN COIL UNITS	AS PER HVAC MAKE LIST SL. NO. 15
15	FLEXIBLE DUCT	TWIGA/ RUSKINTITUS/ ATCO/ KIMMCO/ SEVENSTAR
16	FLOW SWITCH	RAPIDCOOL/ SIEMENS/ ANERGY/ HONEYWELL/ DANFOSS
17	FIBRE GLASS INSULATION	OWENS CORNING/ U. P. TWIGA
18	G.I. PIPES	SAIL/ TATA/ JINDAL
19	HEAT PUMP	DAIKIN/ TRANE/ TROX/ YORK/ CARRIER
20	M.S. PIPES	AS PER FIRE FIGHTING MAKE LIST SL. NO. 20
21	ROCK WOOL INSULATION	ROXUL-ROCKWOOL/ ROCKWOOLINDIA/ LLOYD/ OWENS CORNING
22	2-WAY/ 3-WAY MODULATING VALVES AND THERMOSTAT	JOHNSON CONTROLS/ SIEMENS/ HONEYWELL/ DANFOSS/ OVENTROP
23	ACTIVE/ PASSIVE HARMONIC FILTER FOR VFD (EXCEPT FOR CHILLER VFD)	L&T/ EPCOS/ SCHNEIDER/ DANFOSS/ ABB
	MISC. ITEMS : LV	
1	COMPUTER AND SERVER FOR BMS/ FAS/ CCTV/ SCADA ETC.	DELL/IBM/ HP
2	MONITOR & DISPLAY	LG/ SAMSUNG/ SONY/ PANASONIC
3	PRINTER	EPSON/ HP/ CANON.
4	DFMD, BAGGAGE SCANNER	RAPISCAN/ SMITH/ GILARDONI/ SAFRAN MORPHO
5	CHANNEL NETWORK DIGITAL VIDEO RECORDER (NVR)	AVIGILON / AXIS / PELCO / MOBITIX/ CP PLUS/ HONEYWELL /BOSCH
6	VIDEO SURVEILLANCE HARD DISK	SEAGATE/ WD
7	PORT MANAGED POE ETHERNET	CISCO/ JUNIPER/ NETGEAR

SL. NO.	ITEMS	MAKES
	SWITCH	
8	DISPLAY	SONY/ LG/ SAMSUNG/ PANASONIC
	<u>SOLAR POWER SYSTEM</u>	
1	MATERIAL FOR STRUCTURE	TATA/JINDAL (HISAR) /SAIL
2	SOLAR MODULE	TATA SOLAR/ BHEL/ VIKRAM/ ADANI/ WAAREE/ HAVELLS/ EMVEE
3	DATA LOGGER	COMPATIBLE TO INVERTER
4	INDUSTRIAL PC FOR DATA MONITORING	DELL/IBM/ HP
5	MODULE MOUNTING STRUCTURE (MMS) AS PER MNRE STANDARDS / SPECIFICATIONS- HOT DIP GI 2-3MM THICK	TATA / JINDAL (HISAR)/ SAIL
6	MMS – ACCESSORIES SS (304 GRADE OR ABOVE)	TATA / JINDAL (HISAR)
	<u>STAGE LIGHTING</u>	
1	STEP LIGHT	SKYLLO/ ILLUMINATION INDIA
2	PAR LIGHT	KEYA LIGHTS/ ETC/ MARTIN/ CANARA/ PLS/ MODERN STAGE
3	PARCAN LIGHT	KEYA LIGHTS/ ETC/ MARTIN/ CANARA/ PLS/ MODERN STAGE
4	BLINDER MATRIX	KEYA LIGHTS/ ETC/ MARTIN/ CANARA/ PLS/ MODERN STAGE
5	ALL TYPE OF SPOT LIGHT	KEYA LIGHTS/ ETC/ MARTIN/ CANARA/ PLS/ MODERN STAGE
6	BAR LIGHT	KEYA LIGHTS/ ETC/ MARTIN/ CANARA/ PLS/ MODERN STAGE
7	10R BEAM	KEYA LIGHTS/ ETC/ MARTIN/ CANARA/ PLS/ MODERN STAGE
8	LIGHTING CONSOLE	KEYA LIGHTS/ ZERO88/ AVOLITE
9	DMX SPLITTER	KEYA LIGHTS/ ZERO88/ AVOLITE
10	MODULAR CURTAIN	KEYA LIGHTS/ EFFECTRON/ CANARA
11	COTTON/ VULVATE FABRIC	RELIANCE/ NEXGEN/ INNOVATIVE/ RAYMONDS
12	BAR LIGHT/ MS WING FRAME/ CONTROL PANEL	KEYA LIGHTS/ MARKRICH/ MODERN STAGE

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.

FINANCIAL BID

CIVIL CONSTRUCTION UNIT					
Name of work: - Modernisation of the Entrance Plaza of National Zoological Park at New Delhi, India on EPC mode-1.					
NIT No: 06/2026-27/CE/CCU/CED-I/New Delhi					
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	Planning, designing and construction of Modernisation of the Entrance Plaza of National Zoological Park at New Delhi, India on EPC mode-1 Consisting of Food Court, Information Centre & Souvenir Shop, Entry gate, Entry Forecourt, Extension of old footover bridge along with its landscaping at Mathura road to enter in Zoo, bus drop off shelter, four-wheeler dropoff shelter, development of green areas, surface parking, landscape fountain, paved forecourt, internal roads and footpaths, entry for parking area, demolition of existing boundary wall at Mathura Road to facilitate entry and exit of the vehicles at Zoo, construction of boundary wall where ever required at all such locations to encompass the zoo campus, external development works around the buildings and services and complete site development etc. and Civil, E & M Works, MEP works associated with all these structures and services are to be carried out at the site. (Civil, E & M Works, Bulk E&M services, MEP services, Horticulture, Development and other works required for functionality of the project etc.) for National Zoological Park, New Delhi on EPC Mode-I (Design &	57,96,25,394	*	*	*

Build) Turn key basis comprising of the following: a) Food Court Building (Ground+ One Upper Floors), Information Centre & Souvenir Shop Building (Ground Floor), Entry gate (Ground Floor), Entry Forecourt (Ground Floor), Extension of old footover bridge along with its landscaping at Mathura road to enter in Zoo, bus drop off shelter, four-wheeler dropoff shelter as per the conceptual architectural drawings to be developed by EPC contractor for approval from local bodies and specifications mentioned in scope of work in this tender document, using RCC framed structure, External walls, external façade work, Internal partitions, Flooring, Wall Panelling, false ceiling, doors & windows, fire check doors, External & internal finishing, including, Miscellaneous structures and items etc. complete as per mentioned in the scope of work, specifications and approved drawings by Engineer-in-charge. b) Development works such as cutting and filling of earth, Retaining walls, Toe wall, boundary wall, roads, foot paths, covered path ways, Kerbstone, water-supply system, sewerage system, drainage system, fountain work, Amphitheater with stepped sitting arrangement, Fish Pond, underground sump, pump room, STP and Landscaping of open land area, all horticulture works and Utility services as defined in the scope of work, specifications mentioned in bid document and as per approved architectural drawings and layout plan. d) E&M Works and Bulk E&M Services : These works includes Wet riser system of Fire Fighting System with sprinkler,				
--	--	--	--	--

	Illuminated Signages & fire extinguisher, Automatic Fire alarm system and Public Address system, Internal Electrical Installations, External Electrical Service Connections, compound lighting, Entry gate lighting, Power Wiring and Plugs, Lightning Conductors, Telephone Conduits, Electrical Sub-station, Diesel Generating Sets (DG sets), UPS, 2 numbers Passenger Escalators, Baggage Scanner, Door Frame Metal Detector, HVAC (VRV/ VRF Air Conditioning System), Solar Photo Voltaic Power Generation Plant, IP Based CCTV Surveillance System and Allied equipment, Automated Flap Barrier System, Sewage Treatment Plant (STP), Hydro pneumatic System including hydro pneumatic pumps.				
	Total	57,96,25,394			

:-*- 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.

SOIL INVESTIGATION REPORT

**GEOTECHNICAL
INVESTIGATION
REPORT**

**REPORT ON SOIL INVESTIGATION WORK FOR
PROPOSED RESIDENTIAL BUILDINGS AT NATIONAL
ZOOLOGICAL PARK, MATHURA ROAD, NEW
DELHI.**

(REPORT NO. 13258 DATED 25.11.2022)

SUBMITTED BY

**FOUNDTEK CONSULTANTS PVT.LTD.
202-203, ANSAL'S MAJESTIC TOWER, PLOT NO. 17,
COMMUNITY CENTRE, BLOCK G-1,
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FOUNDTEK CONSULTANTS (P) LIMITED

GEOTECHNICAL CONSULTANTS, LAND SURVEYORS

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PROJECT : REPORT ON SOIL INVESTIGATION WORK FOR PROPOSED
RESIDENTIAL BUILDINGS AT NATIONAL ZOOLOGICAL
PARK , MATHURA ROAD , NEW DELHI.

ARCHITECT : M/S ARCH LINE DESIGNS PRIVATE LIMITED ,
LEVEL 3RD, B-58 B , SECTOR-60 ,
NOIDA U.P.-201301.

REPORT NO. : 13258

DATE : 25.11.2022

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RESIDENTIAL BUILDINGS AT NATIONAL ZOOLOGICAL
PARK , MATHURA ROAD , NEW DELHI.

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REPORT ON SOIL INVESTIGATION WORK FOR PROPOSED
RESIDENTIAL BUILDINGS AT NATIONAL ZOOLOGICAL
PARK , MATHURA ROAD , NEW DELHI.

1. INTRODUCTION

1.1 PROJECT

This soil investigation work , whose results are being presented herewith , has been carried out for the Residential buildings being proposed to be constructed by the project authorities at their site situated at NATIONAL ZOOLOGICAL PARK , MATHURA ROAD , NEW DELHI.

The proposed structures of this project will comprise of double storeyed height Residential buildings.

A plan of the site is being enclosed indicating the plot dimensions and the locations of the investigation points.

1.2 AIM OF SOIL INVESTIGATION

Soil investigation has been conducted at the site in order to evaluate the parameters required for design of foundations. These parameters are :

- (a) Type of foundation on which the proposed super structure will be supported.
- (b) Depth of foundation, and
- (c) Allowable bearing pressure at the founding level.

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SOIL INVESTIGATION REPORT

To evaluate these parameters, following engineering properties of the sub-soil have been studied :

- (a) Sub-soil penetration resistance characteristics which have been determined insitu.
- (b) Properties like particle size distribution, atterberg limits , bulk density , moisture content , dry density and shear strength parameters ; which have been determined in the laboratory by conducting testing of various soil samples.

1.3 SCOPE OF WORK

The stipulated scope of work comprised of the following:

- a) Mobilisation of equipment and personnel to the site and back.
- b) Sinking boreholes (2 nos.) down to 6 m depth or refusal whichever is encountered earlier , conducting required field and laboratory tests and their analysis.
- c) Preparation and submission of technical report.

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2. INVESTIGATIONS CONDUCTED**2.1 INSITU TESTS**

Locations of field testing points have been marked at the site as shown on the enclosed site plan. These locations have been designated as BH 1 and BH 2 in this report.

2.1.1 BOREHOLES

Following operations have been carried out during the progress of boreholes :

- (a) Augering operations down to termination depth of 6 m below the existing ground level.
- (b) Standard penetration tests at regular intervals.
- (c) Collection of soil samples from various levels of the sub-soil strata.

Two boreholes have been terminated at 6 m depth below the existing ground level.

2.1.1.1 WATER TABLE

Water table was encountered at following depths below the existing ground level in the two boreholes :

Borehole no.	Water table depth below G.L. (m)
1	0.70
2	1.15

This water table is liable to rise upto the top ground level during heavy rainy seasons.

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2.1.1.2 FILLED UP SOIL

Filled up soil was encountered down to following depths at the top in the two boreholes :

Borehole no.	Filled up depth (m)
1.	0.6
2.	1.0

2.1.1.3 STANDARD PENETRATION TEST RESULTS

Following standard penetration resistance ('N') values have been recorded at various depths in the two boreholes :

DEPTH (M)	'N' VALUES	
	BH 1	BH 2
1.5	4	
2.0		5
3.0	6	
3.5		8
4.5	9	
5.0		9
6.0	11	10

2.2 LABORATORY TESTS AND RESULTS

Following tests have been conducted on various soil samples in the laboratory :

- (a) Particle size Distribution.
- (b) Liquid and plastic limits.
- (c) Shear Tests.
- (d) Specific Gravity.

Results are being tabulated as follows :

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LABORATORY TEST RESULTS

BOREHOLE LOCATION : 1

DISTURBED SAMPLES

DEPTH (M)	GRADATION ANALYSIS (%)				ATTERBERG LIMITS (%)	
	GRAVELS	SAND	SILT	CLAY	LIQUID	PLASTIC
1.5	0	85	15	0	NONPLASTIC	
3.0	0	96	4	0	NONPLASTIC	
4.5	0	97	3	0	NONPLASTIC	
6.0	0	96	4	0	NONPLASTIC	

REMOULDED SAMPLES

DEPTH (M)	COHESION (Kg/sq. cm)	ANGLE OF SHEARING RESISTANCE (O)
2.5	0.00	29

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LABORATORY TEST RESULTS

BOREHOLE LOCATION : 2

DISTURBED SAMPLES

DEPTH (M)	<u>GRADATION ANALYSIS (%)</u>				<u>ATTERBERG LIMITS (%)</u>	
	GRAVELS	SAND	SILT	CLAY	LIQUID	PLASTIC
2.0	0	93	7	0	NONPLASTIC	
3.5	0	95	5	0	NONPLASTIC	
5.0	0	98	2	0	NONPLASTIC	
6.0	0	96	4	0	NONPLASTIC	

REMOULDED SAMPLES

DEPTH (M)	COHESION (Kg/sq.cm)	ANGLE OF SHEARING RESISTANCE (O)
1.5	0.00	28

SPECIFIC GRAVITY

BOREHOLE NO.	DEPTH (M)	SPECIFIC GRAVITY
1	2.5	2.67
2	1.5	2.68

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3. OBSERVATIONS

Following points are observed from results obtained :

- (a) Grain size distribution curves plotted from sieve and hydrometer analysis indicate that the sub-soil strata in the site comprises of predominantly sand. Gravels and Clay particles were not observed at any levels.
- (b) Average values of cohesion and angle of shearing resistance values work out to 0.00 kg./sq.cm. and 28 degrees respectively.
- (c) The sub-soil strata is nonplastic in nature as indicated by 'atterberg limits' tests' results.

4. DISCUSSIONS

For designing the foundation system, the following parameters are required :

- (a) Suitable type of foundation on which the proposed super-structure can be supported.
- (b) Depth of these foundations, and
- (c) Allowable bearing pressure at the founding level corresponding to various footing sizes.

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4.1 TYPE OF FOUNDATION

Type of foundation to be adopted for a particular structure depends upon the loading intensity at the foundation level and the configuration of loading points.

Considering the anticipated loads, proposed project buildings can be supported over square isolated foundations.

4.2 DEPTH OF FOUNDATION

Foundations for the proposed structures will be placed at a minimum depth of 200 cms. below the existing ground level OR 100cms. within virgin soil whichever is deeper.

4.3 ALLOWABLE BEARING PRESSURE

Following criteria have been adopted for evaluation of allowable bearing pressure values :

1. Settlement criterion
2. Shear strength criterion

Shear failure condition as per I.S. 6403 has been considered for deducing shear strength value.

Allowable settlement values of 50 mm has been considered for allowable bearing pressure computation.

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5. SAMPLE CALCULATIONS

Type of foundation : Square Isolated
Depth of foundation : 200 cms. below the
existing ground level
OR 100 cms. within
virgin soil whichever
is deeper.
Width of foundation : 200 cms.

I. SETTLEMENT CRITERIA FROM 'N' VALUES

Weighted average 'N' value = 8

Referring to I.S.8009 Part I,
Settlement per unit pressure
(kg./sq.cm.) corresponding
to above 'N' value = 54 mm

Considering water table correction ,

Settlement per unit pressure
(kg./sq.cm.) = 108 mm

Considering depth factor as per Clause 9.5.1 ,

Settlement per unit pressure
(kg./sq.cm.) = 83.7 mm

Allowable settlement = 50 mm

Net allowable bearing
pressure = 0.60 kg./sq.cm.

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II. SHEAR FAILURE CRITERION

FOR GSF
$$Q = 0.4 (1.3 c N_c + 1.2 \times q (N_q - 1) + 0.20 r B N_r)$$

FOR LSF
$$Q = 0.4 (2/3 \times 1.3 c N_c + 1.2 \times q (N_q - 1) + 0.20 r B N_r)$$

Cohesion , $c = 0.00 \text{ Kg/sq.cm.}$

Angle of shearing resistance , $\phi = 28 \text{ degrees}$

Bearing capacity factors

GSF :
 $N_c = 26.37$, $N_q = 15.30$, $N_r = 17.79$

LSF :
 $N_c = 14.52$, $N_q = 6.20$, $N_r = 5.17$

Overburden density , $r = 1.00 \text{ gms./cc.}$

Shear strength (GSF), $Q(\text{GSF}) = 1.66 \text{ kg./sq.cm.}$

Shear strength (LSF), $Q(\text{LSF}) = 0.58 \text{ kg./sq.cm.}$

Shear Strength (Intermediate) = 0.85 kg./sq.cm.

III. RECOMMENDATIONS

ADOPT , $Q_{\text{net}} = 0.60 \text{ kg./sq.cm.}$

Based upon the same , the recommendations are being provided as follows :

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6. RECOMMENDATIONS

- I. Type of foundation : Square Isolated
- II. Depth of foundation : 200 cms. below the existing ground level
OR 100 cms. within virgin soil whichever is deeper.
- III. Allowable Bearing Pressure
- A net allowable bearing pressure value of 0.60 kg. / sq. cm. can be adopted corresponding to all foundation widths at above recommended depth.

NOTES :

- a) After the excavations for the foundations have been completed, a layer of thickness 8" of broken stone pieces of size 6"-8" will be laid. A layer (of thickness 6") comprising of coarse sand (Badarpur) mixed with 40 mm aggregate will be laid above it so as to fill the voids. Compacting operations will be carried out with the help of suitable means in order to eliminate the loose pockets beneath the foundations.

Thus prepared surface can be used for laying the P.C.C. and resting the foundations.

- b) In view of shallow water depth at the project site, recommendations are being provided for Bored cast-in-situ pile foundations as follows:

BORED CAST-IN-SITU PILE FOUNDATIONS

- I. DEPTH OF FOUNDATION: 6.0 m below the existing ground level (Effective length of pile = 5.0 m).

Cut off level of the piles may be taken at 1.0 m below the existing ground level.

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II. VERTICAL PILE CAPACITIES

EFFECTIVE PILE DEPTH (M)	PILE CAPACITY (TONNES) CORRESPONDING TO PILE STEM DIA. (CMS.) OF	
	40	50
5.0	8.1	11.7

III. UPLIFT PILE CAPACITIES

EFFECTIVE PILE DEPTH (M)	PILE CAPACITY (TONNES) CORRESPONDING TO PILE STEM DIA. (CMS.) OF	
	40	50
5.0	3.5	4.6

IV. LATERAL LOAD CAPACITIES

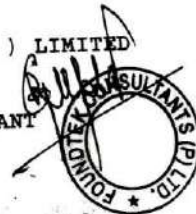
PILE DIA. (cms.)	LATERAL PILE CAPACITY (TONNES)
40	2.9
50	4.1

Initial Pile load tests will be conducted on the test piles as per relevant I.S. code of practice.

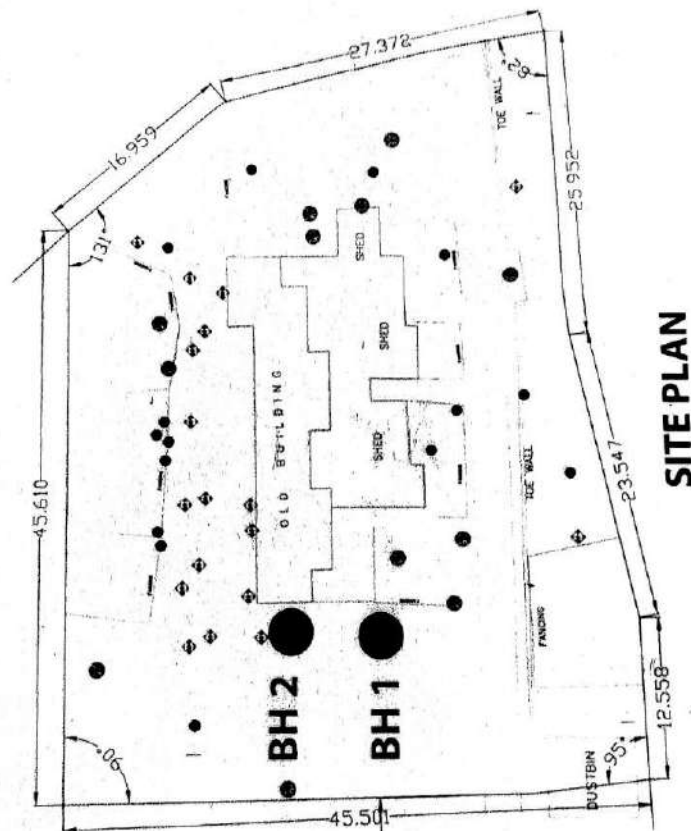
- c) In case, it is desirable to have design parameters at any levels other than recommended in this report, the case may be referred back to the consultants for analysis.

For FOUNDTEK CONSULTANTS (P) LIMITED

(RAJESH GUPTA)
ENGINEERING CONSULTANT



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SOIL INVESTIGATION REPORT

Project: PROPOSED RESIDENTIAL BUILDINGS AT NATIONAL ZOOLOGICAL PARK,
MATHURA ROAD, NEW DELHI.

Bore Hole No.: 1

Depth of termination: 6.00 M BELOW THE EXISTING G.L.

Depth of Water Table: 0.70 M BELOW THE EXISTING G.L.

COMPILED BORELOG PROFILE

Depth (m)	N value	Notation	Soil Description
0.00			FILLED UP SOIL
0.50			
0.60			
1.00			SILTY SAND
1.50	4		
2.00			
2.50			
3.00	6		
3.50			
4.00			
4.50	9		
5.00			
5.50			
6.00	11		

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SOIL INVESTIGATION REPORT

Project: PROPOSED RESIDENTIAL BUILDINGS AT NATIONAL ZOOLOGICAL PARK,
MATHURA ROAD, NEW DELHI.

Bore Hole No.: 2

Depth of termination: 6.00 M BELOW THE EXISTING G.L.

Depth of Water Table: 1.15 M BELOW THE EXISTING G.L.

COMPILED BORELOG PROFILE

Depth (m)	N value	Notation	Soil Description
0.00			FILLED UP SOIL
0.50			
1.00			
1.50			SILTY SAND
2.00	5		
2.50			
3.00			
3.50	8		
4.00			
4.50			
5.00	9		
5.50			
6.00	10		

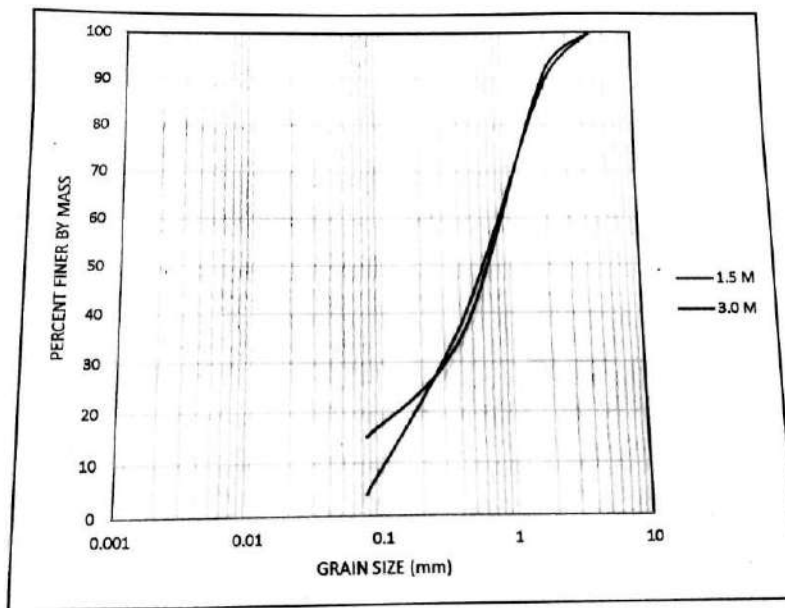
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GRAIN SIZE DISTRIBUTION CURVE (BH 1)

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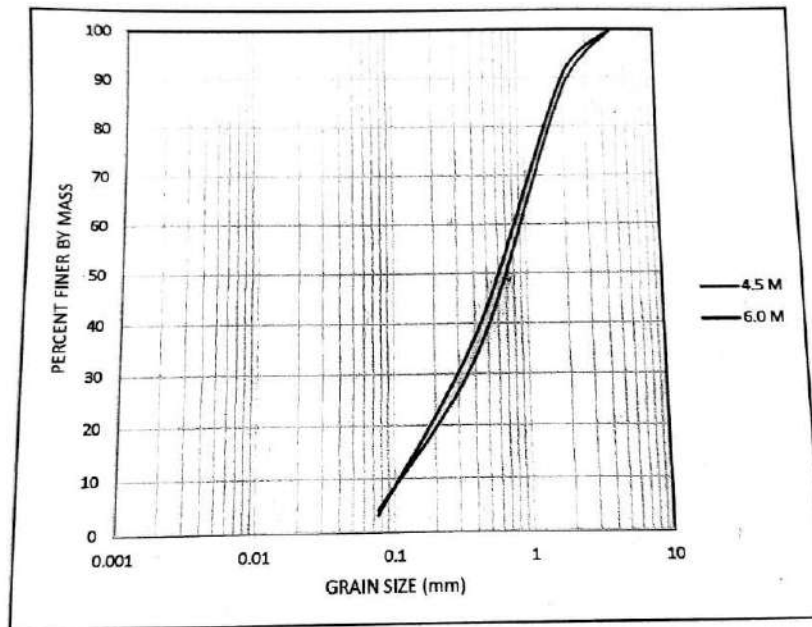
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GRAIN SIZE DISTRIBUTION CURVE (BH 1)

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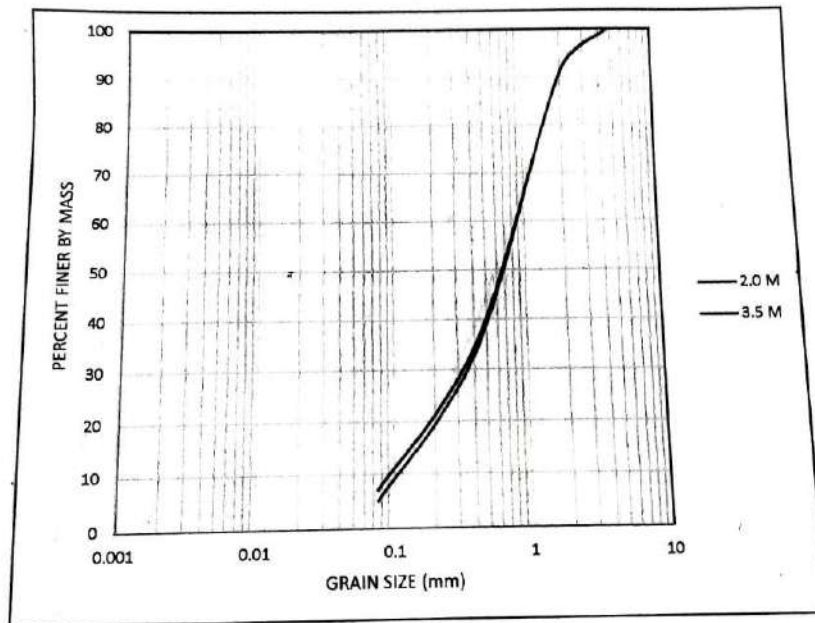
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GRAIN SIZE DISTRIBUTION CURVE (BH 2)

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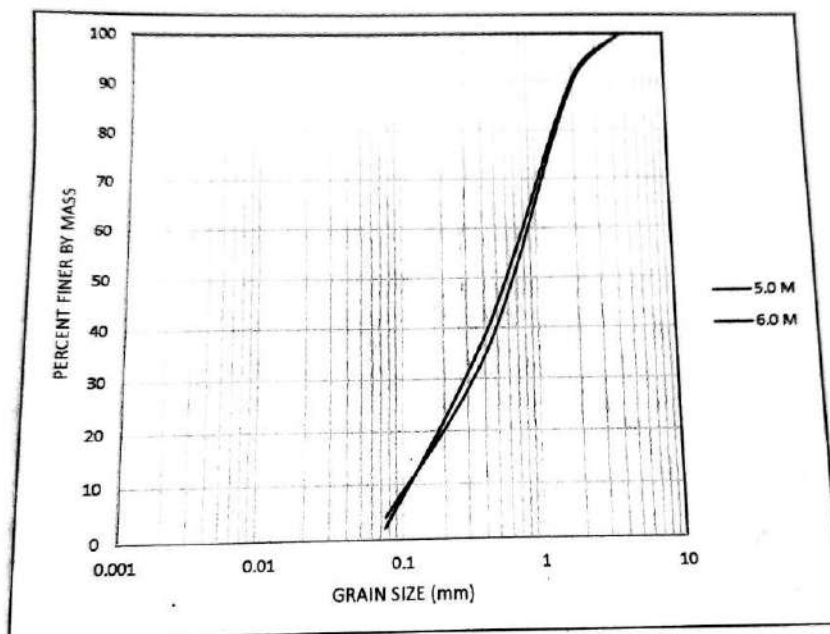
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GRAIN SIZE DISTRIBUTION CURVE (BH 2)

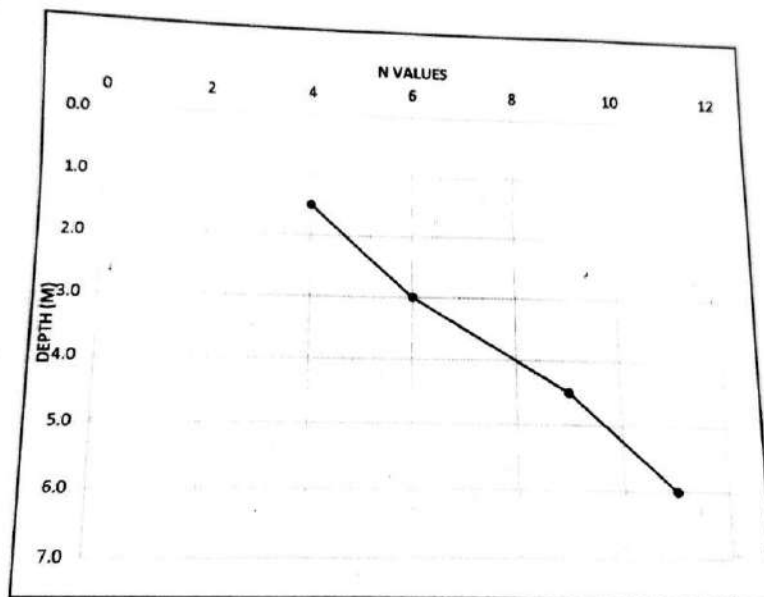
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DEPTH VS SPT VALUES (BH 1)

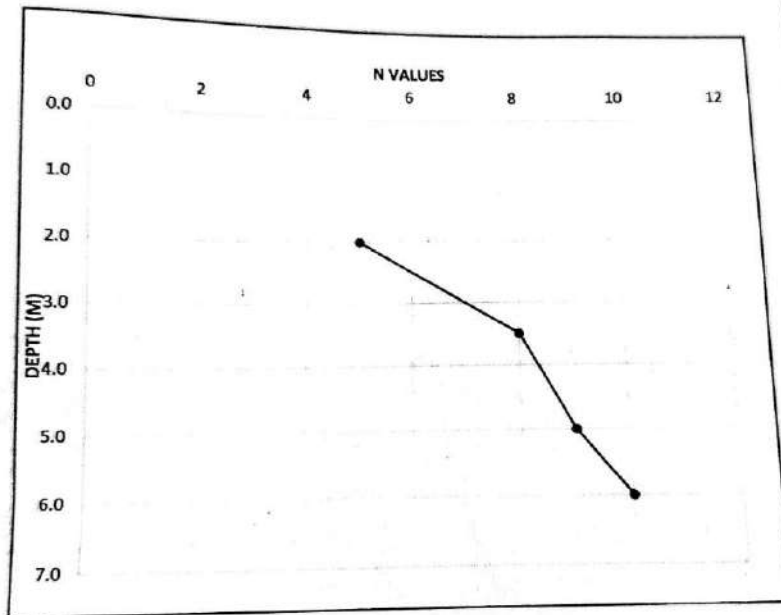
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DEPTH VS SPT VALUES (BH 2)

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