TENDER ISSUED TO: M/S_____
DATE: _____

CADET COLLEGE SANGHAR

AT JAM NAWAZ ALI, VIA TANDO ADAM, SINDH

CONSTRUCTION OF FOLLOWING BUILDINGS

a. CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL.
b. CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY IV (OFFICERS COLONY).
c. CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY V
d. CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY VI

(CIVIL, PLUMBING & ELECTRICAL WORKS)

TENDER DOCUMENTS

1. NOTICE INVITING TENDER
2. SCOPE OF WORK
3. INSTRUCTION TO TENDERERS
4. SPECIAL CONDITIONS OF CONTRACT
5. SPECIAL STIPULATIONS
6. FORMS OF AGREEMENT / PERFORMANCE BOND / MOBILIZATION ADVANCE
7. TECHNICAL SPECIFICATION
8. LIST OF SPECIFIED MATERIAL
9. BILL OF QUANTITIES
10. FORM OF TENDER
11. TENDER DRAWINGS

YOUNG ASSOCIATES

CONSULTING ENGINEERS, ARCHITECTS & PLANNERS
9-C, 24TH COMMERCIAL STREET, PHASE – II (Ext.)
DEFENCE HOUSING AUTHORITY, KARACHI
PHONE # 0321-2491553 , 0321-2491553 Fax: 021–35883106
E-MAIL: info@youngassociates.com.pk
URL: www.youngassociates.com.pk

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SECTION – 1

NOTICE INVITING TENDER

CADET COLLEGE SANGHAR
At Jam Nawaz Ali, Via Tando Adam, District Sanghar

NOTICE INVITING TENDER
(Single Stage-Two Envelope Procedure)

Cadet College Sanghar invites sealed Bids/ Tenders from interested Contractors of repute enlisted in category C-3 or above for construction of following works:

S. No	Name of Project	No./ Units	Total Area(SFT)	Cost (Million)	Completion Period
1.	CADET COLLEGE SANGHAR a. Construction Of Lal Shahbaz Qalandar Boys Hostel	01	23420	333.189	18 Months
	b. Construction of Staff Family Quarters/ Flats category IV (Officers Colony)	08	8000		12 Months
	c. Construction of Lower Staff Family Quarters/Flats category V	08	6800		12 Months
	d. Construction of Lower Staff Family Quarters/Flats category VI	08	6000		12 Months
2.	e. Construction of Military Training Staff Barrack & Classes	01	10600	20.061	12 Months

Scope of work details are mentioned in Bidding Documents.

Bidding/Tender Documents: Complete set of Bidding Documents can be obtained from **10 till 24 December 2025** upon submission of a written application on official letter head and payment of a Non-refundable fee of Rs. 10000 in the shape of Pay order in favor of Principal Cadet College Sanghar. The Bidding Documents will also be available on EPADs SPPRA's website and Cadet College Sanghar website (**www.ccsanghar.edu.pk**).

Submission: **"Technical"** and **"Financial"** bids completed in all respects in sealed envelopes separately mentioning name of work and marked as **"Technical"** and **"Financial"** Proposals must be submitted in one envelope on or before **26 December 2025 at 12:00 PM** and must be accompanied by a Bid Security of 2% of the Bid price in the shape of Pay Order/ Demand draft in favor of Principal & Project Director, Cadet College Sanghar.

Tender Opening: Initially the **Technical proposal** will be opened on **26 December 2025 at 02:00 PM,** where as the **financial proposals** will be retained with the Tender opening Committee. The technical proposal will be evaluated by Tender opening committee. Thereafter, financial proposal of technically qualified firms will be opened by the same committee on the date and time to be communicated to the bidders. The financial proposal of the bids found technically disqualified shall be returned unopened to the respective bidders. In case of unusual circumstance, Tenders will be opened on next working day at the same time.

Place of Issuance, Submission, Inquiries & Opening: Office of the Principal & Projector Director, Cadet College Sanghar at Jam Nawaz Ali via Tando Adam, District Sanghar.

Telephone Numbers: 0235-548008, 0235-548077, 0344-3611347.

Eligibility: Valid registration with Tax Authorities (FBR & SRB) and Pakistan Engineering Council in category C-3 and discipline as mentioned in Bidding Documents.

Bidding Procedure: Single Stage two Envelope

Terms & Conditions: under the following conditions, Bids will be rejected:

i. Conditional and Telegraphic Bids/ Tenders
ii. Bids not accompanied by Bid security of required amount and form
iii. Bids received after specified date and time
iv. Bids submitted by black listed firms
v. Incomplete bids as per instruction given in bidding documents

Bids Validity Period: Ninety (90) days.

The Principal & Project Director, Cadet College Sanghar reserves the right to reject any or all bids subject to the relevant provisions of Sindh public procurement rules 2010 (amended time to time).

Principal/ Project Director
College Sanghar

CRITERIA OF QUANTIFICATION/QUALIFICATION

(a). The following documents should be attached with the Technical Proposal.

i) Name of Firm, Postal Address, Telephone, Fax Number, E-mail Address and Organization Chart.
ii) Legal Status of Firm.
iii) Copy of valid PEC Contractor's License in category C-3 and discipline CE-09, CE-10, EE-04, EE-06, Electrical Inspectors License valid in Sindh (Mandatory).
iv) Copy of NTN Certificate (Mandatory).
v) Copy of Prequalification letters issued by other Govt. /Semi Govt. autonomous bodies and Organizations. (Building Works only)
vi) Certificate of satisfactory completion of works by the clients. (Building Works only upto 100 Million)
vii) List of Key Permanent Technical Staff Members along with their latest affidavit on judicial stamp paper of Rs.100/- that they are working with the applicant.
viii) List of works completed in last five years with name and telephone No. of the clients and value of project (Mandatory). (Building Works only upto 100 Million)
ix) List of work in hand including all details required in (viii) above. (building Works only)
x) Affidavit on Rs.100/- Non Judicial Stamp Paper declaring that the firm has never been Blacklisted by any Govt./Semi Govt. Autonomous body or organization. (Mandatory).
xi) List of Equipment/Plants available with the firms which can be verified.
xii) Audit financial statement last 05 years.
xiii) Bank Statement of last 05 years.
xiv) Income Tax Return for last 05 years.

(b). Scope of Contract.

The Scope of Contract includes but not limited to the following:

a. Construction of RCC structure
b. finishing works
c. Civil, Electrical, Firefighting & Plumbing works

Note: 1). Verification of the information provided by the applicants in the submissions for short listing may be made. In case the information is found to be wrong or incorrect in any material way or the applicant is found to be lacking in the capability or resources to successfully perform the contract, the application shall not be entertained.

2). The document not containing Mandatories will not be entertained.

(c). Technical Evaluation Criteria.

(a).	**Legal Status of Firm**	**(Maximum 3 Points)**
(i)	Limited Co.	3 Points
(ii)	Partnership	2 Points
(iii)	Individual	1 Point
(b).	PEC Registration C-3 (CE-09, CE-10)(EE-04.EE-06), Electrical Inspectors License	Mandatory
(c).	NTN Registration, SRB Registration	Mandatory
(d).	Certificate of completion of works (civil, plumbing & electrical works) with cost undertaken. (attached certificates) (Only Building Works more than 100 Million will be considered)	3 Point per Certificate (Max 15) Points.
(e).	List of works (civil plumbing & electrical works) in hand. Provide Documentary Evidence (work orders with cost) (Only Building Works more than 100 Million will be considered)	5 Point for each work order (Max 15 Points).
(f).	List of permanent technical Staff (a). Masters 3 Marks for each Engineer holding Masters Degree (b). Graduate 2 Marks for each Engineer holding Graduation Degree (c). Diploma Holder 1 Marks for each person having relevant certificate	Max 15 Points
(g).	Affidavit on Rs. 100/- stamp paper declaring that the firm has never been black listed.	Mandatory
(h).	List of equipment & plant (ownership document evidence is mandatory)	(Max 17 Points)
(i).	Concrete Mixers	2 Points
(ii).	Concrete Hoist	2 Points
(iii).	Vibrators	1 Point
(iv).	Tractor with Trolley	1 Point
(v).	Leveling instrument / Theodolite	1 Point
(vi)	Steel welding plant	1 Point
(vii)	Batching Plant	5 Point
(viii)	Shuttering (min. shuttering owned by contractor must be 100,000 sft including its vertical props)	4 Points
(i).	**Average Annual Turnover of last 05 years from Audit Reports.** (i). Above Rs. 100 million (ii). From Rs. 90 to Rs. 100 million (iii). From Rs. 70 to Rs. 90 million (iv). From Rs. 50 to Rs. 70 million (v). upto Rs. 50 million	(Max 25 Points) Full Points 25 Points 20 Points 15 Points 12 Points 10 Points
(j).	**Bank Statements of last 05 years.**	1 Points for each year (Max 5 Points)
(k).	**Income Income Tax Returns (Last 05 Years).**	1 Points for each year (Max 5 Points)
		100 Points

Qualifying Score: 60 Points

For Category C-3 (CE-09, CE-10) (EE-04, EE-06) and above

Signature with Official Seal

SECTION – 2

SCOPE OF WORK

SCOPE OF WORK

Cadet College Sanghar at Jam Nawaz Ali, Via Tando Adam, District, Sanghar intends to Construct **"Construction of following Buildings: (a). Construction of Lal Shahbaz Qalandar Boys Hostel, (b). Construction of Staff Family Quarters / Flats Category – IV (Officers Colony), (c). Construction of Lower Staff Family Quarters / Flats Category – V, (d). Construction of Lower Staff Family Quarters / Flats Category – VI"** in accordance with the drawings and specifications appended hereto.

The scope of contract for this bid shall be limited to Civil, Plumbing and Electrical works.
The Owner may increase or decrease the quantum of Work given in BOQ at his sole discretion at the rates quoted here in and no such increase or decrease shall give rise to any claim or compensation in this account.

The scope of work given in Contract Document includes items based on unit rates as indicated in schedule of rates, Govt. of Sindh (2024) for which Specifications of standing rates committee Govt. of Sindh be followed. (If Specification of any item is not indicated in Technical Specification of Tender Document) and / or items based on market rates for which Technical Specifications are given in the nomenclature and in section "Technical Specification"

The Contractor will be responsible for properly placing the location of the building as per Contour Plan and fix the plinth level in conjunction with the Bench Mark available at site as per the drawings provided by the Consultants and get it verified from them before taking up the works.

SECTION – 3

INSTRUCTIONS TO TENDERERS

INSTRUCTIONS TO TENDERERS

1. GENERAL

1.1 The Principal / Project Director, *Cadet College Sanghar* (hereinafter referred to as the "OWNER") through their Consultants viz YOUNG ASSOCIATES hereinafter referred to as "CONSULTANTS" invites from Contractors to submit tender for **"Construction of following Buildings: (a). Construction of Lal Shahbaz Qalandar Boys Hostel, (b). Construction of Staff Family Quarters / Flats Category – IV (Officers Colony), (c). Construction of Lower Staff Family Quarters / Flats Category – V, (d). Construction of Lower Staff Family Quarters / Flats Category – VI"** as described in the scope of work in accordance with specifications and drawing requirements.

1.2 Tenders shall be prepared and submitted to the OWNER strictly in accordance with the instructions set forth herein.

1.3 All entries in the tender are to be in ENGLISH LANGUAGE, Corrections, overwriting etc, shall be signed by the authorized persons.

2. TENDER DOCUMENTS

The list of document indicated in the Form of Agreement shall form integral part of the agreement subsequently.

3. INSPECTION OF SITE AND LOCATIONS

3.1. The Tenderer shall inspect the site of work and surroundings and shall satisfy themselves before submitting their Tenders as to the qualities and nature of the work, the requirements and availability of manpower, labour, materials, water, electricity and roads, the means and access to the site. The tendered rates shall be considered to include all these factors as well as any, or all other factors which may influence the cost of construction.

3.2. The rates shall include the cost of all material, but in case, owner agrees to supply any or all the building materials to the Contractor, the deduction for the cost of these materials shall be made from the bills (Interim or final as the case may be) of the Contractor.

4. SUFFICIENCY OF TENDER

4.1. Each tenderer shall be deemed to have fully satisfied himself before submitting the Tender as to the Correctness and sufficiency of his Tender and of the rates and prices stated in the Bill of Quantities which rates and prices shall, except in so far as it is otherwise expressly provided in the Conditions of contract, must cover all his obligations under the Contract and all matters and things necessary for the proper completion of Project.

4.2. No tenderer shall have any right to make any objection, excuse or claim about correctness and sufficiency of this Tender after acceptance of his Tender by the OWNER.

5. VERBAL INSTRUCTIONS BE IGNORED

The Owner shall not assume any responsibility for information, interpretation and deductions the Tenderers may make from the data furnished by the Owner or the Consultants. No verbal understanding, agreement or conversation with any officer, employee or agent of the Owner or the Consultants, either before, during or after the execution of the Contract, shall affect or modify any of the terms or obligations contained in the Tender Documents.

6. EXPLANATION OF DOCUMENTS

Any tenderer who may have any doubt or question as to the true meaning of any part of the Tender Documents should deliver to the OWNER or the CONSULTANTS a written request for a clarification or answer thereof, prior to two days of the date set for opening of the Tender. Any explanations, revisions, additions or deletions to the tender documents will be made only by formal addendum, duly signed and issued with prior approval of OWNER and mailed or delivered to each tenderer who has received a set of Tender Documents. Such addendum will become an integral part of the Tender Documents and receipt thereof must be acknowledged by return of on the form issued with the addendum. Each addendum shall be signed by the Tenderers. The OWNER shall neither be responsible nor bound by any explanations, revisions, additions or deletions to the Tender Documents except those contained in the formal Addendum signed and issued by the OWNER or the CONSULTANTS.

7. DRAWINGS

The drawings showing the proposed work are also being issued with the Tender. The OWNER / CONSULTANT, however, reserves the right to make any addition, alteration or modification and / or deletion in these drawings, specifications and / or BOQ (Scope of work) at any time in the best interest of the work.

8. COST OF TENDERING

Tenderers shall have no claim for reimbursement of any expenses of any kind whatsoever incurred in connection with preparation and submission of their tenders.

9. INCOMPLETE TENDERS

Incomplete Tenders shall be liable for rejection by the Owner.

10. SUPPLY OF MATERIALS, WATER AND ELECTRICITY

a). No materials of any kind what so ever required for execution of the work shall be supplied or arranged by the OWNER. It shall be the responsibility of the Tenderer to procure all materials required for timely completion of the work.

b). The Contractor should make his own arrangements for water and electricity.

c). If available electric supply and water may be supplied by the Owners the some may be shared with the contractor @0.25% for electric supply of the contract amount and 2 % for water supply service of the contract amount .

11. EARNEST MONEY

11.1. The original Tender shall be accompanied by Earnest Money 5% as specified in NIT in the form of Pay Order / Demand Draft issued by a Schedule Bank of Pakistan in favor of The Principal / Project Director, *Cadet College Sanghar*. The money will be adjusted in Performance Guarantee of the successful bidders.

11.2. The Earnest Money will be refunded to unsuccessful bidders within 30 days from the date of opening of tenders.

12. SUBMISSION OF TENDER

The Tender Document duly signed on each page, corrections and overwriting alongwith the Earnest Money for the tender shall be properly signed and sealed and clearly marked as Technical & Financial Proposal and delivered in person or by registered mail or through Courier Service to the following address.

TO
THE PRINCIPAL / PROJECT DIRECTOR
CADET COLLEGE SANGHAR
AT JAM NAWAZ ALI, VIA TANDO ADAM,
PH: 235-548001-4

so as to reach on or before the time and date given in the Notice of Tender at which time and place, they will be opened in the presence of such of the representatives of the Tenderers who may wish to be present. Only the name of the Tenderers and the Total quoted rates shall be announced by the OWNER at the time of opening of the Tender.

In case of any calculation errors detected during scrutiny of the Tenders, the unit RATE quoted by the Tender shall be taken as final and the tender value corrected accordingly.

13. AWARD OF CONTRACT

The OWNER does not bind himself to award the Contract to the lowest or to any other Tenderer but will take into consideration all aspects as are deemed relevant and applicable. Once the OWNER has arrived at the decision, he will issue a written letter of Award to the successful tenderer. Thereafter, the successful tenderer will be required to execute a formal agreement. Failure of the successful tenderer to sign the agreement within the prescribed time-schedule shall be a just cause for the annulment of the award of the contract and in the event of such annulment, the Earnest Money of the successful tenderer will be forfeited by and to the OWNER.

14. MOBILIZATION

If the tenderer to whom the Letter of Award is issued by the OWNER does not mobilize at the site of work within the stipulated time and take all appropriate steps to commence the work, the Earnest Money deposited by him along with his tender shall stand forfeited in favor of the OWNER as liquidated damages.

15. COMPLETION TIME AND COMPLETION CERTIFICATE.

a). The work is to be substantially completed in all respects, in accordance with drawings and specifications, to the entire satisfaction of Engineer Incharge within the period set forth in the Tender. Failure of the Tenderer to complete the whole of the work within the specified time, will result in imposition and recovery of liquidated damages under the conditions of contract.

b). When the work is completed in all respects and handed over to the OWNERs the Consultant will issue the certificate that the works are substantially completed and Defect Liability Period will commence with effect from the date of issue of such certificate and will indicate the terminal date of such period.

16. MAINTENANCE PERIOD

The maintenance period of the work shall be 365 days effective from the date of issue of completion certificate by the Consultants.

17. SPECIAL STIPULATIONS

In case of doubt Special Stipulations will take precedence over all other conditions in Tender Documents.

SECTION – 4

SPECIAL CONDITIONS OF CONTRACT

SPECIAL CONDITIONS OF CONTRACT

1. DEFINITIONS AND INTERPRETATIONS

1.1. Definitions

In the Contract (as hereinafter defined), the following words and expressions shall all have the meanings herein assigned to them unless the context otherwise requires:

a) "OWNER" means the M/s Cadet College Sanghar, Sindh legal successors and assignees.

b) "CONSULTANTS" means M/S YOUNG ASSOCIATES, 9-C, 24th Commercial Street, Phase-II (Ext), DHA, Karachi, appointed by the OWNER as CONSULTANTS for the purpose of Technical assistance for supervision and management of the "WORKS" hereinafter defined.

c) "ENGINEER" means the person or agency for the time being or from time to time designated or appointed in writing by the Consultant to represent them and to perform the duties set-forth in Article-4 hereof.

d) "ASSOCIATE" means a firm / company hired to work in the trades of Electrical Installations / Air-Conditioning Installations or any other special trade having valid P.E.C. License in relevant category and also valid license issued by Electrical Inspector or by any other license granting Agency for the respective trades.

e) "WORKS" means Construction of **"Construction of following Buildings: (a). Construction of Lal Shahbaz Qalandar Boys Hostel, (b). Construction of Staff Family Quarters / Flats Category – IV (Officers Colony), (c). Construction of Lower Staff Family Quarters / Flats Category – V, (d). Construction of Lower Staff Family Quarters / Flats Category – VI"** LUMHS, Jamshoro, Sindh by virtue of the contract to be executed, whether temporary or permanent and whether original, altered, substituted or additional in accordance with the contract.

f) "CONTRACTOR" means the person, firm or company whose Tender has been accepted by the OWNER and includes the contractor's representatives, successors and permitted assignees.

g) "DRAWINGS" means the drawings showing the related details of architectural, structural, plumbing, electrical and mechanical services and other such works including the layout plans, elevations, sections, details, perspectives, sketches and other details and also the drawings referred to in the specifications and any modifications of such drawings approved in writing by OWNER / CONSULTANTS and such other drawings as may from time to time be furnished for approval in writing by the OWNER in Consultations with the CONSULTANTS.

h) "SITE" means the land and other places on, under over, in or through the work s are to be executed or carried out and any other lands or places provided by the owner for the purpose of the Contract together with such other places as may be specified in or pursuant to the contract as forming part of the site.

i) “TENDER” means the offer tendered by the Contractor for the Works governed by the Contract.

j) “SPECIFICATIONS” means directions, provisions and requirements contained in the drawings or in the nomenclature or descriptions given in the contract documents and / or the verbal instructions of the Consultants.

k) “CONTRACT DOCUMENT” means and includes the Letter of Work Award, agreement, conditions of contracts, specifications, schedule of quantities, Tender Drawings, details, sketches Performance / Bank Guarantee, Insurance Policies and all other papers pertaining to the construction work of this project. It shall also include any and all supplementary documents which may be necessitated to complete the work as required by the Owner through Consultant.

l) “APPROVED” means approved in writing by Owner through Consultants.

2. SINGULAR & PLURAL

Words purporting the singular include the plural and vice-versa.

3. EXECUTION OF WORK

All works to be executed under the Contract shall be executed under the overall direction and subject to the approval in all respect of the OWNER.

4. ENGINEER

4.1. Duties and Power of the Engineer

The duties and power of the Engineer are to watch and supervise the Works and to test and examine any materials to be used or workmanship employed in connection with the works. He shall have no authority to relieve the contractor of any of his duties or obligations under the contract nor to make any variation of or in the works nor except as expressly provided hereunder order any works involving delay or any extra payment by the OWNER. The OWNER may from time to time in writing delegate to the Engineer through Consultant any of the powers and authorities and shall furnish to the contractor a copy of all such written delegations of powers and authorities and also of any revocation thereof.

Any written instructions or written approval given by the Engineer to the contractor within the terms of such delegations (but not otherwise) shall bind the contractor and the OWNER provided always as follows:

i. Failure of the Engineer to disapprove any work or material shall not prejudice the power of the CONSULTANTS and the OWNER thereafter to disapprove such work or materials and to order the pulling down, removal or breaking up thereof.

ii. If the Contractor shall be dis-satisfied by reason of any decision of the Engineer, he shall be entitled to refer the matter to the CONSULTANTS who shall thereon confirm, reverse or vary such decision. The CONSULTANTS's decision in such a case shall be final and binding upon the Contractor.

iii. The fact that the CONSULTANTS or Engineer for whatever reasons, fail to detect defects in the layout or in the quality of the works executed shall not relieve the Contractor of his liability for rectifying the said defects in the layout or in the quality of the works at his own cost.

4.2. Emergency Powers of the Engineer.

Notwithstanding the provisions of Sections 4.1 hereof, if in the opinion of the Engineer an emergency occurs affecting the safety of lift or of the works or adjoining property he may direct the Contractor in writing to carry out all such work or to do all such things as may be necessary in his opinion to abate or reduce the risk. The contractor shall forthwith comply without appeal with any such direction of the Engineer.

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5. CONTRACT DOCUMENTS

5.1. Language

The language according to which the Contract is to be construed and interpreted shall be English.

5.2. Documents Mutually Explanatory

The several documents forming Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies the same shall be explained and adjusted by the Consultant, who shall thereupon issue to the Contractor instructions directing in what manner the work is to be carried out. The provisions of special conditions of Contract shall prevail over the General Conditions of Contract and General Conditions over those of any other documents forming part of the Contract.

6. PERFORMANCE BOND

a). The Contractor shall, within fourteen days after written Letter of Award has been issued by the Owner, provide a performance guarantee from a Scheduled Bank of Pakistan to be jointly and severally bound with the Contractor to the Owner for the due performance guarantee in the form appended to tender an amount equal to 5% (five percent) of the Contract Price.

b). The Performance Bond shall be valid till the completion and end of the period of Maintenance. The cost of the Bond so entered into shall be at the sole expense, of the Contractor.

c). No RA Bill will be processed unless the Performance guarantee is submitted.

6.1. INSURANCE OF WORKS ETC.

The Contractor shall, insure in the joint names of the Owner and the Contractor, against all loss or damage from whatever cause arising for which he is responsible under the terms of the contract and in such manner that the Owner and Contractor are covered during the period of the commencement to the completion of the works and are also covered during the period of Maintenance for loss or damage arising from a cause occurring prior to the commencement of the period of maintenance and for any loss or damage occasioned by the Contractor in the course of any operations carried out by him for the purpose of complying with his obligations.

i) The works and temporary works to the full value thereof executed from time to time.

ii) The maintenance, constructional plant and other things brought on to the site by the Contractor for the purposes of the contract to the full value of such materials, constructional plant and other things.

a) Provided always that without limiting his obligations and responsibilities as aforesaid nothing in this clause contained shall render the Contractor liable to insure against the necessity for the repair or reconstruction of any work constructed with materials or workmanship not in accordance with the requirements of the Contract.

b) Such insurance shall be affected with an insurer and in terms approved by the Owner and the Contractor shall whenever required produce to the Owner the original policy or policies of insurance and the receipt for payment of the correct premiums. The contract price shall be deemed to include in the Contractor's cost for the provision of such insurance.

c) All money received under any insurance mentioned in the Section shall be applied in or towards the cost of making good the loss or damage which has occurred but this provision shall not affect the contractor's liabilities under the contract.

6.2. DAMAGE TO PERSONS AND PROPERTY

The Contractor shall (except if and so far as the contract otherwise provides) indemnify and keep indemnified the Owner against all losses and claims for injuries or damage to any person or any property whatsoever which may arise out, or in consequence, of the performance of the Contract and against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto. Provided always that nothing herein contained shall be deemed to render the Contractor liable for or in respect of or to indemnify the Owner against any compensation or damages for or with respect to:

i) The permanent use or occupation of land by the work for any part thereof.

ii) Surface or other damage (caused by tenants or occupiers) to land or plants within the site which land or plants will be disturbed or damaged as an unavoidable result of the execution of the works.

iii) The right of the Owner to construct the work for any part thereof on, cover, under, in or through any land.

iv) Interference, whether temporary or permanent with any right of light, air, way, water or support or other easement or quasi easement which is the unavoidable result of the performance of the contract.

6.3. a) THIRD PARTY INSURANCE

Before commencing the execution of the works, the contractor shall, without limiting his obligations and responsibilities insure and, of the duration of the performance of the Contract, keep insured, in the joint names of the Owner and the Contractor against any damage, loss or injury which may occur to any property or to any person (including any employee of the Owner or Engineer or Consultants) by or arising out of the execution of the works or temporary works.

b) MINIMUM AMOUNT OF THIRD PARTY INSURANCE.

Such insurance shall be effected with an insurance company of AA rating and in terms approved by the Owner and for at least the amount stated in the Tender and the Contractor shall whenever required produced the original policies of insurance and the original receipts for payment of the current premiums. The Contract prices shall be deemed to include the contractor's costs of premium and incidental to the provision of such insurance.

6.4. a) ACCIDENT OR INURY TO WORKMEN

The Owner shall not be liable for or in respect of any damage or compensation payable in law in respect or in consequence of any accident of injury to any workman or other person in the employment of the Contractor or any of his sub-contractors and the Contractor shall indemnify and keep indemnified the Owner against all claims, demands, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

b) INSURANCE AGAINST INJURY TO WORKMEN

The Contractor shall insure against any such liability with an insurer approved by the Owner and shall continue such insurance during the whole of the time that any persons that are employed by him on the works and shall when required produce to the Owner, in original, such policy of insurance and the receipt for payment of the current premium. Provided always that in respect of any persons employed by any of his sub-contractors, the Contractor's obligation to insure as aforesaid under this clause shall be satisfied if the sub-contractor shall have insured against the liability in respect of such persons in such manner that the Owner is indemnified under the policy but the Contractor shall require such sub-contractor to produce in the original to the Owner when required such policy of insurance and the receipt for payment of the correct premium. The contract price shall be deemed to include the costs of such insurance by the Contractor and his sub-contractors.

6.5. a) REMEDY ON CONTRACTOR'S FAILURE TO INSURE

If the Contractor fails to effect and keep in force the insurances or any other insurance which he may be required to effect under the terms of the contract or any applicable Laws / Bye-Laws, then in any case the Owner may (without prejudice to any other right or remedies) effect and keep in force such insurance and pay such premium or premiums as may be necessary for that purpose and from time to deduct the amount so paid by the Owner as aforesaid from any moneys due or which may become due to the Contractor or recover the same as a debt due from the Contractor.

b) CONTRACTOR TO NOTIFY INSURERS

The Contractor shall notify the insurers of any of the insurance any matter or event which by the terms of such insurances are required to be so notified and the Contractor shall indemnify and keep indemnified the Owner against all losses, claims, demands, proceedings, costs, charges and expenses whatsoever arising out of or resulting from any default by the Contractor in employing with the requirements of this Section whether on account of the avoidance of any such insurance or otherwise.

7. DAMAGE TO PERSONS AND PROPERTY

The Contractor shall (except if and so far as the contract otherwise provides) indemnify and keep indemnified the Owner against all losses and claims for injuries or damage to any person or any property whatsoever which may arise out, or in consequence, of the performance of the Contract and against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto. Provided always that nothing herein contained shall be deemed to render the Contractor liable for or in respect of or to indemnify the Owner against any compensation or damages for or with respect to:

i) The permanent use or occupation of land by the work for any part thereof.

ii) Surface or other damage (caused by tenants or occupiers) to land or plants within the site which land or plants will be disturbed or damaged as an unavoidable result of the execution of the works.

iii) The right of the Owner to construct the work for any part thereof on, cover, under, in or through any land.

iv) Interference, whether temporary or permanent with any right of light, air, way, water or support or other easement or quasi easement which is the unavoidable result of the performance of the contract.

8. GENERAL OBLIGATIONS

8.1. Agreement

The Contractor shall, within fourteen days after the written Letter of Award has been issued to him by the OWNER, enter into and execute an Agreement (to be prepared at the cost of the Contractor) in the form appended to the Tender with such modifications as may be considered necessary by the OWNER.

8.2. Site Information

The Contractor shall be deemed to be in possession of all necessary information of the site and its surrounding, to have satisfied himself as to the nature of roads and as to possible interruptions thereto and the access to and exist from the site, to have made inquiries as to the available accommodation for his staff and labour, to have made inquiries as to the sub soil water levels and the variations thereof, and drains, storms, prevailing winds, climatic conditions generally and other similar matters, to have satisfied himself as to the courses and means of obtaining adequate supplies of skilled and unskilled labour and also all materials required for the works and the transport thereof, to have considered the possibility of delays or inconvenience that may be caused to his operations by any reasons of the breakdown of communications, storms, floods, adverse weather conditions to have acquainted himself as to his liability for payment of Government taxes another charges, to have examined the contract document generally to have obtained information on all matters whatsoever that might affect the carrying out of the works. The Contractor shall not be entitled to any claim if he fails to fulfill his obligation in acquiring the information before submitting his tender.

8.3. Works to be done to the satisfaction of the OWNER

The Contractor shall execute, complete and maintain the Works in strict accordance with the Contract to the satisfaction of the OWNER and the whole of the materials, plant, labour and other things to be provided by the Contractor in pursuant to the Contract and the mode, quality, manner and speed of execution and maintenance of the Works shall be of a kind conducted in a manner to the satisfaction of the OWNER and CONSULTANTS.

8.4. Compliance with CONSULTANT'S Instructions

The Contractor shall comply and adhere strictly to the CONSULTANT's instructions and directions (subject to the limitations referred to hereof) from the Resident Engineer on behalf of the OWNER regarding any matter (whether mentioned in the Contract or not) touching or concerning the Works.

8.5. a) Contractor's Agent

The Contractor shall with the approval of the CONSULTANTS (which approval may at any time be withdrawn) employ and arrange whole-time presence of a duly authorized agent or representative at the Site. The said agent or representative shall give his whole time superintendence to the Works and shall act in harmony with the CONSULTANTS and the OWNER. The said agent or representative shall not be removed by the Contractor from the Works or the Site without consent in writing of the CONSULTANTS.

b) Agent to Receive Instructions

The Agent and representative shall receive on behalf of the Contractor the instructions of the OWNER / CONSULTANTS or (subject to the limitations of Article 3, 4, 5 hereof) the Engineer.

8.6. Contractor's Employees

The Contractor shall employ in and about the execution and maintenance of the Works and provide at the Site:

i. Only with technical assistants, foremen and leading hands as are careful, skilled and experienced in their respective trades and are competent to give proper supervision to the work they are required to supervise, and

ii. Such skilled, semi-skilled and unskilled labour as necessary for the proper and timely performance of the Contract.

8.7. Assignment and Sub-Letting Assignment

The Contractor shall not assign the Contract or any part thereof or any benefit or interest therein or there under without the prior written consent of the Owner.

Subletting

The contractor shall not sub-let the whole of the works, except where otherwise provided by the Contract. The Contractor shall not sub-let any part of the works without the prior consent of the Owner and such consent if given not relieve the Contractor from any liability or obligation under the contract and he shall be responsible for the acts, defaults and neglects of any sub-contractor, his agents, servants or workman.

8.8. Security Deposit

a). The Security Deposit of the contractor to be retained by the Owner shall be 5% of the total cost of the work carried out by the Contractor and it shall be deducted from each of the interim bill as well as from the final bill submitted by the Contractor and shall be retained by the Owner until the expiry of Defects liability period as guarantee of the good workmanship and good material used for the construction of project.

b). 50% Amount of Security Deposit will be released after issuance of certificate of substantial completion of works by the Consultants.

c). 50% Amount of Security Deposit will be released after completion of Defects Liability Period and after proper handing over by the Contractor and taking over by the Owner in writing.

9. MODE OF PAYMENTS

The Contractor shall submit 3 (three) copies of the Interim Bill accompanied by three copies of the details of measurement to the Consultants after completion of about one tenth ($1/10^{th}$) portion of the total work. The Consultants shall scrutinize the same and issue to the Contractor the Certificate of payment on the basis of this scrutiny without prejudice to any of the rights of the Owner.

The payment made on the basis of interim bills shall be regarded as an advance against the total cost of work till the final bill is scrutinized and the cumulative amount paid by the Owner to the Contractor shall be adjusted against the overall amount of the final bill.

10. TIME ALLOWED FOR COMPLETION

The time allowed for completion and handing over the work complete in all respects to the Owner shall be as specified and shall be deemed to be effective from the date of Letter of Award. The contractors shall commence the work within 7 (seven) days of award of work. In case the contractor fails to commence the work within the stipulated time, the contract may be awarded to any other tenderer or party which in the opinion of the Consultants serves the best interest of the Owner. Earnest Money will be forfeited in favour of the OWNERS.

11. EXTENSION IN COMPLETION TIME

The Owner on the recommendations of Consultant reserves the right to refuse / grant reasonable extension in completion time under special circumstances which the CONSULTANTS / OWNER deem to regard as beyond the control of the contractor, and the Contractor has within One month after such circumstances have arisen or as soon thereafter as is practicable, delivered to the consultants full and detailed particulars of any claim to extension of time to which he may consider himself entitled in order that such claim may be investigated at that time.

12. PENALTY

(a) Penalty to the client

The completion time stipulated is the essence of this contract and for each day for which the work remains un-commenced or unfinished after the proper dates, the Contractor shall pay to the Owner a sum of Rs.0.05% (Point Zero Five Percent) of the contract value per day till such time the Project is completed in all respects and formally be handed over to the Owner, subject to a maximum of 10 % of the cost of the total works.

(b) This shall include penalty payable to consultant as per clause 15 page 7 of Instruction to Tenderers.

13. CONSTRUCTION SCHEDULE

Within 10 (ten) days of the Award of the work, the contractor shall submit to the Consultants a detailed phasing of the Construction programme he propose to adopt for completing the project within the stipulated period.

If the Consultants are not satisfied with this programme they may ask to revise the same to their satisfaction and the Contractor shall carry out the changes accordingly and will strictly adhere to this programme throughout the progress of the construction work. The Contractor will pay Rs.500/- (Rupees Five Hundred Only) per day for the delay beyond 15 days after the date of work order / Agreed Date of Commencement.

14. RIGHT TO ACCESS

The Owner and the Consultants reserve the right to enter upon the site at all times and the contractor or his representatives shall extend them all the cooperation for inspection of the quality and the progress of the Construction works.

15. REMOVAL OF EMPLOYEES WORKMEN AND FOREMEN.

The Owner / Consultant shall have full powers at all times to object to the employment of any of the workmen, foremen or other employees on the works by the contractor and if the contractor shall receive a notice from the consultants, requiring the removal of any person or persons from the works, the contractor shall comply with the instruction forthwith. The Contractor shall not be entitled to demand the reason from the consultants for such notice.

16. SETTING OUT

The Contractor shall be fully responsible for correctly setting out the work on the site as per dimensions indicated in the drawings and if any error is found at any stage of the work, the contractor shall rectify the same at his own risk and expense accordingly.

17. DISCREPANCY IN DRAWINGS

Only the written dimensions shall be followed for all the drawings and details. However, it will be the responsibility of the Contractor to study, check and tally the drawing/details issued to him by the consultants. Before proceeding with the construction, he shall be deemed to have thoroughly satisfied himself about the accuracy of all drawing/details. If any discrepancy is detected by him, he should immediately bring it to the notice of the consultants and get the same rectified before proceeding with the work or else the responsibility for the faulty construction shall rest with the contractor.

18. REPLACEMENT OF DEFECTIVE WORK

The Contractor shall be responsible for strictly observing his obligations as regards the correct interpretation of the drawings, details, specifications, schedule of quantities or any other relevant part of the contract documents. If during the progress of the work any defect is discovered either in the use of materials or the workmanship the contractor shall at once demolish such work on receiving instructions from the Owner, Agent or their accredited representative & replace the same as directed.

19. OWNER'S RIGHT TO IMPOSE PENALTY MEASURES

The Contractor shall strictly carry out the entire work according to the tender documents. However, at any stage of the execution of the work, if it is discovered that work carried out by the Contractor as regards the materials or the workmanship, or both, is not as per the drawings, details, specifications, and the instructions of the Owners agent, the Owner reserve the right to impose the lump-sum penalty on the contractor disown / order to dismantle, or to reduce the tendered rates of the contractor to commensurate with the actual quality of the work as carried out by the Contractor.

20. GUARANTEE FOR GOOD MATERIALS AND WORKMANSHIP

The Contractor shall execute a guarantee specimen draft valid for entire liability period after completion and handing over the works to the owner as regards the use of good construction materials and workmanship for the entire work, if any defect is discovered after completion within the said period, the Contractor shall replace the defective works at his own expenses. However, in the event of the failure on the part of the Contractor to rectify and replace the defective works, the Consultants may advise the owner to rectify the same at the expenses of the Contractor and to adjust such amount from his Security Deposit. In case the cost of replacement of defective works exceeds the amount of Security Deposit lying with the owner, the extra, expenditure so incurred shall be recovered from the Contractor.

21. CLERK OF WORK

The Owner may appoint the Site Engineer or site supervisor who may henceforth be referred to as the clerk of works, under the orders of the Owner and having the powers and authority so delegated to him by the Owner. The duties of the clerk of works shall be to inspect and supervise the works according to the specifications laid down by the Consultants. He shall have no power to relieve the Contractor of any obligation under the Contract nor to make any variation order nor to order any work involving delay or extra expenditure.

22. INTIMATIONS FOR INSPECTION

The Contractor shall inform the Owner when any parts of the work is ready for checking. No earth shall be backfilled until the Owner agent has inspected the foundations and plinth work. Any part of the work which shall not be visible in the subsequent stage of its completion shall be got inspected / measured by the Consultants.

23. OBSERVANCE OF CONSULTANTS / OWNER INSTRUCTIONS

The Contractor shall abide by the instruction of the Consultants / Owner or their duly accredited engineer or representatives as regards the progress and quality of the Construction. No work shall be continued without the approval of the Consultants / Owners. No concrete shall be poured in R.C.C. structures unless the reinforcement is checked and approved by the Consultants / Site Engineer in writing (Pour Slip).

24. PROGRESS REPORT AND PHOTOGRAPHS

The Contractor shall regularly submit to the Consultants every week, the progress reports in quadruplicate so as to reach them in the first working day of every month. If the Owner find the progress slow as compared to the Construction schedule already submitted and approved he may instruct the Contractor to increase the rate of progress and warn him about the possible enforcement of penalty clause and in that case the Owner shall take the necessary measures to accelerate the work. In the event of failure by the Contractor to comply with such instruction or such warnings, the penalty clause shall be strictly imposed upon the Contractor if the contractor falls behind the stipulated completion period. The report of every fourth week shall be fully supported with photographs of post card size depicting the completed stages of the work. No R.A Bill of Contractor shall be processed unless the photograph and monthly progress report are submitted on regular basis.

25. (A) MEETINGS ON PROGRESS OF WORK

The Contractor and his Agent shall attend any or all meetings when called by the Owner to discuss progress of the work and other matters related to the works and the contract.

(B) LIQUIDATED DAMAGES FOR DELAY.

Time shall be deemed to be the essence to the contract.

a) It is agreed that the amounts specified hereinafter are reasonable compensation to the Owner without reference to the actual loss or damage sustained and whether or not any damage has or has not been sustained.

b) If the work remains un-commenced at the expiry of the commencement period stipulated in the Tender, the contractor shall be liable (in addition to any other penalties liable under the contract) to pay to the Owner a sum of Rs.0.05% (Point Zero Five Percent) of the contract value for each day that the work remains un-commenced provided that the maximum amount under this sub-clause (excluding penalty or penalties under other sub-clause) shall not exceed 10 % (ten percent) of the contract price of the work.

c) The contractor shall ensure good progress during the execution of the works and shall be bound in all cases to strictly comply with the programme submitted by him and approved by the owner under this contract.

In case the execution of work falls so much in arrears, behind the programme so as to necessitate a fresh programme the approval by the Owner of the revised programme shall not be deemed to prejudice the power of the Owner to levy penalty under this sub-clause with scale prescribed in sub-clause(c) above and the contractor shall remain liable to pay, Rs.0.05% (Point Zero Five Percent) of the contract value per day for the period revised programme had not been approved.

d) If the Contractor shall fail to complete the works within the time prescribed by section 10 hereof or extended time, then the contractor shall pay to the Owner liquidated damages for such default and not as a penalty of Rs.0.05% (Point Zero Five Percent) of the contract value for each calendar day which shall elapse between the time prescribed by section 10 hereof or extended time as the case may be and the date of completion of the works but not exceeding a maximum of ten percent (10%) of the contract price. The Owner may, without prejudice to any other method of recovery deduct the amount of such damages from any moneys in his hands due or which may become due to the contractor. The payment or deduction of such damages shall not relieve the contractor from any other of his obligations and liabilities under the contract.

e) If the contractor fails to complete the works in all respects or abandons in an incomplete state, or where his contract is rescinded due to breach of contract, the contractor shall be liable to pay to the Owner a sum equal to 10 % (Ten Percent) of the contract price as penalty.

f) The Contractor shall not claim exemption from the penalties as aforesaid without obtaining a written approval of the Owner. Mere fact that the contractor has applied for such exemption would be granted. No such application for exemption shall be considered unless it is submitted within 15 days of the occurrence of the handicap resulting in the levy of penalty.

g) The Owner may without prejudice to any other method or recovery, deduct the amount of the penalties including the amount paid to the consultant as remuneration for supervision beyond the time of completion a prescribed by the section 10 hereof or extended time as aforesaid from any moneys in their hand due or which may become due to the contractor.

h) The contractor shall pay a penalty in terms of liquidated damages to the consultant for the supervision service rendered beyond the agreed date of completion as per clause 15 page 7 of Instruction to Tenderers.

i) The payment or deduction of such penalties and / or liquidated damages shall not relieve the contractor from his obligation to complete the works or from any other of his obligation and liabilities under the contract.

26. VALUABLE / ANTIQUES ETC

If during the excavation on the site any valuable or antiques are found, their ownership shall rest with the owner and the Contractor shall immediately hand these over to the owner (where applicable).

27. SUB CONTRACTING

The sub-contracting of this work or part thereof shall not be allowed, however, in case the Contractors wants to sub-contract a part of the work, requiring specialized experience, he may ask for the permission of the Consultants / Owner to do so, but in no case the Contractor shall sub-contract with the work or any part thereof without the permission of the Consultants / Owner.

28. STORAGE

It shall be the responsibility of the Contractor to protect the materials stored on the site for the use at appropriate stage of work, against weathering for that he shall provide adequate storage depots on the site at his own expenses. In the event of the damage to these materials on account of negligence of the Contractor, the consultants shall order for removal of the materials from the site and replacement with fresh materials at the expense of the Contractor.

29. SAMPLES

The Contractor shall submit to Consultants for Owner's approval the samples of the material, fittings and fixtures which he may propose to use for the construction. He shall also provide the details of the origin of such samples to the consultant.

The Consultants may allow the use of these materials with the approval of Owners if he is satisfied with their quality. However, if he finds these samples not in conformity with the specification, he may reject them and ask the contractor to produce the required quality products. The contractor shall use only the materials fittings and fixtures of the approved quality.

30. USE OF SITE

The site handed over to the contractor by the owner for carrying out the tendered work shall not be used for any purpose other than the construction. Any activity other than related to the tendered work shall be considered to be illegal and tantamount to be the breach of the contract.

31. INDEMNIFICATION OF OWNER

The Contractor shall indemnify the owner in respect of all claims, damage, compensation or expenses by any workman or other persons in the employment of the contractor or not, while in vicinity or upon the said works or the site of the same and the owner shall not be responsible to defend all the suits, claims, damages etc. arising out of any activity or consequences thereof connected with the construction. Such activity shall include upon an alleged infringement of a prevented invention and or acts improperly carried out or omission to carry out a proper or delay in carrying out proper work.

32. SITE OFFICE AND STORAGE

The Contractor shall construct at his own expense the necessary site offices and toilet facilities both for his use and for the use of the owner. He shall also construct at his own expense the necessary godowns and storages and access roads if needed. He shall demolish if required by the owner all these structures and clear the site by removing debris.

33. TESTING OF MATERIALS

The contractor shall from time to time carry-out the testing of materials used for the construction as and when desired by the consultants at his own expenses, in the laboratories as approved by the consultants. In the event of the un-satisfactory test results, the consultants shall reject such materials and order demolition of the work constructed from these materials & further order the replacement of the same to meet the required specification at contractors own expense.

34. DEFECT LIABILITY

The Contractor shall be responsible for making good all the defects appearing within 365 days after the satisfactory completion of works. The security deposit of the contractor shall be retained until after the expiry of this defect liability period.

If the Contractor fails to rectify the defects which are brought to his notice by the Consultants, the owner shall get these defects rectified from the security deposit at the

risk of the Contractor. The owner may release the security deposit before the expiry of this period, in lieu of the suitable BANK Guarantee which shall be entirely to Owner's discretion.

35. FULFILLMENT OF CONTRACT

On completion of the contract work, the contractor shall intimate the owner in writing and arrange for joint inspection of the completed works by the owner & the consultants. On this inspection, the consultants shall scrutinize the completed work as regards its quality and adequacy in keeping with the contract documents.

If they find the completed works falling short of any of the specifications or other obligations under the contract, they may ask the contractor to rectify the same. If they find the works duly completed as per contract, they may issue the final certificate for payment to the contractor. However the fulfillment of contract shall not be considered until after the acceptance of the completed work.

36. FORFEITURE

If the contractor shall become insolvent to have an order admitting a petition in insolvency made against him or shall present his petition in insolvency or shall make an arrangement with or assignment in favour of his creditors or shall agree to carry-out the contract under a committee of inspection of his creditors or (being a corporation) shall go into liquidation (other than a voluntary liquidation for the purpose of amalgamation or reconstruction) or if the contractor shall assign the contract without the consent in writing of the owner first obtained or shall have an execution levied on his goods or if the consultant shall certify in writing to the owner that in his opinion the contractor.

a) Has abandoned the contract, or

b) Without reasonable excuse has failed to commence the work or has suspended the progress of work for 15 (fifteen) days after receiving from the consultant written notice to proceed, or

c) Has failed to proceed with the works with due diligence, or

d) Has failed to meet the desired schedule of progress of work, or

e) Has failed to remove materials from the site or pull down and replace work for 15 (fifteen) days after receiving from the Owners through the Consultants written notice tht the said material or work has been condemned and rejected by the consultants under these conditions, or

f) Is not executing the works in accordance with the contract or is persistently or flagrantly neglecting to carry out his obligations under the contract, or

g) Has to the detriment of good workmanship or in defiance of the Engineer‘s instructions to the contrary sub-let any part of the contract, and so often as any of the events aforesaid shall occur, then the owner may adopt any of the following courses as it may deem best suited to the interest of the owner (without prejudice to any rights it may have against the contractor) after giving fifteen days notice in writing to the contractor.

   i) Terminate the contract, enter upon the site and the works and expel the contractor there-from in which case the security deposit of the contractor shall stand forfeited and be absolutely at the disposal of the owner.

   ii) Enter upon the site and the works and expel the contractor there-from without there by voiding the contract or releasing the contractor from any of his obligations or liabilities under the contract or affecting the rights and power conferred on the owner or the consultants by the contract and may itself complete the works or may engage any other contractor to complete the works at the risk and cost of the contractor.

   iii) To complete the works or part of works by the owner at the cost of the contractor, viz to supply labour paid by the owner and to supply materials to carry out the works or any part of the works debiting the contractor with the cost (as hereinafter specified) of labour and materials and crediting with the value of the work done in all respects under same manner and at the same rates as if it had been carried out by the contractor under the terms of his Contract. For the purpose of this clause cost of labour shall be actual expenditure plus 25 % to cover overhead charges, if the materials have been supplied by the owner, the cost of material will be based on the market rate or stock issue rate whichever is greater plus 10 % overhead charges. The certificates of the authorized representative of the owner as to the value of the work done and as to the cost shall be final and conclusive against the contractor.

37. i) VALUATION OF VARIATION

The Consultants shall determine the amount (if any) to be added to or deducted from the sum named in the tender in respect of any extra or additional work done or work omitted by his order.

All such work shall be valued at the rate set out in the contract, if in the opinion of the consultants the same shall be applicable if the contract shall not contain any rates applicable to be the extra additional work then reasonable prices shall be fixed by the Consultants. This shall be with the approval of Owners only.

ii) POWER OF CONSULTANT TO FIX RATE

Provided that if the nature or amount of any omission or addition relative to the nature or amount of the whole of the contract work or to any part hereof shall be such that in the contract for any item or the works is by reason of such omission or additions rendered unreasonable or inapplicable the consultant shall fix such other rate or price as in the circumstances he shall think reasonable and proper. In the event of dispute the decision of the Owners shall be final.

38. VARIATIONS

a) CONTRACTOR NOT TO VARY WORKS.

The Contractor shall not make any variation in the works except in accordance with a written variation order of the Consultants duly approved by the Owner.

b) VARIATION ORDER

The Consultant with the prior approval of the Owner may from time to time make any variation in the form, quality or quantity of the works or any part thereof that may in his opinion be necessary and for that purpose or if for any other reason it

shall in his opinion be desirable shall have power by a written variation order to order the contractor to do and the Contractor shall do any of the following:

i) Increase or decrease quantity of any work included in the contract.

ii) Omit any such work.

iii) Change the character or quality or kind of any such work.

iv) Change the levels, lines, position and dimensions of any part of the work and

v) Execute additional or substituted work of any kind necessary for the completion of the works.

c) (i) NOT TO INVALIDATE CONTRACT

No variation order shall in any way vitiate or invalidate the Contract but the value if any of all such variations ordered shall be taken into account in ascertaining the amount of the Contract price.

(ii) CHANGE IN QUANTITIES

No such variation shall be made by the Contractor without an order in writing of the Owners through Consultant or his authorized representative PROVIDED that no order in writing shall be required for increase or decrease in the quantity of any work where such increase or decrease is not a result of an order given under the clause but is the result of the quantities exceeding or being less than those stated in the bill of quantities.

Provided also that if for any reasons the Engineer shall consider it desirable to give any such order verbally, the Contractor shall comply with such order. Any confirmation in writing of such verbal order given by the Engineer whether before or after carrying out of the order shall be deemed to be an order in writing within the meaning of this clause.

(iii) NOTICE OF INTENDED CLAIMS

No claims for any variation shall be allowed except as per the provision contained in section 39. No increase of the Contract price under clause (iii) of this section shall be made unless as soon as practicable and not later than thirty days from the date of the variation order notice shall have been given in writing subject to the approval of the Owner.

(iv) CLAIMS

The Contractor shall send to the Consultant once in every month an account of full and detailed particulars of all claims for any additional expense to which the Contractor may consider himself entitled and of all extra or additional work ordered by the Consultant as per provision of clause (39) which he has executed during the preceding month and no claim for payment for any such work will be considered which has not been included in such particulars, provided always that the Consultant with the approval of the Owner shall be entitled to authorize payment to be made for any such work notwithstanding the Contractor's failure to comply with this condition if the Contractor has at the earliest practicable opportunity notified the Consultant that he intends to make claim for such work.

39. MEASUREMENT

(i) RECORD OF MEASUREMENT

The contractor shall submit the interim bills to consultants in triplicate with complete detailed measurements for scrutiny and approval. The consultant after scrutiny of the bill shall send one copy to owner for payment and other copy to the contractor for his record.

The contractor shall be solely responsible for correct recording of the measurement of the items & get them checked by consultants before covering the hidden items.

40. SETTLEMENT OF DISPUTES

In case of any dispute or difference arising between the parties (Contractor and Owner) out of Contract which cannot be amicably settled, shall be finally settled under the provisions of the Arbitration Act. 1940 and rules made there under as amended from time to time. The venue of Arbitration shall be at Karachi.

41. MISCELLANEOUS

Within the ambit of this Contract and to further its execution, the Owner may issue directions from time to time which will be binding upon the Contractor.

42. CONTRACTOR TO PROVIDE EVERY THING

The Contractor is to provide everything of every sort and kind which may be necessary and requisite for the proper execution of the works included in the contract whether original or altered according to the intent and meaning of the drawings and specification taken together, which are to be signed by the Owner and the contractor whether the same may or may not be particularly described in the specification or shown in the drawings provided that the same are reasonably to be inferred there-from and in case of any discrepancy between the drawings and the specifications the Owner is to decide which shall be followed. The contractor shall also provide all necessary fencing and lights required to protect the public from accident, & shall be bound to bear the expenses of defence of every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions, and to any damages and cost which may be awarded in any such suit, action or proceedings to any such person or which may with the consent of the Contractor be paid to compromise any claim by any such person.

43. ESCALATION

a). No escalation shall be entertained on any item during first year of project.

b) No Escalation / Claim on account of fluctuations of rates shall be entertained during the currency of Contract against any item under Schedule of Rates involved in Construction of Work, unless announced (on Items) by the Govt. of Sindh after Award of Work but within contract period on “Schedule of Rates Items” only.

b). Non-Schedule Rate Items.

Escalation / claim on account of fluctuations of rates will be paid during the currency of Contract on Non-Schedule items.

The following basic rates shall be considered for calculating the escalation of the following item (Ex-factory).

O.P Cement	Rs. 27,100/- Per Tonne Lucky Brand.
S.R. Cement	Rs. 28,600/- Per Tonne Lucky Brand.
Steel All Diameters	Rs.242,000/- Per Tonne.

Difference in cost (+ / -) will be paid only for material consumed as per R.A bill.

c). No Escalation will be entertained on Schedule / Non-Schedule items after expiry of date of completion of project as envisaged in Contract unless the extension is granted due to conditions of force majeure or certain delays beyond the control of Contractor.

44. KEEP FOUNDATIONS AND WORKS FREE FROM WATER

If necessary, the Contractor shall provide and maintain power driven pumps to keep the works free from water. The water shall be disposed to the satisfaction of the local authorities and / or the Consultants.

45. WATER / POWER FOR CONSTRUCTION PURPOSES

The Contractor shall make at his own cost arrangements for water / power and shall have to lay his own distribution system to place where water / power is required. Contractor shall allow free use of water / power to his sub-contractors. If available the Owner may supply power @ 0.75% of the Contract amount and 2% for water of the contract amount for this service.

46. BAR BENDING SCHEDULE (FOR CIVIL WORKS CONTRACTOR ONLY)

The Contractor shall prepare bar bending schedule for commencing the work of cutting, bending and binding of the steel reinforcement of any structural member for approval of consultants and for recording in measurement book.

47. AS BUILD DRAWING (FOR CIVIL CONTRACTORS ONLY)

After the completion of the project the following as build drawings should be submitted to the CONSULTANTS for submission to the Owner. (To whom and where applicable)

i. Complete Architectural Plans.
ii. Plumbing / Drainage Layout Plans.
iii. Electrical Installations.

In service drawings all sizes and routing of pipes, cables and wires should be clearly indicated in different colours.

48 TERMS OF PAYMENTS

a) Mobilization Advance

(1) Mobilization Advance upto 10% of the Contract Price stated in the Letter of Acceptance shall be paid by the Procuring Agency to the Contractor on the works costing Rs. 2.5 Million or above on following conditions:

- On submission by the Contractor of a Mobilization advance Guarantee for the full amount of the Advance in the specified form from a Scheduled Bank in Pakistan to the Procuring Agency;

- Contractor will pay interest on the Mobilization Advance at the rate of 10% per annum on the advance; and

- This Advance including the interest shall be recovered in 5 equal installments from the five (05) R.A bills and in case the number of bills is less than five (05) then 1/5th of the advance **inclusive of the interest** thereon shall be recovered from each bill and the balance together with interest be recovered from the final bill. It may be incurred that there is sufficient amount in the final bill to enable recovery of the Mobilization Advance.

OR

(2) **Secured Advance on Materials**

- The Contractor shall be entitled to receive from the Procuring Agency Secured Advance against an INDENTURE BOND in P.W Account Form No. 31 (Fin. R. Form No. 2 acceptable to the Procuring Agency of such sum as the Engineer may consider proper in respect of non-perishable materials brought at the Site but not yet incorporated in the Permanent Works provided that:

- The materials are in accordance with the Specifications for the Permanent Works.

- Such materials have been delivered to the Site and are properly stored and protected against loss or damage or deterioration to the satisfaction and verification of the Engineer but at the risk and cost of the Contractor.

- The Contractor's records of the requirements, orders, receipts and use of materials are kept in a form approved by the Engineer, and such records shall be available for inspection by the Engineer:

- The Contractor shall submit with his monthly statement the estimated value of the materials on Site together with such documents as may be required by the Engineer for the purpose of valuation of materials and providing evidence of ownership and payment therefore:

- Ownership of such materials shall be deemed to vest in the Procuring Agency and these materials shall not be removed from the Site or otherwise disposed of without written permission of the Procuring Agency:

- The sum payable for such materials on Site shall not exceed 75% of the (i) landed cost of imported materials, or (ii) ex-factory / ex-warehouse price of locally manufactured or produced materials, or (iii) market price of stands other materials;

- Secured Advance should not be allowed unless & until the previous advance, if an, fully recovered;

- Detailed account of advances must be kept in part II of running account bill; and

- Secured Advance may be permitted only against materials / quantities anticipated to be consumed / utilized on the work within a period of 3 months from the date of issue of secured advance and definitely not for full quantities of materials for the entire work / contract.

- Recovery of Secured Advance

    - Secured Advance paid to the Contractor under the above provisions shall be effected from the monthly payments on actual consumption basis, but not later than period specified in the usles and more than three months (even if unutilized). Other conditions.

- As recoveries are made the outstanding accounts of the items concerned in Part – II should be reduced to making deduction entries in the column, --- deduct quantity utilized in work measured since previous bill, equivalent to the quantities of materials used by the Contractor on items of work shown as executed in Part 1 of the bill.

- Interim Payments. The Contractor shall submit to the Engineer monthly statements of the estimated value of the work completed less the cumulative amount certified previously.

- The value of work completed comprises the value of the quantities of the items in the Bill of Quantities completed.

- Value of secured advance on the materials and valuations of variations (if any).

- Engineer may exclude any item certified in a previous or reduce the proportion of any item previously certified in any certificate in the light of later information.

(v) Retention money and other advances are to be recovered from the bill submitted by Contractor.

SECTION – 5

SPECIAL STIPULATIONS AND FORMS

SPECIAL STIPULATIONS

The Stipulations outlined hereunder in the form of a Table summarize certain terms and conditions which are set forth in the Instructions to Tenderers and Conditions of Contract and these Stipulations form an integral part of the Contract.

1	Works	**"Construction of following Buildings: (a). Construction of Lal Shahbaz Qalandar Boys Hostel, (b). Construction of Staff Family Quarters / Flats Category – IV (Officers Colony), (c). Construction of Lower Staff Family Quarters / Flats Category – V, (d). Construction of Lower Staff Family Quarters / Flats Category – VI"**
2	Owner	Cadet College Sanghar
3	Owner's Representative	The Principal / Project Director, Cadet College Sanghar
4	Earnest Money	2% of the Tender Price of work in the Shape of Pay order / Demand Draft issued by a Scheduled Bank of Pakistan in Favour of Vice Chancellor, LUMHS, Jamshoro, Sindh.
5	Time for commencement	Within Seven (7) days from the date of receipt of Owner's letter of Award.
6	Time for furnishing the programme	Within Ten (10) days from the date of receipt of letter of Award
7	Time of completion	As per N.I.T
8	Defects liability period	365 days from the effective date of taking over / completion certificate whichever is later.
9	a). Amount of liquidated damages	Rs. 0.05% (Point Zero Five Percent) of contract value for each day of delay in Commencement / Completion of the works subject to a maximum of 10 % of contract price stated in the Letter of Award.

11	Limit of Retention Money	5 % of Final cost of the Project. a). 50% amount will be released after issuance of completion certificate of substantial completion of works by the Consultants. b). 50% amount will be released after completion of Defects Liability Period and handing over the site by the Contractor and taken over by the Owners in writing.
12	Minimum amount of interim Payment Certificate (Running Bill)	1/10th portion of total work
13	Time required to enter into and execute the Agreement.	14 (Fourteen) days from date of Award of Work.
14	Escalation in the cost of Material and Labour	All as per Clause 43 Page 29 of special conditions of contract.
15	Time of interim payment	Within 30 days from the date of delivery of consultant's certificate to the Owner.
16	Income Tax Deduction	As per Law of Pakistan.
17	Performance Bond	To be obtained from approved Bank for a sum equivalent to 5% of Contract Price stated in the Letter of Award for the whole completion period and also for Defect Liability Period. (No. RA Bill will be processed until the Bond is submitted).
18	Insurance cover for works	It shall be a Contractor All Risk Policy and workmen's compensation policy to cover an amount equal to full contract value and cost of equipment, the labour employed by the Contractor as well as the Owner, visitors and guests. Insurance cover will be arranged by the Contractor from Insurance Company, approved by the owner and should be submitted within 30 days from the date of Owner's Letter of Award. (No. RA Bill will be processed until C.A.R Policy is submitted).

19	Minimum Amount of Third Party Insurance	Rs. 10,00,000/- (Rupees One Million)
20	Mobilization Advance	Upto 10% (Ten Percent) of the Contract amount, payable to the Contractor against irrevocable guarantee from a schedule bank approved by Owner after execution of the agreement and all other bonds.
		OR
21	Secured Advance	Secured advance may be paid against non-perishable items delivered at site (No secured Advance will be paid for cement being perishable item)

ACCEPTED

_____

Contractor's Signature
With Stamp & Date

SECTION – 6

FORMS OF AGREEMENT / PERFORMANCE BOND / MOBILIZATION ADVANCE / INTEGRITY PACT

AGREEMENT OF WORK

THIS AGREEMENT is made at Karachi on the _____ day of _____ 20____ between THE PRINCIPAL / PROJECT DIRECTOR, CADET COLLEGE SANGHAR (hereinafter called the OWNER) of the ONE PART.

and

M/S _____ having registered office at _____ (hereinafter called "Contractor") of the OTHER PART.

Whereas the OWNER is desirous that certain WORKS viz; **"Construction of following Buildings: (a). Construction of Lal Shahbaz Qalandar Boys Hostel, (b). Construction of Staff Family Quarters / Flats Category – IV (Officers Colony), (c). Construction of Lower Staff Family Quarters / Flats Category – V, (d). Construction of Lower Staff Family Quarters / Flats Category – VI"** should be carried and has accepted a Tender by the Contractor for the construction, completion and maintenance of the works.

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS;

1. In this Agreement, words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz;

    a. Tender Notice.
    b. Instructions to Tenders.
    c. Special Conditions of Contract.
    d. Special Stipulations.
    e. Addenda & Corrigenda, if any, issued by the Owner and duly accepted by the Contractor at the signing of the Contract.
    f. Earnest Money
    g. Form of Tender.
    h. Letter of Award by the Owner
    i. Form of Agreement / Contract Agreement.
    j. Owner's Order to Commence the Works.
    k. Performance Bond
    l. Contractors All Risk (C.A.R) Policy
    m. Third Party Insurance
    n. Other Insurance required as per Contract
    o. Limit of Retention Money
    p. Any correspondence by the Owner / Contractor mutually accepted by the Owner and Contractor
    q. Technical Specifications
    r. Bill of Quantities
    s. Detailed Working Drawings.

3. In consideration of the convenience and agreement to be kept and performed by the Contractor, and for the faithful performance of this contract and the completion of the works embraced therein, according to the specifications and conditions herein contained and referred to or agreed to in the course of subsequent negotiations and in accordance with the “General Conditions of Contracts” the owner shall pay and the contractor shall received full compensation for everything furnished and done by the contractor under this agreement, the contract price stipulated in the Contractor’s tender, or such other sum as may be ascertained in accordance with such conditions of contract, etc, and rates quoted against each item of work and agreed to and accepted by the parties as one instrument and at the times in the manner prescribed by the conditions of contract.

4. The contractor, at his own proper cost and expense shall do all work and furnish all labour, materials, supplies, water & power, tools, machinery and other equipment and constructional plant that may be necessary for the execution of the work.

5. The maintenance of a rate of progress in the work which will result in its completion within the specified time, is an essential feature of this contract and the contractor agrees to proceed with all due diligence and care at all times and take all precautions to ensure the time of completion as defined herein, time being deemed to be the essence of the contract on the part of the Contractor.

6. The said works shall be started within 7 (Seven) days of the issue of Letter of Award from the Owner to the Contractor to proceed with the works, and the Contract shall be duly completed on or before _____

7. The Contract documents (Including any addenda thereto) consisting of the Instructions to Tenderers, the Tender for works, General Conditions of Contract, Special Provisions and Stipulations, Bill Of Quantities & rates Technical Specifications, Drawings, Performance Bond, Construction Schedule submitted by the Contractor, Letters of Award, forming part of this contract, are each and all made a part hereof, and have the same force and effect as if set forth at length herein.

8. The Owner shall deduct and retain an amount equal to 5% (Five Percent) of the amount payable to the Contractor under each “On Account” bill submitted by the Contractor as security deposit for the due and faithful discharge by the Contractor of his obligations under this agreement. The sum of such security deposit will be refundable to the Contractor after the successful completion and acceptance of works on expiry of twelve months of the maintenance period in a manner indicated in special stipulations. Income Tax will be deducted from every bill submitted by the Contractor as per Law of Pakistan.

9. That this contract agreement shall be executed in four original signed copies, three copies where of shall be filed in the office of the Owner and one given to the Contractor.

10. The owner shall make all possible efforts to pay off the running bills on account of work done, submitted by the Contractor as early as possible.

IN WITNESS WHEREOF, the Owner and the Contractor have executed this Agreement on the day and year mentioned above.

_____	_____
FOR AND ON BEHALF OF CONTRACTOR	PRINCIPAL / PROJECT DIRECTOR CADET COLLEGE SANGHAR AT JAM NAWAZ ALI VIA TANDO ADAM, SINDH (OWNER)
(SEAL)	(SEAL)
Signed and delivered by the Contractor above named in the presence of :	Signed and delivered by the Owner above named in the presence of :
WITNESS:	WITNESS:
1. _____	1. _____
2. _____	2. _____

To,

_____

_____

PERFORMANCE BOND

WHEREAS _____

(hereinafter called the Contractor) of the one part by an agreement made between The Principal / Project Director, Cadet College Sanghar, Sindh (hereinafter called the Owner) of the other part, has entered into a Contract (hereinafter called the Contract) for the construction, completion and maintenance in conformity with the provision of the Contract works viz _____

AND WHEREAS in accordance with the provision of the Contract, the Contractor is required to furnish a Performance Bond for the due performance and observance of all the terms, provision and stipulations of the Contract by the Contractor & the Contractor has requested us _____ to issue the said Bond for an amount of Rs. _____ (Rupees _____ only) equivalent to 5% (Five Percent) of the Contract price.

In consideration of the premises, we _____ scheduled bank _____ hereby guarantee irrecoverably and unconditionally forthwith to pay to the owner without any reference to the Contractor on the Owner's first demand in writing stating that the Contractor has committed a default under the Contract without any further statement of the particulars of such default and notwithstanding any contestation by the Contractor an amount not exceeding Rs. _____ (Rupees _____ only) limited do hereby further declare that no alternation in the terms of the Contract made by agreement between the Owner and the contractor or in the

extent or nature of works to be constructed, completed and maintained therein and no allowance of time by the Owner or the consultant under the Contract not forbearance of forgiveness in or in respect of any matter or thing concerning the Contract on the part of the Owner or the said consultant shall in any way release this _____ scheduled bank from any liability under this Bond.

This Bond shall remain valid & in force upto the completion works and completion of maintenance period and any demand for payment made by the Owner before the date of expiry of this Bond shall be paid forthwith by this _____ scheduled bank to the Owner.

Signed and delivered by the Contractor
Above named in the presence of

1 _____ _____

_____ (CONTRACTOR)

_____ Date: _____

2 _____

_____

_____

Signed and delivered by the
Surety above named in the
presence of

1 _____ _____

_____ (SURETY)

_____ Date: _____

2 _____

_____

_____

MOBILIZATION ADVANCE BANK GUARANTEE FORM

To,

_____

_____

Sir,

We understand that you have entered into Contract with:

Messrs _____

(Full Name and Address)

(hereinafter reference to as our Customer) and that one of the conditions of the Contract is submission of Bank Guarantee in the sum of _____ against Mobilization Advance and at the request of Customer and in consideration therefore, we hereby agree and undertake as under:

1. To pay to you on demand unconditionally and without any question and without any reference to our Customer an amount not exceeding the sum of Rupees_____

   _____

   (in words)

   As mentioned in your written demand notice in case of failure of M/s _____ to fulfill their obligation including non-completion of project within _____ months

2. We hereby guarantee to pay the full amount of this guarantee (as indicated herein above) to be beneficiary if the Contractor.
   a. Fails to utilize the amount of Mobilization advance for the purpose agreed / indicated in the Contract.
   b. Fails to repay and or adjust the advance by _____ irrespective of any reason.

3. In case beneficiary decides not to encash the guarantee under para 2 (b) above we guarantee to pay the interest @ _____ % month to beneficiary on the balance amount of advance outstanding against our customer till the full amount is recovered.

4. The validity period of this guarantee is upto _____ (date) unless otherwise extended by us, or when its value has been reduced to nil, or upon presentation of a copy of the Certificate with Clause _____ of the agreement, whichever is the sooner.

5. Claims, if any must be duly received by us on or before the validity date. Our liability under this guarantee will cease upon the close of banking business hours on this date. Claims received thereafter will not be entertained by us whether or not you have suffered and loss. On receipt of payment under this guarantee, this guarantee must be duly cancelled, discharged and returned to us.

6. We _____ (Bank) further agree and declare that the beneficiary shall have the fullest liberty without our consent or prior approval and without affecting in any manner our obligations, to vary and of the terms and conditions of the said agreement or to extend time of its performance by the said contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the beneficiary against the contractor(s) and to forbear or enforce any of the terms and conditions relating to the said agreement and be it expressly declared that not withstanding and such variations or extension being granted to the contractor(s) by the beneficiary of the beneficiary in favour of the contractor(s), the contractor(s) shall not be relieved of their liability by reason of such variation, extension or acts of forbearance.

7. In order to give full effect to the guarantee herein contained, our liability shall not be discharged or account of beneficiary forbearance, variation, extension nor shall we claim any rights or surety ship in respect of any security which you might be having in respect of the said agreement.

8. The maximum liability under this guarantee will be reduced equal to the amount recovered by the beneficiary through the contractors running bills
9. This guarantee, within the validity period shall not be affected by any change in the constitution of the contractor or us nor shall it be affected by any change in beneficiary constitution.

10. The guarantee shall come into force upon receipt by M/s _____ of the Mobilization advance.

11. This guarantee shall not be revocable by us except with beneficiary previous consent in writing.

12. It shall not be necessary for beneficiary to proceed against the contractor before proceeding against us and the guarantee herein contained shall be enforceable against us not withstanding any security which beneficiary may have obtained or obtain from contractor(s) at any time or when proceedings are taken against us.
13. We certify that our bank is a scheduled bank.

Guarantor

(_____ Bank Limited.)

Bank seal and signature

Contractor:
The signature should be of the same person who had signed the Contract.

WITNESS:

1 _____

2 _____

Full Name, Address and
N.I.C. No. of the Bank Official.

INDENTURE FOR SECURED ADVANCES.

(For use in cases in which is contract is for finished work and the contractor has entered into an agreement for the execution of a certain specified quantity of work in a given time).

This INDENTURE made the _____ day of _____ 20__. BETWEEN (hereinafter called "the Contractor" which expression shall where the contract so admits or implied be deemed to include his heirs, executors, administrators and assigns) of the one part and THE GOVERNOR OF SINDH (hereinafter called " the Government" of the other part).

WHEREAS by an agreement, dated _____ (hereinafter called the said agreement, the contractor has agreed to perform the under mentioned works (hereinafter referred to as the said work):-

(Here enter (the description of the work).

AND WHEREAS the contractor has applied to the _____ for an advance to him of Rupees _____. (Rs. _____) on the security of materials absolutely belonging to him and brought by him to the site of the said works the subject of the said agreement for use in the construction of such of the said works as he has undertaken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charge) AND

WHEREAS the Government has agreed to advance to the Contractor the sum Rupees, (Rs. _____) on the security of materials the quantities and other particulars of which are detailed in Part II of Running Account Bill (E). the said works signed by the contractor *(Fin R. Form 17.A)* on _____ and on such covenants and conditions as are hereinafter contained and the Government has reserved to itself the option of marking any further advance or advances on the security of other materials brought by the Contractor to the site of the said works.

NOW THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees _____ (Rs. _____) on or before the execution of these presents paid to the Contractor by the Government (the receipt whereof the Contractor doth hereby acknowledge) and of such further advances (if any) as may be made to him as aforesaid (all of which advances are hereinafter collectively referred to as the said amount) the Contractor doth hereby assign upto the Government the said materials by way of security for the said amount.

And doth hereby covenant and agree with the Government and declare by follow:

- That the said sum of Rupees _____ (Rs. _____) so advanced by the Government to the Contractor as aforesaid and all or any further sum or sums which may be advanced aforesaid shall be employed by the contractor in or towards expending the execution of the said works and for no other purpose whatsoever.

- That the materials detailed in the said Running Account Bill (B) which have been *(Fin R. Form No. 17.A)* offered to and accepted by the Government as security for the said amount are absolutely by the Contractors own property free from encumbrances of any kind and the Contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the Contractor hereby agrees, at all times, to indemnity and save harmless the Government against all claims whatsoever to any materials in respect of which and advance has been made to him as aforesaid.

- That the said materials detailed in the said Running Account Bill (B) and all other Materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereinafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of the Divisional Officer _____ (hereinafter called the Divisional Officer) and in the terms of the said agreement.

- That the Contractor shall make at his own all necessary and adequate arrangement for the proper watch, safe custody and protection against all risks of the said material and that until used in construction as aforesaid the said materials shall remain at the site of the said works in the Contractor's custody and at his own risk and on his own responsibility and shall at all times be open to inspection by (he Divisional Officer or any Officer authorized by him. In the event of the said materials of any part (hereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof Contractor will forthwith replace the same with other materials of like qualify or repair and make good the same as required by the Divisional Officer and the materials so brought to replace the said materials so repaired and made good shall also be considered as security for the said amount.

- Hurt the said materials shall not on any account be removed from the site of the said works except with the written permission of the Divisional Officer or an officer authorized by him in that behalf.

- That the said amount shall be payable in full when or before the Contractor receives payment, from the Government of the price payable to him for the said works under the terms and provisions of the said

  agreement PROVIDED THAT if any intermediate payments are made to the contractor on account of work done then on the occasion of each such payment the Government will be at liberty to make a recovery from the Contractors Bill for such payment by deducting there from in the value of the said materials (hen actually used in the construction and in respect of which recovery has not been made previously the value for this purpose being determined in respect of each description of material at (he rates at which the amount of the advances made under these presents were calculated.

- That if the Contractor shall at any time make any default in the performance or observation in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing to the Government shall immediately on the happening of such default be repayable by the Contractor to the Government together with interest thereon at twelve percent per annum from the date or respective dates of such advance or advances to the date or repayment and with all costs, charges, damages and expenses incurred by the Government in or for the recovery thereof or the enforcement of this security or otherwise by reason of (he default of the Contractor and any money so becoming due and payable shall constitute a debt due from the Contractor to the Government and the Contractor hereby covenants and agrees with the Government to repay and the same respectively to it accordingly.

- That the Contractor hereby charges all the said materials with the repayment to the Government of the said sum of Rupees: _____ (Rs. _____) and any further sum or sums which may be advanced as aforesaid and all costs charges damages and expenses payable under these present PROVIDED ALWAYS and it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the powers contained therein if and whether the covenant for payment and repayment hereinbefore contained shall become enforceable and the money owing shall not be paid to accordingly.

Once there with the Government may at any time thereafter adopt all or any of following courses as it may deem best:-

- Seize and utilize the said materials or any part thereof in the completion of the said works on behalf of the Contractor in accordance with the provisions in that behalf contained in the said agreement debiting the Contractor with the actual cost of effecting such completion the amount due in respect of advances under these presents and crediting the Contractor with the value of work done as he had carried it out in

  accordance with the said agreement and at the rates thereby provided. If the balance is against the Contractor he is to pay the same to the Government on demand.

- Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale retain all the sums aforesaid repayable to the Government under these present and pay over the surplus (if any) to the Contractor.

- Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.

That except as is expressly provided by the presents interest on the said advance shall not be payable.

That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been hereinbefore expressly provided for the same shall be referred to the Superintending Engineer _____ Circle whose _____ decision shall be final and the provisions of the Indian Arbitration Act for the time being in force so far as they are applicable shall apply to any such reference.

In witnesses whereof the *_____ on behalf of the Governor of Sindh and the said _____ have hereunto set their respective hands and seals the day and first above written.

Signed sealed and delivered by* in the presence of

Seal
1st witness 2nd witness

Signed sealed and delivered by* in the presence of

Seal
1st witness 2nd witness

SECTION – 7

TECHNICAL SPECIFICATION

SECTION – I

TECHNICAL SPECIFICATIONS

CIVIL WORK

SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in connection with excavating filling and backfilling for building construction and other foundation complete in strict accordance with the applicable drawings and subject to the terms and conditions.

1 (a) – EXCAVATION AND BACK FILLING

As specified in the Bill of Quantities.

1. (b) - DISPOSAL OF SURPLUS EARTH AND RUBBISH

All surplus earth and rubbish shall be disposed off by the Contractor at his cost as directed by the Consultants. The terms of disposal shall include all operations of loading, unloading, stacking, spreading filling depressions, consolidating & ramming in layers not exceeding 12" (300 mm) thickness.

2 CONCRETE WORK

SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all labour, equipment, appliances and materials and in performing all operations in connection with concrete work complete in strict accordance with the applicable drawing and the specifications set here in and subject to the terms and conditions of the contract.

Electrical / Mechanical poker vibrator of suitable diameter shall be used for vibrating all concrete specially R.C.C. works.

a) Full cooperation shall be extended to other trades to install embedded items. Embedded items will be inspected and tests for concrete and other materials or for mechanical operations will be completed and approved before concrete is placed.

b) MATERIALS

i) WATER

Only clean water from the city supply, tube well installed at the site or from other sources approved by the Engineer In-charge shall be used in mixing concrete, Curing, Cleaning plant and tools. The water shall be tested according to B.S. 3148. When its suitability is doubtful.

The Engineer In-charge may refuse to permit water containing any sugar, excess, acid alkali or salt. As a guide the following concentrations represent the maximum permissible values:

i. To neutralize 260 ml sample it should be required more than 2 ml of 0.1 normal NaOh.

ii. To neutralize 200 ml sample it should not required more then 10 ml of 0.1 normal HCL.

iii. Percentage of solids should not exceed the following.

*	Percentage
Organic	0.02
Inorganic	0.30
Sulphates	0.50
Alkali chlorides	0.10

Table 4.3

In case of doubt the Engineer In-charge may require that concrete mixed with water proposed to be used should not have a compressive strength lower then 90% of the strength of concrete.

ii) CEMENT:
In all the R.C.C. structure, sulphate resisting cement shall be used upto plinth level. (If Specified in Structural drawings).

In super structure ordinary grey Portland cement (local) shall be used. Use of imported cement is totally forbidden unless approved by the CONSULTANTS.

iii) The Contractor shall provide at his own cost on the site all necessary sheds which shall be perfectly dry and water tight for the storing of cement to be delivered to the works to ensure adequate supplies being available for site work.

iv) If at any time the Consultants consider that any batch of cement may have deteriorated on site during storage of any reason he will direct that tests shall be made and the batch of cement on the site which may be in question, shall not be used until it has been shown by test to be satisfactory. Any rejected cement shall be removed from the site by the Contractor without delay. Cement reclaimed from cleaning bags or leaking containers shall not be used.

v) Cement shall be consumed in the sequence of receipt of shipment unless otherwise directed by the Consultants.

c) AGGREGATES

i. All fine and coarse aggregate to be used shall be supplied from approved source which shall not be changed without permission in writing from the Consultants. Aggregate shall conform to the test requirements of B.S. No. 812 or equivalent ASTM or Pakistan Standard 243:1963.

ii. Fine aggregate shall be approved sand to be obtained from approved source and shall be clean sharp, free from clay, earth, vegetable and organic matters, alkaline or acid reactions or other deleterious matter or impurities.

iii. Fine aggregates shall conform to British Standard specifications B.S. No. 882 and shall be graded as follows:

B.S. Sieve	Percentage (weight) Passing	
No.	(Grading Zone -1)	(Grading Zone - 2)
3/8" (10mm)	100	100
3/16" (5mm)	90 – 100	90 – 00
No. 7	60 – 110	75 – 100
No. 14	30 – 70	55 – 90
No. 25	15 – 34	35 – 59
No. 52	5 – 20	8 – 30
No. 100	0 – 10	0 – 10

iv. Locally available Coarse aggregate shall be crushed stone and shall be clean free from sand, dust, salt, lime, chalk, clay, organic impurities or other deleterious matter.

v. Coarse aggregate shall conform to the relevant British Standard specifications or ASTM Standard.

vi. If required, aggregate shall be washed and screened to the satisfaction of the Consultants before use by making proper screening and washing.

vii. Sieve analysis and other necessary tests of all aggregates shall be carried out as and when required by the Consultants. Sample for such tests shall be taken in the presence of the Consultants.

viii. All costs in connection with the tests shall be borne by the Contractor.

ix. All aggregates shall be subject to the approval of the Consultants. Any aggregates not found to the required standard shall be rejected by the Consultants and shall have to be removed from site without any delay. Concrete structures executed with rejected aggregates shall be dismantled and rebuilt at the contractor's expense.

3. CLASSIFICATION OF CONCRETE

Classes of concrete to be used in various parts of the works shall be indicated on the drawings and concrete of various grades shall be proportioned as set out in Table-1 appended hereto.

Table-1 showing minimum required compressive strengths of 6 in. x 6 in. x 6 in. (150 x 150 x 150 mm) cubes and minimum quantity of cement required per 100 cubic feet of finished concrete for various mixes and under various conditions.

Class of Concrete	Nominal Mix-Ratio	Min.Qnty Bags per % cft.	Preliminary test Cubes strength.		Work test Cube strength.	
			p.s.i at 7 days	p.s.i at 28 days	p.s.i at 7 days	p.s.i at 28 days
A	1:1:2	30	4000	6000	3000	4500
B	1:1-1/2:3	24	3300	5000	2500	3750
C	1 : 2 : 4	17	2660	4000	2000	3000
D	1 : 3 : 6	13.5	1330	2000	1000	1500
E	1 : 4 : 8	10.0	900	1350	660	1000

The Mix-Ratio indicated in above table are only as guide line normally these ratios achieve the required strength but may vary due to quality of aggregates available in the area of work. The structural design is based on cube strength after 28 days. Therefore the strength should be achieved by design of mix.

To achieve the required strength is the sole responsibility of the Contractor. No Admixture is recommended for use in concrete for getting the required strength, if any Admixture is recommended by the Laboratory it may be used after approval from The Consultants at the entire RISK AND COST of the Contractor. No extra payment will be made in this regard even if the Admixture is approved by the Consultant.

4. PROPORTIONING OF CONCRETE MIXES

All concrete shall be proportioned by volume unless specifically allowed by Consultants. This proportions given in Table-1 above are suitable only when the specific gravities of the aggregate are in the region of 2.5.

The Contractor shall submit to the consultant proposed mix designs for concrete to be used, based on preliminary laboratory test to determine proportion of cement, aggregate and water in the concrete conforming to the quality and strength requirement specified herein Preliminary test results of at least three different mixes of each class of concrete with varied water cement ratio shall be submitted. The results of 7 days and 28 days cube tests shall be used to establish the ration between 7 days and 28 days strengths.

The consultants may make adjustments in the mix for a certain work. Preliminary design of mixes and testing shall be a responsibility of the contractor. The proportions voids in the aggregate shall be controlled and if it exceeds 45%, sand and consequently the cement shall be increased by the contractor without any charge. If the proportion is less than 40%, sand shall be decreased but not the cement.

5. WATER CEMENT RATIO

5.1 SLUMP TEST

A test of the plasticity and flow ability of concrete should be made in the field in presence of Representative of Owner during every concrete operation. The slump cone is a sheet metal (or frustum of a cone) 12” high, 4” in diameter at the top and 8” in diameter at the bottom. After the mixer is fully emptied of a batch, the cone is filled in three layers, roding each layer 25 times with a 5/8” dia bullet pointed rod. The cone is then lifted and the slump is measured. The height of the pile will be less than 12”. The allowable slump is generally defined in specifications.

5.2 MAXIMUM ALLOWABLE WATER CONTENT

All concrete specimens shall be made, cured and tested in accordance with British Standard or ASTM Standard. A curve representing the relation between the water content and the average 28 days compressive strength earlier strength at which the concrete is to receive its full working load shall be established for a range of value including all the compressive strength shown on the Plans. The curve shall be established by at least four points, each point representing average values for at least four test specimens. The maximum allowable water content for the concrete shall be as determined from this curve and shall correspond to a strength 15% greater than indicated on the plans. The slump for concrete shall be minimum of 1" (25mm) and a maximum of 2-1/2" (75 mm) provided the requisite strength is obtained. Corrective additions to remedy deficiencies in aggregate gradations shall be used only with the written approval of the Consultants. When such permissions are permitted the material shall be measured separately for each batch of concrete.

6. SAMPLES AND TESTING

a. GENERAL
Test cubes concrete shall be provided and stored by the Contractor as and when directed by the Consultants. Test cubes shall be tested by the approved laboratory and the contractor shall bear the charges for the same.

b. Cement shall be tested as prescribed in British Standard or ASTM Standard, at the cost of Contractor.

c. AGGREGATES
Aggregates shall be tested at Contractor's cost as prescribed in British Standard 812. In additions, fine aggregates shall be tested for organic impurities in conformity with B.S. 812 or equal ASTM Standard.

d. TESTING OF CONCRETE

i. All test cubes shall be 6 x 6 x 6 inch (150 x 150 x 150 mm) size.

ii. Specimens shall be cured under laboratory conditions except that the Consultants may require curing under field conditions.

iii. Three cubes of the set shall be tested at 7 (seven) days and 3 (three) shall be tested at 28 days or at such ages as directed by the Consultants.

iv. All cube moulds shall be steel moulds perfectly true having all internal and the meeting faces machined to smooth surface as approved by the Consultants.

v. If the strength tests of the laboratory controlled specimens for any portion of the work falls below the minimum allowable compressive strength at 28 days required for the class of concrete used in that portion the consultants shall have the right to order replacement of the affected work.

e. PLACING CONCRETE

i. All concrete shall be thoroughly compacted and consolidated by means of pneumatic mechanical or electrical vibrators or other approved compacting method. Care shall be taken to avoid segregation due to excessive vibration and placing / dropping of concrete from a height of more than 7'–0". The contractor shall maintain on site at all times one or more stand-by vibrators.

ii. Compaction shall be done until the whole mass assumes a jelly like appearance and consistency, with the water just appearing on the surface. Concrete shall be sufficiently tamped and consolidated around the steel rods, care be taken that the vibrator does not as such touch steel or form work.

iii. Hardened concrete, debris and foreign materials shall be removed from interior of forms and from inner surface of mixing and conveying equipments.

iv. Constructions joints in concrete shall only be given at location indicated in the drawings or as approved by the Consultants. At the end of the day's work the concrete shall be finished off against a temporary shutter stop which shall be vertical and securely fixed.

v. Should any part of the exposed surface present a rough uneven or imperfect appearance when shuttering is removed, it shall be picked out to the such depth and refilled and properly resurfaced as per directions of the Consultants.

vi. Whole work is to be smooth, pleasing and to the entire satisfaction of the Consultants.

7. FORM WORK

48. GENERAL

The form work shall be inclusive of all labour, material, workmanship and alike. All formwork and supports thereto shall be designed by the contractor and relevant drawings shall be submitted to the Consultant for approval before the work is put in hand. Such an approval shall not relieve the contractor for all the obligations of the contract or give rise to any claims.

49. FORM WORK NOT TO INTEREFERE AND INJURE WORK.

The form work shall be so designed and arranged as not be unduly interfere with concrete, during its placing, and easy to be removed without injuring the finished concrete edges, clamps, bolts and tie rods shall be used, when permitted and where practicable, in making the form work rigid and in holding it to true position.

50. OPENINGS IN FORM WORK.

Wherever the concreting is required to be carried out within forms of considerable depths, temporary openings in the side of the form shall be provided to facilitate the pouring and consolidation of the concrete. Small temporary openings shall be provided at the bottom of all forms to permit the removal of rubbish etc.

51. OPENINGS IN THE STRUCTURE AND OTHER DETAILS.

Provisions shall be kept in the form work for openings such as recesses, holes, packets, fillets etc. for housing services and other architectural details in the finished concrete or on its surface and edges as shown on drawings or as directed by the Consultants to fix all necessary inserts, dowels pipe, holdfast, etc. as shown on drawings or as directed.

52. JOINTS IN FORM WORK.

All joints in the form work shall be sufficiently water tight to prevent undue leakage or cement slurry from concrete surface not to be exposed in the finished work. The joints in the form work for all concrete surfaces to be exposed in the finished work shall be water tight jointed and perfectly smooth so as not to allow any leakage of the cement slurry from the concrete.

53. TREATMENT AFTER REMOVAL OF FORMS.

All honey combing or other irregularities are to be properly made good upon the removal of the form work and the surface made good to the satisfaction of the Consultants. All such defects must be inspected by the CONSULTANT before carrying out any remedial work.

54. No form work shall be measured and paid for separately and shall be deemed to be included in the units price of Concrete whether cast-in-situ or pre-cast and subsequently fixed in position.

8. CLEARING AND REMOVAL OF RUBBISH

On completion of works herein the contractor shall remove all concrete debris, rubbish, shuttering materials, scraps etc. from the vicinity of the structures completed. All areas shall be cleaned to the satisfaction and approval of the Consultants.

9 REINFORCEMENT STEEL

9.1 SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all materials, tools, labours and in performing all operations in connection with providing, straightening, cutting, bending, binding and fixing in strict accordance with this section of specifications, the applicable drawings, bar bending schedule, (to be prepared by the CONTRACTOR as per terms and conditions of the contract).

9.2 MATERIALS:

i). Reinforcing steel to be new billet stock of deformed steel as specified on the drawings
and shall conform to British Standard Specifications or equivalent ASTM or Pakistan Standard.

ii). The Contractor shall furnish to Consultants, Manufacturer's mills certificate to guarantee that steel meets the standard, specifications, requirements and minimum certified yield stresses as follows:

ALL REINFORCEMENT STEEL SHALL CONFORM TO ASTM A-615

YIELD STRENGTH	60,000 Psi
ELONGATION	14 %

10. BRICK MASONRY

10.1 SCOPE OF WORK

The work covered under this section of specifications consists of furnishing all labour, material tools and plants for the satisfactory completion of the works in accordance with the drawings as specified herein and subject to the terms and conditions of the contract.

10.2 GENERAL

Each finished brick shall not be less than 3" x 4½" x 9" in size and shall have a ¼" deep frog on the upper face. All the bricks shall be regular, of homogenous texture uniforms in shape and size with sharp and square arises, parallel faces and deep red colour may vary by 1/8" from the standard size. When stuck, they should give a clear ringing sound. They shall not absorb more than $1/6^{th}$ of their weight of water after being soaked for one hour, and shall show no sign of effervescence on drying. A good brick should not break when struck against another brick or when dropped flat from a height of 3'-0" to 4'-0" on the ground. It should have a surface so hard that it cannot be scratched by finger nail. The average compressive strength of five representative bricks shall not be less than 1,800 P.S.I.

10.3 EXECUTION

a) Unless otherwise specified, bricks shall be laid in English Bond with the frogs upwards. Each brick shall be set with both bed and vertical joints filled with mortar and thoroughly bedded in by tapping with handles of the trowel. No half bricks or bats shall be used except where necessary to complete the Bond. Simple lipping with mortar at the edges shall not be permitted.

b) All bricks work shall be taken up truly plumb and should be so done with a plumb and straight edge.

c) Brick work shall be carried up all round at the same height and during construction one part of wall should not be more than 3'-0" higher than any other part.

d) Brick work constructed shall be of best standard of workmanship obtainable and objectionable offsets in the brick work shall be removed by and at the expense of the contractor.

e) Each course in the wall after being laid should be properly grouted to fill all of the voids in the area. The grout should be fluid enough to perform this function.

10 PLASTERING.

11.1 SCOPE OF WORK.

The work covered under this section of specifications consist of furnishing all labour, material, tools and plants for the satisfactory completion of the works in accordance with the drawings, as specified herein and the terms and conditions of the Contract.

11.2 MATERIALS.

a) CEMENT
Cement shall be as specified in the section of Plain and Reinforced Cement Concrete.

b) SAND
Sand shall be as specified in the section of concrete work except that the maximum size shall be restricted to that passing a No. 14 sieve for finishing coat and passing a No. 7 sieve for base coat (if any)

c) WATER
Water shall be as specified in the section of Concrete work.

11.3 MORTAR COMPOSITION

a) Mortar for cement plaster shall be mixed in the properties as specified in the Bill of Quantities and shall be applied in one coat or two coats thickness as given in Bill of Quantities and relevant drawings.

11.4 MORTAR BATCHING

a) Methods sand equipment used for mixing mortar shall be such as will accurately determine and control the amount of such separate ingredient entering into mortar.

b) The mortar shall be prepared by mixing the ingredients twice in a dry state, on a pucca platform or in trough and then mixing thoroughly after the addition of water.

c) Mortar shall be mixed only in sufficient quantities for immediate use and all mortar not consumed within 30 minutes after the addition of water to the dry mix shall be rejected and the same will not be allowed to be used. Mixing roughs and pans shall be thoroughly cleaned and washed at the end of each day work.

11.5 PLASTERING

a) The joints of Block Masonry, which in to be plastered, shall have ½“ deep grooved join which should be raked before the mortar sets each day.

b) The concrete surfaces to receive plaster shall be properly roughened by dragging with wire brushes while the concrete has not hardened. In case of the hardened concrete, the surface shall be roughened.

c) The surfaces to be plaster shall be kept damp for at least two hours and then treated with cement slurry before plastering.

d) Level pegs shall be made for all plaster work and shall be got checked from the Engineer at least one day before the plastering work is carried out.

e) The plaster shall be laid to a true and plumb bob and a straight edge not less than 10 feet in length. All horizontal lines and surfaces shall be tested with a level and all vertical lines and corners with a plumb bob as the work proceeds. The plaster shall be finished perfectly smooth and shall be without wavy surfaces. The edge and corners shall be rounded or chamfered if instructed by the Engineer.

12. GLAZED, MATT FINISH WALL AND FLOOR TILES

12.1 GENERAL

The contractor shall supply and fix tiles as described in B.O.Q.

12.2 LAYING

i) All tiles should be soaked in water before laying in sufficient quantity to complete a days work.

ii) All tiles shall be set in bed of cement sand mortar to its correct level and line the mortar shall be evenly spread on the full bottom of tiles.

iii) Joints shall be grouted with white cement mixed with matching colour of tiles as approved by the Engineer Incharge.

13. PORCELAIN, TERRAZO AND MARBLE TILES

13.1 GENERAL

a) The contractor shall submit samples of Marble and Porcelain Tiles for flooring and dado required in various locations. The finished floors and dados shall conform in all respects to the characteristics of approved sample by the CONSULTANT / OWNER.

b) Marble tiles shall be of first quality, free from cracks chips or any other defects and shall be uniform in tone and colour, as selected by Consultant. Marble Tiles be ½" thick, on floors and ¾" thick on steps of staircases where specified.

c) Marble Tiles in floor, steps and Risers be laid on a layer of pure white cement slurry over cement Concrete Bed.

13.2 LAYING

i) Immediately prior to laying the tiles will be checked the lot and rejected tiles be replaced.

ii) All Tiles shall be set in bed of cement / sand mortar to their correct lines and level and the mortar shall be spread evenly on the full bottom of tiles.

iii) All Tiles should be set without joints (Butt joints) as approved by the Consultants.

iv) Marble Tiles be polished and finished with chemical polish.

14. CARPENTRY, JOINERY AND HARDWARE

14.1 SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in connection with fabrication and installation of shelves, cupboards paneling, doors /

windows frames, shutters etc. as per size, thickness, dimension and details shown on the working drawings, compete schedule of Doors and Windows in strict accordance with this section of the specification and the applicable drawings, finishing schedule, instructions of the Engineer.

14.2 MATERIALS, FITTINGS & SAMPLES

(i) SOFT WOOD

The timber of trees belonging to the botanical group Gymnosperms, commercial timber deodar of this group, with best quality shall be used.

(ii) PLYWOOD

Shall comply in all respects with B.S.S. 1455: 1948. The plywood shall only be obtained from approved manufactures.

The plywood used for doors, paneling and the like shall be of the thickness as specified. The grade shall be first quality. The face and back shall be free from end-joints, dead-knots, overlaps, patches and other defects. Edge joints in veneers shall be well made. Isolated pinworm holes shall be permitted provided they do not run along with plane of the veneer. The face and back shall be free smooth for painting or polishing.

(iii) TEAK VENEER BOARD

Shall be first quality obtained from the manufacture approved by the Engineer / Consultant.

14.3 HARDWARE AND FITTINGS

Hardware and fittings shall be heavy duty hardware of approved quality and manufacture otherwise mentioned in the drawings and Bill of Quantities.

14.4(i) LOCKS AND DOOR CLOSER

Shall be of the best quality available from the approved manufacturers according to the Samples approved by the Consultants.

(ii) HINGES

Shall of best quality (local) heavy duty steel hinges 3" (75 mm) in windows, 4" (100 mm) in single leaf doors and 5" (125 mm) in Main door every leaf should have 4 hinges fixed with steel screws.

(iii) All other fittings shall be best quality available from approved manufacturer. Samples shall be submitted to the consultants, for his approval. Cost of hardware shall be included in item of door and no separate payment will be made.

(iv) HARDWARE-SCHEDULE

Each flush door shutter shall be furnished with the following.

- Best quality (aluminum or bronze) Mortice lock / knobset (local)-1 No.
- Tower-bolts 8" (200 mm) long chromium plated / Aluminum (local)-2 Nos. Door closers (Japan) of approved Manufacturer where directed by the Engineer-1 No.
- Kick-plates / push plates of stainless steel 6" x 1/8" (150 mm x 3mm) where directed by the Engineer-both sides. All material will be best quality as approved / specified by the owner.

(ii). HINGES

Shall of best quality (local) heavy duty steel hinges 3" (75 mm) in windows. 4" (100 mm) in single leaf doors and 5" (125 mm) in Main door every leaf should have 4 hinges fixed with steel screws.

(iii). All other fittings shall be best quality available from approved manufacturer. Samples shall be submitted to the consultants, for his approval. Cost of hardware shall be included in item of door and no separate payment will be made.

(iv). HARDWARE – SCHEDULE

Each flush door shutter shall be furnished with the following.

- Best quality (aluminum or bronze) Mortice lock / knobset (local) -1 No.
- Tower-bolts 8" (200 mm) long chromium plated / Aluminum (local) -2 Nos. Door closers (Japan) of approved Manufacturer where director by the Engineer-1 No.
- Kick-plates / push plates of stainless steel 6" x 1/8" (150 mm x 3mm) where directed by the Engineer-both sides. All material will be best quality as approved / specified by the owner of the time of installation.

14.5 WOOD TREATMENTS

In addition to the prior seasoning treatment of timbers, ceilings frame joints, purlins, planks, all the door frames, furring strips blocking grounds, nailing strips in contact with concrete or masonry or wood or other materials, shall first be treated with the pesticides designated in relevant section on Termite control of these specifications and then with solignum or equally approved material in accordance with manufacturers / consultant's instructions.

14.6 FLUSH DOORS

Flush doors shall be solid cored as per description in Bill of Quantities covered on both side with commercial ply or Teak veneered block board as specified in drawing. The doors shall be lipped and edges fitted and hung to the frames. The flush door shall be obtained form the source approved by the consultant and shall be of uniform quality and texture.

14.7 FABRICATION

(a) The contractor shall perform all necessary groovings, notching, tonguening, housing, rebating and all other work necessary for the correct jointings. The contractor shall also provide all metal plates, screws, nails and other fixing that may be necessary for the proper execution of the joinery work specified. The contractor shall also required to carry out all works necessary for the proper construction of all framings, etc. and for their support and fixing in the building. All wood work shall be approved and initialled be the consultant or Engineer before being fixed in position.

(b) Any joinery which may show signs of defects arising from the unsound materials or defective workmanship before the expiry of the maintenance period shall be cut out and replaced at contractor's own expense.

(c) All hold-fast are to be cut to size and shall be 1/8" thick M.S. flat iron as shown on the drawing.

(d) Solid wood frames as per BOQ or as shown on drawing are to be prepared with posts tenoned with the beads or as shown on the drawings.

(e) The shutters will be fixed to the frames with approved quality fittings. The frames will be secured with wrought iron clamps.

(f) All doors and windows shutters shall be fabricated in workman like manner in accordance with the drawings or as directed by the Engineer.

(g) All articles of ironmongery to be soundly and strongly made well finished and equal in quality to first grade articles of approved manufacturers.

(h) Steel fittings are to be furnished and oxidized on exposed surfaces. Aluminum fittings are to be anodized on exposed surfaces. Aluminum fittings are to be the best quality of their kind and shall have a base coat of brass or copper.

(i) Locks, or knob sets, handles, heavy handles etc. shall be as specified and approved by Engineer / Consultant.

(j) Paint and Polish shall be carried out as specified in relevant section.

(k) Anti-termite treatment of approved quality shall be applied to frames on the surface in contact with earth, or wall etc. as per directions of Engineer. Contractor's rates in BOQ for doors, windows shelves etc. shall include this item and no additional payment shall be made.

(l) (i) Three coats of Enamel paint should be applied on all wood work after preparing all surfaces.

(ii) Three coats of Enamel paint on all steel works over priming coat of Red oxide.

14.8 SHOP DRAWINGS AND SAMPLES

The contractor should submit the shop drawings for the approval of Consultants or should submit sample of one complete door and window for approval of Consultant / Owner.

15. GLAZING

15.1 SCOPE OF WORK

The work covered under this section of specifications consists of furnishing all labour material, tools and plants and performing all operations in connection with fixing of the glass to the doors windows, skylights etc in accordance with the drawings, as specified herein and subject to the terms and conditions of the contract.

15.2 GENERAL

(a) Size of glass indicated on drawings are only approximate actual sizes required shall be determined by measuring all panels. Glass shall be without wave, distortion or bulbs.

(b) For wooden Doors and Windows, where provided, glass shall be secured in place with Deodar wood beading.

(c) All glass shall be of manufacture and quality approved by the consultant or Engineer. 5 mm thick glass should be used in doors and windows and 3 mm thick glass should be used in ventilators.

15.3 ACCEPTANCE

Glass shall be protected against damage. After inspection any labels, paint smears and the glass shall be washed clean on both sides. Damaged or broken glasses shall be removed and replaced with new ones before acceptance at no additional cost.

15.4 ROOF WATER PROOFING AND INSULATION

Providing and Supplying Heat & U/V resistant Protective Liquid Membrane Roof water proofing water shield ZSAC-10/55 of M/s ZAHABIYA or MATRIX water stopper MT 22/6 in white colour etc. etc. complete as described in Nomenclature of BOQ.

16. PAINTING AND FINISHING

16.1 SCOPE OF WORK

The work covered in this section of the specifications consists of furnishing all plants, labour, equipment, appliances and materials and in performing all operations in connection with protective and general painting and finishing complete in strict

accordance with this section of the specifications and applicable drawings and subject to the terms and conditions of the contract.

16.2 GENERAL

The terms “Paints” as used herein means enamel paints Emulsion Paint, primers, colour washes, chalk washes etc. All colours shall be subject to the approval of the Consultants / Owner.

All Paints shall be of first class quality product made by an approved manufacturer ICI or equivalent approved and shall conform to the requirements of current British Standards specifications or ASTM standards.

16.3 All colours and shades shall be as directed by the Consultants / Owner. The colour of each coat of paint shall not be of a different shade from the following coat.

17. COOPERATION WITH OTHER TRADES

(a) All work under this section shall be coordinated with the work to be done as specified under other sections of the specifications.

(b) The contractor shall drill, tap, cut and fit the work included herein as required, to accommodate work of other trades in conjunctions with it.

18. SAMPLE

Samples of materials specified shall be submitted for approval when required by the Consultant / Owner.

TECHNICAL SPECIFICATIONS
(HVAC SYSTEM WORKS)

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC SERVICES

1. GENERAL

1.1 REFERENCE

Conform to the General Requirements and Conditions for MEP Works, Section 01 00 00.

1.2 SUMMARY

This Section includes the following:

a. General HVAC Requirements specifically applicable to all Division 23 Sections.
b. Project LEED Requirements (where applicable)
c. Certain Definitions
d. References and Standards
e. Certain Submittals
f. General Quality Assurance and Safety Requirements
g. General Operation and Maintenance Manual Requirements
h. Chicago and Evanston Campus Steam Service Information
i. Special Warranties
j. General Delivery, Storage and Handling Requirements
k. General Coordination Requirements
l. General Product and Material Requirements
m. General Requirements for Grout
n. General Requirements for HVAC Demolition, Equipment Installation, Concrete Bases, and Erection of Metal and Wood Supports and Anchorages.

1.3 DEFINITIONS

a. **Finished Spaces:** Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

b. **Exposed, Interior Installations:** Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

c. **Exposed, Exterior Installations:** Exposed to view outdoors or subject to outdoor

ambient temperatures and weather conditions. Examples include rooftop locations.

d. **Concealed, Interior Installations:** Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

e. **Concealed, Exterior Installations:** Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 APPLICABLE CODES AND STANDARDS

The editions recognized by latest the following are hereby included in and made a part of this section:

NFPA	National Fire Protection Association
UL	Underwriters' Laboratories, Inc.
AFI	Air Filter Institute
NEMA	National Electrical Manufacturer's Association
NEC	National Electric Code
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ARI	American Refrigeration Institute
AMCA	Air Moving and Conditioning Association
ASME	American Society of Mechanical Engineers
AWS	American Welding Society
ANSI	American National Standards Institute
AGA	American Gas Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
HI	Hydronics Institute
OSHA	Occupational Safety and Health Act
MSS	Manufacturer's Standardization Society of the Valve and Fittings Industry, Inc.
ASTM	American Society for Testing and Materials

1.5 SUBMITTALS

a. As required for LEED portion of project (where applicable)
b. Welding certificates
c. For any equipment/components used by the contractor during construction, submit preventative maintenance records for same
d. Shutdown "Methods of Procedures"
e. Notification to Work Forms
f. Operation and Maintenance Manuals (In PDF format and Hard Copy)
g. As specified elsewhere in this Section

1.6 QUALITY ASSURANCE

a. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

b. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

c. Electrical Characteristics for Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

d. Meet all in-force Owner, OSHA, state, and local safety requirements.

e. To meet the Owner goals of safety, reliability, serviceability, and efficient operation, all contractors shall use the Hot Work Permit Procedure.

f. All work to meet in-force local plumbing code. In the case of discrepancies between the project contract documents and the in-force local code, the most stringent shall govern.

g. All materials and installations shall meet applicable FM Global requirements.

h. Complete Project Closeout list, Pre-Occupancy checklist, and Project Turnover checklist prior to project turnover to Owner.

1.7 GENERAL OPERATIONS AND MAINTENANCE MANUAL REQUIREMENTS

a. Two weeks prior to shipment, the contractor shall submit three (3) bound copies (One copy for archive, two for shop use. One to the actual shop location and one left on site) of operating and maintenance data on all equipment furnished (separated by individual unit) to include, but not limited to, the following:
   i. Shop Drawings
   ii. Model, system/tag and serial numbers of all equipment

iii. Performance data/curves
iv. Fan curves for fans with variable frequency drives shall show fan performance at various percentages of frequency/speed from 100% to 0% in 10% increments
v. Manufacturer's written instructions for the operation and maintenance of the component equipment
vi. Lubrication schedule indicating all equipment to be lubricated, recommended lubrication interval, and type and quality of lubricant to be used
vii. Recommended spare parts

b. Two of the bound copies are to be distributed to the Engineer's Department. One copy is to be located in the associated mechanical room and another to the shop. The associated manuals will be stored on a project supplied book shelf. Prints are to be installed on a vertical wall mounted print storage rack.
i. Two copies Single line, full size, piping and ventilation prints laminated and stored on the respective print storage device. One copy is for the building and the other is for the shop files.
ii. Two copies of the piping print showing floor and branch isolation valves indicated by the respective tag number.
iii. Two copies of the ventilation print showing all smoke and fire dampers.

c. Provide verification document to make sure there is record of them receiving Operation and Maintenance Manual.

1.8 SPECIAL WARRANTIES

a. Three (3) years for new equipment and work.

b. Extended warranties for equipment/work utilized by contractor during construction.

1.9 DELIVERY, STORAGE AND HANDLING

a. Piping, duct, equipment, and associated accessories kept on-site should be stored off the ground on skids, ends should be capped or sealed, and these items should be covered with plastic to prevent fouling or contact with excessive moisture. Piping, duct, and equipment should be cleaned of debris inside and out before installation and should be kept clean and protected throughout construction.

b. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.10 COORDINATION FOR SHUTDOWNS

a. All contractors are to fill out and submit Notification of Work Forms, and coordinate with the respective Project Manager.

b. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

c. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

d. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces.

e. All shutdowns are to be requested with the respective Project Manager. All shutdowns must have a shutdown request filled out for the applicable trade and submitted to the respective trades' shop calendar 48 hours in advance, they shall include Methods of Procedure. Emergency situations will be addresses and a case by case basis.

2. PRODUCTS

2.1 EQUPMENT AND MATERIALS

a. All equipment and materials shall be furnished in strict accordance with the equipment named and according to Specification requirements. Each bid shall be based upon one of the materials or manufacturers specified.

b. Equipment and materials specified shall be considered to have prior approval, but submittal for approval is required. Furnish construction drawings to other Contractors when required to coordinate construction.

c. Where multiple manufacturers are named the drawings and specifications are based on the requirements and layouts for the equipment of the first named manufacturer. Any change required by the use of other named manufacturers such as revisions to foundations, bases, piping, controls, wiring, openings, and appurtenances shall be made by the Contractor at no additional cost to the Owner.

2.2 GROUT

a. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
   i. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   ii. Design Mix: 5000-psi, 28-day compressive strength.
   iii. Packaging: Premixed and factory packaged.

3. EXECUTION

3.1 HVAC DEMOLITION (WHEN INDICATED ON THE DRAWINGS)

a. Refer to applicable Sections covering cutting, patching and selective structure demolition for general demolition requirements and procedures. Follow the instructions of client and consultant before execution.

b. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
   i. **Piping to Be Removed**: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   ii. **Piping to Be Abandoned in Place**: Drain piping and cap or plug piping with same or compatible piping material.
   iii. **Ducts to Be Removed**: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   iv. **Ducts to Be Abandoned in Place**: Cap or plug ducts with same or compatible ductwork material.
   v. **Equipment to Be Removed**: Disconnect and cap services and remove equipment.
   vi. **Equipment to Be Removed and Reinstalled**: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   vii. **Equipment to Be Removed and Salvaged**: Disconnect and cap services and remove equipment and deliver to Owner.
   viii. All piping and ductwork that is not to be reused shall be removed back to the nearest main and capped/plugged with similar material.

c. If pipe, insulation, or equipment to remain is damaged in appearance or unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 GENERAL REQUIREMENTS

a. All work shall be installed in a neat, workmanlike, and professional manner.

b. All materials and equipment provided under this contract shall be new (except where otherwise noted) and shall be listed, labeled or certified by Underwriters Laboratories, Inc., or other acceptable entity.

c. All materials, products, and equipment being installed which fall into a category covered by the ENERGY STAR® program must be labeled as such.

d. All equipment of the same type shall be by the same manufacturer.

e. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the diffuser"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

f. During construction the contractor shall at all times maintain HVAC utilities of the building without interruption. Should it be necessary to interrupt any HVAC service or utility, the contractor shall secure permission in writing from the Owner for such Interruption at least seven days in advance. Any interruption shall be made with minimum amount of inconvenience to the Owner and any shut-down time shall have to be on a premium time basis and such time to be included in the contractor's bid. Arrange to provide and pay for temporary HVAC if required by project conditions.

g. Measure indicated mounting heights to bottom of units/work for suspended items and to center of items of work for wall-mounted items.

h. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

i. Working clearance around equipment shall not be less than that specified by the in-force codes, standards, and the equipment manufacturer's instructions.

j. The locations of sensors, grilles, registers, diffusers, equipment, piping, ductwork, etc. shown are approximate. The contractor shall use good judgment in placing the preceding items to eliminate all interference with lights, cabinetry, sprinklers, etc.

The contractor shall check all furniture plans so that wall mounted sensors, panels, etc., are not located behind same. Relocate same as required, with approval from the Architect and Engineer. The Owner may direct relocation of sensors before installation, up to five (5) feet from the position indicated on the Drawings, without additional cost.

k. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both HVAC equipment and other nearby work/installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity. Normal maintenance shall not require the removal of protective guards from adjacent equipment. Install equipment as close as practical to the locations shown on the Drawings.
   i. Where the Owner determines that the Contractor has installed equipment not conveniently accessible for operations and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Owner.
   ii. "Conveniently Accessible" is defined as being capable of being reached/serviced/maintained without climbing or crawling over or under obstacles such as ductwork, large conduits or banks of conduits, large piping or banks of piping, or similar.

l. Coordinate work with all other trades. This is to include coordinating to eliminate interference to allow proper access to equipment doors, access to valves, and to not interrupt equipment or devices proper operation.

m. Firestopping shall be applied to HVAC penetrations of fire-rated floor and wall assemblies to restore/create the required fire-resistance rating of the assembly according to appropriate Section 09 00 00 and the Owner Fire Protection Group. All floor or wall penetrations will be sleeved with the same or compatible material and appropriately firestopped.

n. Owner Furnished Equipment: Equipment furnished by the Owner shall be received, stored, protected, uncrated, moved into position, and installed by the Contractor with all appurtenances required to place the equipment in operation, ready for use. The Contractor shall be responsible for the equipment as if he had purchased the equipment himself/herself.

3.3 EQUIMENT INSTALLATION – COMMON REQUIREMENTS

a. A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

b. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

c. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

d. Provide access to mechanical equipment, components, and work per manufacturer's recommendations.

e. Minimum service access size for HVAC equipment/components above ceilings shall be 24" cubed.

f. Install equipment to allow right of way for piping installed at required slope.

g. Install equipment to allow for proper access to all ancillary devices that are part of the equipment. This includes valves, circuit setters, building automation system controllers.
   i. If valves are not readily accessible for proper isolation, adequate pipe spacing needs to be allowed with consideration given to insulation that will be installed.
   ii. Valves that are located in areas where access is difficult will be installed at the three or nine o'clock position to allow for service. If this any question about the serviceability, the owner’s appropriate representative will be consulted for review.

3.4 CONCRETE BASES

Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

a. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Install dowel rods to connect concrete base to concrete floor.

b. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

e. Install anchor bolts to elevations required for proper attachment to supported equipment.

f. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

g. In general, use 3000-psi, 28-day compressive-strength concrete and reinforcement. Follow the instructions provided by the Civil Consultant.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

a. Refer to the Details provided in the Drawings and Specification Section of "Metal Fabrications" for structural steel.

b. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor Plumbing materials and equipment.

c. Field Welding: Comply with AWS D1.1.

3.6 GROUTING

a. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

b. Clean surfaces that will come into contact with grout.

c. Provide forms as required for placement of grout.

d. Avoid air entrapment during placement of grout.

e. Place grout, completely filling equipment bases.

f. Place grout on concrete bases and provide smooth bearing surface for equipment.

g. Place grout around anchors.

h. Cure placed grout.

X ---------- END OF SECTION ---------- X

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC SYSTEM

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the "Common Work Results for HVAC Works", Section 23 05 00.

2. PRODUCTS

a. Adjustable clevis type pipe hangers shall be mild steel.

b. Pipe rolls shall have cast iron or aluminum rollers, shaped to accept the outside diameter of the insulated pipe. Roll shall either rotate on a steel shaft mounted on a cast iron stand or shall roll on a cast iron bed plate.

3. EXECUTION

a. Hanger spacing shall be as shown on drawings. Refer to the details provided in drawings for spacing and type of support to be used for duct work, piping and equipment.

b. In addition, provide a hanger within 24" on each side of a valve, elbow or tee. Where the building structure will not accept the weight of pipe insulation and contents, at maximum span shown, the Contractor shall reduce the hanger spacing as required by the Engineer.

c. For chilled water pipe, use a galvanized steel insulation protection shield between the insulation and the hanger. The shield width shall be minimum 20 gauge of the pipe circumference.

d. Refer to Insulation Specification for insulation between pipe and pipe hanger.

e. Unless otherwise specified or shown all pipes installed on roof supported from below shall be mounted on pipe rolls. Outdoor rolls shall be galvanized.

f. All horizontal piping 2" dia. and larger shall be supported by adjustable MS clevis type hangers.

g. Unless otherwise specified or shown, vertical pipes shall be supported at least every 30 feet. Install expansion joint between every two supports.

h. Install resilient hangers as specified under Article entitled 'Vibration and Noise Control.

X ---------- END OF SECTION ---------- X

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the "Common Work Results for HVAC Works", Section 23 05 00.

1.2 QUALITY ASSURANCE

a. Except for packaged equipment with integral isolators, a single manufacturer shall select and furnish all isolation required.

b. Isolation performance requirements shall be as indicated on the drawings. All deflections indicated shall be minimum actual static deflections for specific equipment supported.

c. **ISOLATOR STABILITY:**
   i. Size springs of sufficient diameter to maintain stability of the equipment being supported with minimum horizontal to vertical stiffness ratio not less than 1:1. Spring diameters shall be not less than 0.8 of the compressed height at rated load.
   ii. Springs shall have a minimum additional travel to solid equal to 50 percent of the rated defection.

d. **MAXIMUM ALLOWANCE VIBRATION LEVELS:**
   Peak vibration velocities shall not exceed 2 m/s. If operating vibration velocities exceed this criteria, the equipment shall be repaired or replaced at no added expense to the Owner until approval of the equipment is given by the Owner.

e. **INSTALLER QUALIFICATIONS:**
   Drilled-in anchors shall be installed by the contractor with at least three years of experience performing similar installations.

f. **INSTALLER TRAINING FOR CONCRETE ANCHORS:**
   Conduct a thorough training with the manufacturer or the manufacturer's representative for the contractor/installer on the project. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:
   i. hole drilling procedure
   ii. hole preparation & cleaning technique
   iii. adhesive injection technique & dispenser training / maintenance

iv. rebar dowel preparation and installation
v. proof loading/torqueing

g. **CERTIFICATIONS:**
Unless otherwise authorized by the Engineer, anchors shall have one of the following certifications:
i. ICBO ES Evaluation Report indicating conformance with current applicable ICBO ES Acceptance Criteria.
ii. European Technical Approval indicating conformance with the European Technical Approval Guideline (ETAG) No. 001, Parts 2, 3 or 5.

h. All anti vibration mounts and hangers shall be subject to the Engineer's Approval.

1.3 SUBMITTALS

a. Submit shop drawings showing complete details of construction for Vibration and Seismic Control including:
i. Equipment mounting holes
ii. Dimensions
iii. Isolation selected for each support point
iv. Details of mounting brackets for isolator
v. Weight distribution for each isolator
vi. Details of seismic snubber
vii. Code number assigned to each isolator.

b. Submit product data and calculation sheets for isolators, showing:
Size, type, load and deflection of each required isolator
Percent of vibration transmitted based on the lowest disturbing frequency of the equipment

c. Product specifications with recommended design values and physical characteristics for epoxy dowels, expansion and undercut anchors.

d. Submit procedures for setting and adjusting isolation devices.

e. Where buses, isolators and other equipment specified in this section are provided as part of packaged equipment, submit calculations certifying compliance with this section.

f. Submit installation report.

g. Submit calculations stamped and signed by a registered professional and licensed structural engineer certifying mounting attachment points for isolators and seismic restraints will withstand forces.

h. Shop drawings and calculations shall be stamped by a registered professional licensed structural engineer.

i. Submit certified test reports from a qualified independent testing laboratory,
   i. Pressure drop, insertion loss and generated noise of silencers. The test method used by the independent testing laboratory certifying the silencer data, shall be fully described
   ii. Specified performance characteristics and physical properties of concrete anchors

j. Concrete Anchor Samples: Representative length and diameters of each type anchor shown on the Drawings.

k. Installer Qualifications & Procedures: Submit installer qualifications. Submit a letter of procedure stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date, and a list of the personnel to be trained on anchor installation.

1.4 DELIVERY, STORAGE AND HANDLING

Comply with Division 1 Section - Product Storage and Handling Requirements.

2. PRODUCTS

2.1 MATERIALS

All vibration isolation devices, shall be provided by an approved manufacturer.

a. FASTENERS AND ANCHORS

i. Bolts and Studs: ASTM A307; ASTM A449 where “high strength” is indicated on the Drawings
ii. Carbon and Alloy Steel Nuts: ASTM A563
iii. Carbon Steel Washers: ASTM F436
iv. Carbon Steel Threaded Rod: ASTM A36; or ASTM A193 Grade B7
v. Wedge Anchors: ASTM A510; or ASTM A108
vi. Stainless Steel Bolts, Hex Cap Screws, and Studs: ASTM F593
vii. Stainless Steel Nuts: ASTM F594
viii. Zinc Plating: ASTM B633
ix. Hot-Dip Galvanizing: ASTM A153
x. Metric Anchor Bolts, Screws, and Studs: ISO 898 Part 1
xi. Metric Anchor Nuts: EN 24033
xii. Metric Anchor Stainless Steel Bolts, Screws, and Studs: ISO 3506 Part 1
xiii. Metric Anchor Stainless Steel Nuts: ISO 3506 Part 2
xiv. Reinforcing Dowels: ASTM A615

b. CAST-IN-PLACE BOLTS

Anchors, Bolts, Nuts, and Washers: Bolts and studs, nuts, and washers shall conform to ASTM A307, Grade A, and ASTM A449, ASTM A563, and ASTM F436, as applicable. Hot-dip galvanized bolts and studs including associated nuts and washers in accordance with ASTM A153.

c. DRILLED-IN ANCHORS

i. Wedge Anchors: Wedge type, torque-controlled, with impact section to prevent thread damage and wedge dimples to prevent spinning during installation, complete with required nuts and washers. Provide anchors with length identification markings conforming to ICBO ES AC01. Type and size as indicated on Drawings.

ii. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors manufactured from materials conforming to ASTM A510 or ASTM A108 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).

iii. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
- HSA, ICBO ER-4627

d. HEAVY DUTY METRIC SLEEVE ANCHORS

i. Torque-controlled, exhibiting follow-up expansion under load, with provision for rotation prevention during installation. Type and size as indicated on Drawings.

ii. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors manufactured from materials conforming to ISO 898 Part 1, with zinc plating equivalent to ASTM B633, Type III Fe/Zn 5 (5□m min.).

iii. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be manufactured from materials conforming to ISO 3506 Part 1 and having corrosion resistance equivalent to AISI [Type 316] stainless steel. Stainless steel anchors shall be provided with stainless steel AISI [Type 316] nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ISO 3506 Part 2 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

iv. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Engineer, provide the following:
- HSL, HSL-3-G, or HSL-3-B, ICBO ER-3987

e. CARTRIDGE INJECTION ADHESIVE ANCHORS

Threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Type and size as indicated on Drawings.

i. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel rods conforming to ASTM A36 or ASTM A 193 Type B7 with zinc plating in accordance with

ASTM B633, Type III Fe/Zn 5 (SC1).

ii. Exterior Use: As indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI [Type 316] stainless steel provided with stainless steel AISI [Type 316] nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

iii. Reinforcing dowels shall be A615 Grade 60.

iv. Where anchor manufacturer is not indicated, subject to compliance with requirements and acceptance by the Architect, provide the following:

- HAS, HIT or HIT-TZ threaded rods with HIT HY-150 / HIT ICE Adhesive Anchorage System for anchorage to concrete or grouted masonry, ICBO ER-5193, ICBO ER-5942
- HAS or HIT threaded rods with RE 500 Injection Adhesive Anchoring System for anchorage

2.2 GROUT

a. Adequately isolate all equipment to maintain acceptable noise levels in the occupied areas of the building.

b. The contractor shall ensure that any equipment supplied by him shall have vibration and acoustic characteristics such that after implementing vibration and noise control devices, the reverberation time is 0.5-0.75 and Noise Rating level is NR 35. If required, the contractor shall provide equipment of noise and vibration criteria better than that minimum performance specified elsewhere in this document for individual equipment.

3. EXECUTION

3.1 GENERAL

a. Provide, to the Vibration and Noise Control Manufacturer, one copy of all shop drawings of equipment to be isolated.

b. On system start-up, inspect the complete installation and report in writing.

c. Do not install any equipment, duct, cable tray, busbar or pipe which makes rigid contact with the building other than at points of support. “Building” includes slabs, beams, studs, walls, etc.

d. The installation or use of vibration isolators shall not cause any change of position of equipment or piping which would result in stresses to piping connections or misalignment of shafts or bearings. In order to meet this objective, equipment and piping shall be

maintained in a rigid position during installation. The load shall not be transferred to the isolator until the installation is complete and under full operational load.

3.2 PREPARATION

a. Treat all isolators, including springs, brackets, and housing, with a rustproof metal primer.

b. Coat items exposed to weather with cadmium plating, galvanizing, or plastic coating.

3.3 INSTALLATION

a. VIBRATION ISOLATORS

i. All steel spring isolators should include a neoprene pad at least 10 mm thick mounted next to and in series with the spring.
ii. The neoprene used in isolation (unless otherwise stated) should have a diameter between 30 and 70.
iii. All rubber isolators should be double acting with no through-bolted connections.
iv. There shall be at least a 50 mm air space between the bottom of the isolated equipment and the floor slab.

b. FLOOR MOUNTED CENTRIFUGAL FANS

i. All fan mountings shall have static deflections equal to or larger than 25mm.
ii. Mount each fan and motor on an integral structural steel fan and motor base, reinforced as necessary to prevent base flexure and supported on neoprene-in- shear or unconfined spring mountings. Motor slide rails shall be welded to the structural base.
iii. Design each spring mounting so that the ends of the spring remain parallel during deflection. Each spring mounting shall be set on 6mm thick natural rubber or neoprene vibration isolation pad and shall be complete with leveling Device. Horizontal spring constant shall be equal to vertical spring constant. All hardware shall be zinc chromate painted or galvanized.
iv. Provide horizontal stabilizers for fans with horizontal movement larger than19mm and to the limit the horizontal movement to maximum 19 mm.

c. CEILING SUSPENDED FANS/AHU'S/FCU'S AND OTHER ROTATING EQUIPMENT

i. All units shall have spring type anti-vibration hangers having steel frame and helical compression type steel springs with minimum static deflections equal to or larger than 25mm.
ii. The springs shall be located within synthetic rubber cups to reduce transmission of high frequency noise and vibrations. The rubber cup shall be complete with

embedded load distribution steel plate and with projection bush to prevent metal to metal contact.

iii. The metal frame and springs shall be powder coated for protection against corrosion.

iv. The springs shall be color coded to facilitate identification.

v. If the equipment to be suspended is not furnished with integral structural frame and external mounting lugs of suitable strength and rigidity, install approved structural base with lugs in the field.

d. AIR HANDLING UNIT HOUSING

i. Provide isolation pads between housing and curb.

ii. Where housing is bolted to curb, isolate bolts with neoprene washers and bushings.

e. PIPING CONNECTIONS TO MECHANICAL EQUIPMENT

i. All piping connections to equipment should incorporate flexible rubber expansion joints close to the equipment.

ii. The first three pipe supports outside the expansion joints should incorporate steel spring isolators with a static deflection of at least equal to the equipment isolator static deflection.

iii. The first three isolators should be of the pre-compressed type to avoid excessive loading on the piping.

iv. Vibration isolation hangers should be installed with spring as close to ceiling as possible.

v. Penetrations of walls or floors should allow for a 25 mm clearance around the pipe. The gap should be stuffed with glass fibre insulation and sealed with non-hardening, caulking.

vi. The pipe should not be allowed to rest on the side of the hole.

f. SUPPORT OF PIPING:

i. Suspend all piping on resilient hangers. Where piping is to be supported from the floor, provide specially designed supports to be detailed in shop drawings.

ii. For piping connected to vibration isolated equipment pipe supports within 10 pipe diameters of the equipment shall have a static deflection of twice the deflection of the vibration-isolated equipment. All other piping supports shall have a static deflection of 25 mm minimum.

iii. Where specific supports (Seismic or other) are detailed on drawings or specified elsewhere these shall be checked by the specialist consultant retained by the contractor, and any adjustments or changes required to these supports shall be carried out after the Engineers approval, at no extra cost.

g. FLOOR-MOUNTED CENTRIFUGAL PUMPS

i. Larger than 2.2 kW:
- Mount each pump with motor on spring supported steel and concrete inertia base reinforced if necessary, of thickness as follows,
  - Pumps up to 3.73 KW - 150mm
  - Pumps 5.63 to 18.6 kW - 250mm
  - Pumps >18,6 to 37.3 kW - 400mm
  - Pump >27.3 to 74.5 kW - 600mm
- Each base for horizontally split pumps shall include supports for base elbows for the discharge and suction connections and for vertically split pumps shall include support for base elbow for suction connection. Bolt and grout base elbows to the steel and concrete pump base.
- Mount the steel and concrete base on spring mountings. Where the concrete base is 'T' shaped or other than rectangular, locate the spring mountings under the projections as well as the main body of the base. Spring mountings shall be self-contained concrete inserts with flush openings on the side of the base for spring adjustment or removal. Pour bases 'on roofing felt and elevate 50mm with mounting adjustment bolts after the pumps are grouted to the base. Alternatively, the bases may be constructed as specified for Floor-Mounted Centrifugal Fans. No damping or snubbing materials shall be used spring deflection shall be at least 25mm and all mountings shall have 6mm thick neoprene vibration Isolation pads at the bottom.
- Pump and motor shall be on one-piece base. Base of two or more sections welded or bolted together is not acceptable.

ii. 2.2 kW or less:
- Bolt and grout each pump to neoprene-in-shear supported reinforced concrete base which is a minimum of 150 mm thick. Neoprene-in-shear mountings shall have a minimum static deflection of 6 mm. All metal surfaces shall have friction neoprene pads both top and bottom so they need not be bolted to the base or the floor.

h. HVAC DUCTING

i. Flexible duct connections should be provided between all fans and ductwork.

ii. Resilient thrust restraints should be incorporated into the flexible connections to eliminate loading of the flexible connection. The restraints should be steel spring isolators having a static deflection of at least 19 mm.

iii. Wall or floor duct penetrations should allow for a 13mm clearance around the duct. The gap should be stuffed with glass fibre insulation and sealed with non-hardening caulking. The duct should be supported on both sides of the wall. Where passing through a fire rated wall or shaft wall intumescent packing material shall be used.

iv. Variable-air-volume (VAV) units (if and where used) should be mounted as high in the

ceiling space as possible, at least 2m away from any return air opening.

v. The ducting from the VAV box (if and where used) to the diffuser should be lined with acoustic insulation, at least 25 mm thick; the use of adhesive pins will not be acceptable.

vi. The ducting to supply air diffusers or VAV boxes (if and where used) should be straight and unobstructed for at least 3 duct diameters upstream of the diffuser.

vii. The supply ducting should not include a damper within at least 3 duct diameters, upstream of a supply diffuser. Any equipment not mentioned in this list of recommendations should be installed using good Engineering practice to minimize noise impacts.

i. CAST-IN-PLACE BOLTS

Use templates to locate bolts accurately and securely in formwork.

j. DRILLED-IN ANCHORS

i. Drill holes with rotary impact hammer drills using carbide-tipped bits] [and] [core drills using diamond core bits. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.

- Cored Holes: Where anchors are to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. HIT HY-150 and HIT ICE shall not be installed in core drilled holes.
- Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging pre-stressing tendons, electrical and telecommunications conduit, and gas lines.
- Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

ii. Perform anchor installation in accordance with manufacturer instructions.

k. WEDGE ANCHORS, HEAVY-DUTY SLEEVE ANCHORS, AND UNDERCUT ANCHORS

Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.

I. CARTRIDGE INJECTION ADHESIVE ANCHORS

i. Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Holes do not need to be cleaned for HIT-TZ Rods with HY-150 in accordance with ICBO ER-5942. Holes may be dry, damp or wet. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

ii. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.

3.4 SEISMIC RESTRAINTS

a. Seismic restraints should be employed in all steel spring isolators to limit movement of the equipment in the vertical and horizontal directions. These restraints shall not bypass the isolation under normal operating conditions.

b. Install and adjust seismic restraints so that the equipment and piping vibration isolation is not degraded by the restraints.

c. Each vibration isolation frame for supported equipment shall have a minimum of four seismic snubber mounted as close as possible to the vibration isolators and/or the frame extremities.

d. Care shall be taken so that a minimum 3.2 mm air gap in the seismic restraint snubber is preserved on all sides so that the vibration isolation potential of the isolator is not compromised. This requires that the final snubber adjustment be completed after the vibration isolators are properly installed and the installation approved.

e. Suspended Equipment, Ductwork, and Piping-Cable Method: Install cables so that they do not carry any load. Install with a minimum amount of slack or sag. The uplift and downward restraint nuts and washers for the Type HST hangers shall be adjusted so that there is a minimum 1/4-inch clearance.

f. All vibration isolated rectangular or oval ductwork with area of 0.6 m2 or greater and all vibration isolated round ductwork 700 mm diameter and larger shall be seismically restrained by the cable method.

g. All vibration isolated suspended piping 63.5 mm or larger, vibration isolated suspended piping in mechanical rooms 32 mm or larger, and vibration isolated suspended gas, hazardous, or life-safety piping 25 mm or larger shall be seismically restrained by the cable method.

3.5 REPAIR OF DEFECTIVE WORK

a. Specifier Note: Coordinate high-strength, non-shrink, and non-metallic grout selection.

b. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, non-metallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

3.6 FIELD QUALITY CONTROL

In order to achieve the appropriate level of quality control, testing should be performed by the owner's inspector in consultation with the manufacturer representative. Adjust testing requirements to suit job and local jurisdiction conditions. Select percentage of anchors to be tested. Smaller or more critical installations may warrant a higher percentage of anchors to be tested and a greater penalty for malfunctioning anchors. Verify that anchor embedment and proof loads are shown on the Drawings.

X ---------- END OF SECTION ---------- X

SECTION 23 05 93

TESTING, ADJUSTING AND BALANCING FOR HVAC

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the “Common Work Results for HVAC Works”, Section 23 05 00.
c. Refer to the applicable details of this section.

1.2 SCOPE

a. Balancing Air Systems

b. Balancing Hydronic Piping Systems

1.3 DEFINITIONS

a.	AABC	Associated Air Balance Council
b.	NEBB	National Environmental Balancing Bureau
c.	TAB	Testing, adjusting, and balancing
d.	TABB	Testing, Adjusting, and Balancing Bureau
e.	TAB Specialist	An entity engaged to perform TAB Work

1.4 SUBMITTALS

a. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members.

b. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part Three.

c. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article. Certified TAB reports.

d. Sample report forms

e. Sample pressure profile diagrams

f. Proposed pressure profile locations

g. Instrument calibration reports, to include the following:
   i. Instrument type and make
   ii. Serial number
   iii. Application
   iv. Dates of use
   v. Dates of calibration

1.5 QUALITY ASSURANCE

a. Meet with Project Managers/Engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location. Agenda Items:
   i. The Contract Documents examination report
   ii. The TAB plan
   iii. Coordination and cooperation of trades and subcontractors
   iv. Coordination of documentation and communication flow
   v. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer

b. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

c. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

d. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1 Section 6.7.2.3 - "System Balancing."

1.6 COORDINATION

a. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

b. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

2. EXECUTION

2.1 EXAMINATION

a. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

b. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

c. Examine the approved submittals for HVAC systems and equipment.

d. Examine design data including HVAC system descriptions, and statements and assumptions about HVAC system and equipment controls.

e. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 23 31 00 "HVAC Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

f. Examine equipment performance data including fan and pump curves.
   i. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   ii. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

g. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

h. Examine test reports specified in individual system and equipment Sections.

i. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

j. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

k. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

l. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

m. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

n. Examine system pumps to ensure absence of entrained air in the suction piping.

o. Examine operating safety interlocks and controls on HVAC equipment.

p. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

2.2 PREPARATION

a. Prepare a TAB plan that includes strategies and step-by-step procedures.

b. Complete system-readiness checks and prepare reports. Verify the following:

c. Permanent electrical-power wiring is complete.

d. Hydronic systems are filled, clean, and free of air.

e. Automatic temperature-control systems are operational.

f. Equipment and duct access doors are securely closed.

g. Balance, smoke, and fire dampers are open.

h. Isolating and balancing valves are open and control valves are operational.

i. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

j. Windows and doors can be closed so indicated conditions for system operations can be met.

2.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

a. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of

Environmental Systems" and in this Section.

b. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

c. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   i. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
   ii. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 31 00 "HVAC Ducts and Specialties."
   iii. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 00 "Thermal and Acoustic Insulation".

d. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

e. Upon successful completion of air and hydronic balancing, measure, record and provide for final reports, pressure profiles of all air and hydronic systems. Pressure profiles shall include, but not be limited to the following:
   i. Air Handling Equipment (AHU, EF, VF, Etc.): Pressure measurements across filters, coils, blenders, dampers, fans, etc.
   ii. Pumps, Prime Movers: Pressure measurements across suction diffuser heads, pump suction/discharge, triple duty valves, and other pressure loss appurtenances.
   iii. Supply Duct Systems: Record operating static pressures at various locations (minimum six readings) downstream of the fan discharge focusing on any major duct transitions, elbows, change in directions, split flow fittings more than 25% of total upstream flow.
   iv. Return Duct Systems: Record operating static pressures at various locations (minimum six readings) downstream of the fan discharge focusing on any major duct transitions, elbows, change in directions, split flow fittings more than 25% of total downstream flow.
   v. Utility Plant Piping: Record pressure drops across heat exchangers, chillers, boilers, and any other component which may impact overall system performance.
   vi. Pressure profiles shall be in diagrammatic format representative of the system and its components and locations where measurements are taken.
   vii. Coordinate measurement locations in field with Engineer and Commissioning Agent prior to taking readings.

f. Take and report testing and balancing measurements in inch-pound (IP) units.

2.4 FAN COIL SYSTEMS

a. Fan air handling quantities and other major air flow quantities where required shall be measured by Pitot tube and inclined manometer using multi-point traversing techniques.

b. The following items shall be specifically checked and/or tested and recorded on the Site Test Certificate:
   i. External air-dry bulb temperature and relative humidity
   ii. Air-dry bulb temperature and relative humidity in each space
   iii. Air-dry bulb temperature and relative humidity before and after each cooling coil
   iv. Fresh air quantity (m3/s)
   v. Air flow (m3/s) and pressure (N/m2 or mm of water) across a main fan
   vi. Air flow (m3/s) and resistance (N/m2 or mm of water) across each cooling coil
   vii. Air flow (m3/s) at each supply grille and diffuser
   viii. Maximum and minimum airflows and pressure drop across each VAV box, bypass box and fan powered box. Fan speed of fan powered box
   ix. Fan and motor speeds, air quantity and dry bulb temperature and relative humidity, both on and off the cooling coil, for fan coil- units
   x. Main fan and motor speeds
   xi. Current taken under normal running conditions for each fan
   xii. Operation of all electric coils, staging, sequencing, safety interlocks

2.5 WATER HANDLING SYSTEMS

a. The satisfactory operation of all make-up, drain and overflow arrangement shall be checked. Where water treatment is included initial commissioning shall be carried out and then rates of flow, dosing quantities etc., shall be calibrated and set for routine operation. Where controlled blow-down is included the controlling device shall be calibrated and set for routine operation.

b. The following items shall be checked and/or tested and recorded on the Site Test Certificate:
   i. Flow and return water temperatures at fan coil unit
   ii. Water quantity supplied to the cooling coil of each air-handling unit
   iii. Sump pumps flow and head

2.6 NOISE AND SOUND CONTROL

a. The spaces in which readings shall be taken shall be as read with the Engineer but will in general be the following:
   i. Plant rooms and occupied spaces (i.e. meeting room, offices, etc.)
   ii. Occupied rooms adjacent to plant rooms
   iii. In the space served by the first grille or diffuser after a fan outlet
   iv. In any space where, by the addition of special silencing material or techniques or by

classification of use (e.g. a meeting hall), a low level of noise is clearly required

b. Sound level readings shall be taken using a sound analyzer to give an octave band analysis of the sound spectrum and to pinpoint the frequency values of peak sound levels.

2.7 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

a. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

b. Obtain schematic diagrams of systems' "as-built" duct layouts.

c. For variable-air-volume systems, develop a plan to simulate diversity.

d. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

e. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

f. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

g. Verify that motor starters are equipped with properly sized thermal protection.

h. Check dampers for proper position to achieve desired airflow path.

i. Check for airflow blockages.

j. Check condensate drains for proper connections and functioning.

k. Check for proper sealing of air-handling-unit components.

l. Verify that air duct system is sealed as specified in Section 23 31 00 "HVAC Ducts and Specialties."

2.8 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

a. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   i. Measure total airflow.
      - Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the

total airflow.

ii. Measure fan static pressures as follows to determine actual static pressure:
   - Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
   - Measure static pressure directly at the fan outlet or through the flexible connection.
   - Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
   - Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

iii. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
   - Report the cleanliness status of filters and the time static pressures are measured.

iv. Measure static pressures entering and leaving other devices, such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.

v. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

vi. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

vii. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

b. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

i. Measure airflow of submain and branch ducts.
   - Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
   - Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
   - Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

c. Measure air outlets and inlets without making adjustments.

i. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

d. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
   i. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
   ii. Adjust patterns of adjustable outlets for proper distribution without drafts.

2.9 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

a. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

b. Obtain Schematic diagram of systems as-built piping layout from G.C.

c. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
   i. Open all manual valves for maximum flow.
   ii. Check liquid level in expansion tank.
   iii. Check makeup water-station pressure gage for adequate pressure for highest vent.
   iv. Check flow-control valves for specified sequence of operation, and set at indicated flow.
   v. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
   vi. Set system controls so automatic valves are wide open to heat exchangers.
   vii. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
   viii. Check air vents for a forceful liquid flow exiting from vents when manually operated.

2.10 TESTING OF CHILLED WATER PIPE WORK

a. The Works Contractor shall carry out hydraulic and performance tests, under actual conditions, to the entire satisfaction of the Engineer before any thermal insulation is applied.

b. The newly installed chilled water pipe work system shall be hydraulically tested to a pressure equivalent to one and a half times the maximum working pressure or ten atmospheres, whichever is higher. All flexible/ expansion joints shall be restrained to prevent axial stretch

and all control subject to damage shall be isolated at the time of the pressure test. The indicated pressure shall be maintained for 4 hours without further application of pressure and without visible leakage or a drop in the indicated pressure.

c. When a section of pipe work is complete and ready for testing, it shall be plugged and then slowly and carefully charged with water, allowing all air to escape and avoiding all shock or water hammer. The Works Contractor shall make arrangements for all water used in the test to be properly drained away.

d. Pipe work which fails under test, due to pressure loss or visible leakage, shall be relieved of pressure and all faulty joints or other defects made good.

e. Remedial work and test shall be repeated until the systems are tested successfully. If in the opinion of the Engineer, damage has been caused during the remedial work, or faulty materials have been used, the section under test will be condemned. The installation shall then be removed, cleared from site, replaced with new materials and re-tested as specified.

f. The General Works Contractor shall provide the water and electricity supplies necessary for testing purposes.

2.11 PROCEDURES FOR HEAT EXCHANGERS

a. Measure water flow through all circuits.
b. Adjust water flow to within specified tolerances.
c. Measure inlet and outlet water temperatures.
d. Measure inlet steam pressure. (if applicable)
e. Check settings and operation of safety and relief valves. Record settings.

2.12 PROCEDURES FOR MOTORS

a. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   i. Manufacturer's name, model number, and serial number
   ii. Motor horsepower rating
   iii. Motor rpm
   iv. Efficiency rating
   v. Nameplate and measured voltage, each phase
   vi. Nameplate and measured amperage, each phase
   vii. Starter thermal-protection-element rating

b. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

2.13 PROCEDURES FOR CONDENSING UNITS

a. Verify proper rotation of fans.

b. Measure entering- and leaving-air temperatures.

c. Record compressor data.

2.14 PROCEDURES FOR HEAT-TRANSFER COILS

a. Measure, adjust, and record the following data for each water coil:
   i. Entering- and leaving-water temperature
   ii. Water flow rate
   iii. Water pressure drop
   iv. Dry-bulb temperature of entering and leaving air
   v. Wet-bulb temperature of entering and leaving air for cooling coils
   vi. Airflow
   vii. Air pressure drop

b. Measure, adjust, and record the following data for each electric heating coil:
   i. Nameplate data
   ii. Airflow
   iii. Entering- and leaving-air temperature at full load
   iv. Voltage and amperage input of each phase at full load and at each incremental stage
   v. Calculated kilowatt at full load
   vi. Fuse or circuit-breaker rating for overload protection

c. Measure, adjust, and record the following data for each steam coil:
   i. Dry-bulb temperature of entering and leaving air
   ii. Airflow
   iii. Air pressure drop
   iv. Inlet steam pressure

d. Measure, adjust, and record the following data for each refrigerant coil:
   i. Dry-bulb temperature of entering and leaving air
   ii. Wet-bulb temperature of entering and leaving air
   iii. Airflow
   iv. Air pressure drop
   v. Refrigerant suction pressure and temperature

2.15 TOLERANCES

a. Set HVAC system's air flow rates and water flow rates within the following tolerances:
   i. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
   ii. Air Outlets and Inlets: Plus or minus 10 percent; plus or minus 5 percent for laboratory applications.
   iii. Heating-Water Flow Rate: Plus or minus 10 percent.
   iv. Cooling-Water Flow Rate: Plus or minus 5 percent.

2.16 REPORTING

a. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

b. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

2.17 FINAL REPORT

a. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   i. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   ii. Include a list of instruments used for procedures, along with proof of calibration.

b. Final Report Contents: In addition to certified field-report data, include the following:
   i. Pump curves
   ii. Fan curves
   iii. Manufacturers' test data
   iv. Field test reports prepared by system and equipment installers
   v. Other information relative to equipment performance; do not include Shop Drawings and product data

c. General Report Data: In addition to form titles and entries, include the following data:
   i. Title page
   ii. Name and address of the TAB contractor
   iii. Project name

iv. Project location
v. Architect's name and address
vi. Engineer's name and address
vii. Contractor's name and address
viii. Report date
ix. Signature of TAB supervisor who certifies the report
x. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
xi. Summary of contents including the following:
- Indicated versus final performance
- Notable characteristics of systems
- Description of system operation sequence if it varies from the Contract Documents

xii. Nomenclature sheets for each item of equipment.
xiii. Data for terminal units, including manufacturer's name, type, size, and fittings.
xiv. Notes to explain why certain final data in the body of reports vary from indicated values.
xv. Test conditions for fans and pump performance forms including the following:
- Settings for outdoor-, return-, and exhaust-air dampers
- Conditions of filters
- Cooling coil, wet- and dry-bulb conditions
- Face and bypass damper settings at coils
- Fan drive settings including settings and percentage of maximum pitch diameter
- Inlet vane settings for variable-air-volume systems
- Settings for supply-air, static-pressure controller
- Other system operating conditions that affect performance

d. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
i. Quantities of outdoor, supply, return, and exhaust airflows
ii. Water and steam flow rates
iii. Duct, outlet, and inlet sizes
iv. Pipe and valve sizes and locations
v. Terminal units
vi. Balancing stations
vii. Position of balancing devices

e. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
i. Unit Data:
- Unit identification
- Location
- Make and type
- Model number and unit size

- Manufacturer's serial number
- Unit arrangement and class
- Discharge arrangement
- Sheave make, size in inches, and bore
- Center-to-center dimensions of sheave, and amount of adjustments in inches
- Number, make, and size of belts
- Number, type, and size of filters

ii. Motor Data:
- Motor make, and frame type and size
- Horsepower and rpm
- Volts, phase, and hertz
- Full-load amperage and service factor
- Sheave make, size in inches, and bore
- Center-to-center dimensions of sheave, and amount of adjustments in inches

iii. Test Data (Indicated and Actual Values):
- Total air flow rate in cfm
- Total system static pressure in inches wg.
- Fan rpm
- Discharge static pressure in inches wg.
- Filter static-pressure differential in inches wg.
- Preheat-coil static-pressure differential in inches wg.
- Cooling-coil static-pressure differential in inches wg.
- Heating-coil static-pressure differential in inches wg.
- Outdoor airflow in cfm
- Return airflow in cfm
- Outdoor-air damper position
- Return-air damper position
- Vortex damper position

f. Apparatus-Coil Test Reports:

i. Coil Data:
- System identification
- Location
- Coil type
- Number of rows
- Fin spacing in fins per inch o.c.
- Make and model number
- Face area in sq. ft.
- Tube size in NPS
- Tube and fin materials
- Circuiting arrangement

ii. Test Data (Indicated and Actual Values):
- Air flow rate in cfm.

- Average face velocity in fpm.
- Air pressure drop in inches wg.
- Outdoor-air, wet- and dry-bulb temperatures in deg F.
- Return-air, wet- and dry-bulb temperatures in deg F.
- Entering-air, wet- and dry-bulb temperatures in deg F.
- Leaving-air, wet- and dry-bulb temperatures in deg F.
- Water flow rate in gpm.
- Water pressure differential in feet of head or psig.
- Entering-water temperature in deg F.
- Leaving-water temperature in deg F.
- Refrigerant expansion valve and refrigerant types.
- Refrigerant suction pressure in psig.
- Refrigerant suction temperature in deg F.
- Inlet steam pressure in psig.

g. Fan Test Reports: For supply, return, and exhaust fans, include the following:
   i. Fan Data:
      - System identification
      - Location
      - Make and type
      - Model number and size
      - Manufacturer's serial number
      - Arrangement and class
      - Sheave make, size in inches, and bore
      - Center-to-center dimensions of sheave, and amount of adjustments in inches
   ii. Motor Data:
      - Motor make, and frame type and size
      - Horsepower and rpm
      - Volts, phase, and hertz
      - Full-load amperage and service factor
      - Sheave make, size in inches, and bore
      - Center-to-center dimensions of sheave, and amount of adjustments in inches
      - Number, make, and size of belts
   iii. Test Data (Indicated and Actual Values):
      - Total airflow rate in cfm
      - Total system static pressure in inches wg.
      - Fan rpm
      - Discharge static pressure in inches wg.
      - Suction static pressure in inches wg.

h. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
   i. Report Data:

- System and air-handling-unit number
- Location and zone
- Traverse air temperature in deg F.
- Duct static pressure in inches wg.
- Duct size in inches
- Duct area in sq. ft.
- Indicated air flow rate in cfm
- Indicated velocity in fpm
- Actual air flow rate in cfm
- Actual average velocity in fpm
- Barometric pressure in psig

ii. Air-Terminal-Device Reports:
- System and air-handling unit identification
- Location and zone
- Apparatus used for test
- Area served
- Make
- Number from system diagram
- Type and model number
- Size
- Effective area in sq. ft.
- Test Data (Indicated and Actual Values):
  - Air flow rate in cfm
  - Air velocity in fpm
  - Preliminary air flow rate as needed in cfm
  - Preliminary velocity as needed in fpm
  - Final air flow rate in cfm
  - Final velocity in fpm
  - Space temperature in deg F.

iii. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
- Unit Data:
  - System and air-handling-unit identification
  - Location and zone
  - Room or riser served
  - Coil make and size
  - Flow meter type
- Test Data (Indicated and Actual Values):
  - Air flow rate in cfm
  - Entering-water temperature in deg F.
  - Leaving-water temperature in deg F.
  - Water pressure drop in feet of head or psig.
  - Entering-air temperature in deg F.

- Leaving-air temperature in deg F.

i. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
   i. Unit Data:
      - Unit identification
      - Location
      - Service
      - Make and size
      - Model number and serial number
      - Water flow rate in gpm
      - Water pressure differential in feet of head or psig.
      - Required net positive suction head in feet of head or psig.
      - Pump rpm
      - Impeller diameter in inches
      - Motor make and frame size
      - Motor horsepower and rpm
      - Voltage at each connection
      - Amperage for each phase
      - Full-load amperage and service factor
      - Seal type
   ii. Test Data (Indicated and Actual Values):
      - Static head in feet of head or psig.
      - Pump shutoff pressure in feet of head or psig.
      - Actual impeller size in inches
      - Full-open flow rate in gpm
      - Full-open pressure in feet of head or psig.
      - Final discharge pressure in feet of head or psig.
      - Final suction pressure in feet of head or psig.
      - Final total pressure in feet of head or psig.
      - Final water flow rate in gpm
      - Voltage at each connection
      - Amperage for each phase

j. Instrument Calibration Reports:
   i. Report Data:
      - Instrument type and make
      - Serial number
      - Application
      - Dates of use
      - Dates of calibration

2.18 INSPECTIONS

a. Initial Inspection:
   i. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
   ii. Check the following for each system:
      - Measure airflow of at least 10 percent of air outlets.
      - Measure water flow of at least 5 percent of terminals.
      - Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
      - Verify that balancing devices are marked with final balance position.
      - Note deviations from the Contract Documents in the final report.

b. Final Inspection:
   i. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
   ii. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.
   iii. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
   iv. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
   v. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

c. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
   i. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
   ii. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

d. Prepare test and inspection reports.

2.19 ADDITIONAL TESTS

a. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

b. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

c. The List enclosed is made as a guide line for the testing and commissioning. The Contractor is requested to submit a specified test and commissioning sheet that will cover all the aspects of the system. The consultant shall review and make suitable amendments to the test sheets.

d. It is mandatory that all the systems that is installed is provided with a detailed sequence of operation system wise and all the integration required to make the system fail proof is incorporated. The consultant's approval shall be attained before they are installed.

e. The contractor is responsible for all clarifications that is required for the safe/ reliable and fail proof operation of all the systems in the project.

f. The technical schedules listed hereunder must be filled in and signed by the Tenderer and they must be attached with the offer with complete engineering catalogues for every piece of equipment to enable the Engineer to evaluate each offer. Offers submitted without such information will not be acceptable.

3. CONTROLS

3.1 MOTORISED VALVE

Make/Model : _____
Type/Size : _____
Power Supply : _____
Power Consumption : _____

3.2 TEMPERATURE CONTROLS

Make/Model : _____
Type : _____
Temperature range : _____
Power supply : _____

3.3 AIR HANDLING UNITS

Reference : _____
Location : _____
Make/Model : _____
Type : _____
Total cfm : _____
Fresh Air cfm : _____
Casing Construction : _____
Overall Dimension : _____
Cooling Coil : _____
Total Cooling Capacity : _____
Sensible Cooling Capacity : _____
Coil Face Velocity : _____
Coil rows/deep/fpi : _____
Water temperature In/Out : _____
Water Flow, USGPM : _____
Air on Coil, DB/WB˚F : _____
Air off Coil, DB/WB˚F : _____
Coil Pressure drop, in. w.c. : _____
1/3 Octave band Sound : _____
Data through Casing Panel

3.4 FANS

Type / Make : _____
Total Static Pressure : _____
B.H.P. : _____
Motor H.P./Make : _____
Class of Insulation : _____

Miscellaneous Information
Filters Type and thickness : _____
Insulation Type and Density : _____
Controls provided : _____
Reheaters Capacity : _____

3.5 VENTILATION / EXHAUST FANS

Reference : _____
Location : _____
Service : _____

Type : _____
Make : _____
Model : _____
Size : _____
CFM : _____
Static Pressure, Pa : _____
Motor Rating / Make : _____

3.6 FAN COIL UNIT

Reference : _____
Make : _____
Type/Model : _____
Location : _____
Sensible Cooling Capacity : _____
Total Cooling Capacity : _____
Entering Air Temp. DB, ˚F : _____
Entering Air Temp. WB, ˚F : _____
Air Quantity, CFM : _____
Coil Enter. Water Temp., ˚F : _____
Coil Leave. Water Temp., ˚F : _____
No. of rows deep : _____
No. of fins per inch : _____
Water Flow rate, gpm : _____
Water Pressure drop : _____
Through coil, Pa
Power supply : _____
Motor kW/Make : _____
Overall dimensions : _____
Electric Heaters Cap. : _____

3.7 INSULATION

Manufacturer : _____
Type : _____
Density : _____
Finish : _____

4. COMMISSIONING SHEETS

4.1 COMMISSIONING SHEET OF TREATED FRESH AIR HANDLING UNITS

Project Name : _____

_____

_____

Date : _____

Sheet No. : _____

AHU Pre-commissioning Checks

System Reference : _____
Installation Complete : _____
System Clean and Unobstructed : _____
Inspection Covers Fitted : _____
Balancing Dampers Open : _____
Grilles/Diffusers Open : _____
Fire Damper/Auto. Damper Operational : _____
Chilled Water Lines Insulated : _____
Condensate Drain Line Completed : _____
With 'U' trap with Proper level
Air Components Aligned : _____
Pulley Alignment/Belt Tension : _____
Motor/Fan Bearing Lubricated : _____
Filter in Position and Cleaned : _____
Flexible Connections : _____
Starter Overload Adequate for Load : _____
Control Circuit Operational : _____
Permanent Electrical Supply Available : _____

Certified by _____

4.2 COMMISSIONING SHEET OF CHILLED WATER FAN COIL UNITS/AIR HANDLING UNITS

Project Name : _____

_____

_____

Date : _____

Sheet No. : _____

Location : _____

System/Equip. Reference : _____

Fan Make and Model No. : _____

Fan Type : _____

Fan RPM : _____

Motor Voltage, Phase, Hz. : _____

Fan Belt Nos., Size : _____

Motor Power : _____

Motor Full Load Current : _____

Motor Running Current : _____

Starter Type : _____

Starter O.L. Setting : _____

Air Volume Flow Rate : _____

Fan Static Pressure : _____

Air Temperature : _____

Filter Nos., Size : _____

Motorized Valve Operation : _____

Thermostat Operation : _____

Condensate Drainage : _____

Smoke Detector Operation : _____

Filter Operation : _____

Chilled Water In/Out Temp., ˚F : _____

Chilled Water In/Out Press., Psi : _____

Air Inlet Temp. DB/WB, ˚F : _____

Air Outlet Temp. DB/WB, ˚F : _____

Noise level at 1.0 m : _____

Certified by _____

5. SCHEDULES, EXPLANATORY NOTES

a. The schedules have been prepared for the purpose of facilitating selection of equipment and evaluating the tenders. The reference given against each item in the schedules refers to the appropriate reference in the drawings.

b. Technical details of the equipment offered by the Contractor should be furnished, as asked for in the technical schedules enclosed.

c. The external static pressure for fans, where given are approximate and the Contractor will be required to supply equipment to handle the requirements of his installation without extra cost to the contract.

d. Should the Contractor wish to amplify any information to be provided, this should be set out on separate sheets and submitted with his tender together with explanatory manufacturer's catalogues, curves and selection charts.

e. If the equipment selected by the tenderer should require any special alteration or addition to the architectural or structural work, he must list the requirements separately.

X ---------- END OF SECTION ---------- X

SECTION 23 07 00
HVAC INSULATIONS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the "Common Work Results for HVAC Works", Section 23 05 00.
c. Refer to the details provided in the Drawing Package.

1.2 REFERENCE CODES AND STANDARDS

a. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

b. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

c. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

ASTM B209	Aluminum and Aluminum Alloy Sheet and Plate
ASTM C168	Terminology Relating to Thermal Insulation Materials
ASTM C518	Steady State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C553	Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C612	Mineral Fiber Block and Board Thermal Insulation
ASTM C1071	Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
ASTM C1104	Standard Test Method for Determining the Water Vapor Sorption of unfaced Mineral Fiber Insulation
ASTM C1290	Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
ASTM C1136	Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C1338	Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
ASTM E84	Surface Burning Characteristics of Building Materials
ASTM E96	Water Vapor Transmission of Materials

ASTM E119	Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM G21	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
NFPA 255	Surface Burning Characteristics of Building Materials
SMACNA	HVAC Duct Construction Standards Metal and Flexible
UL 181	Standard for Factory Made Air Ducts and Air Connectors
UL 723	Surface Burning Characteristics of Building Materials
ASTM E2336	Standard for Grease Ducts
ASTM D5590	Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay

1.3 QUANLITY ASSURANCE

a. All HVAC items requiring insulation shall be insulated as specified herein and as required for a complete system. In each case, the insulation shall be equivalent to that specified and materials applied and finished as described in these Specifications.

b. All insulation required for the work shall be new, of first-class quality and shall be furnished, delivered, erected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality is specified, a first-class standard article as approved by the Architect shall be provided.

c. All piping and Ductwork Insulation shall be Rigid Insulation, and must meet Greenhouse Gas and Ozone Depletion Potential: Only use CFC- and HCFC- free products.

d. Flame Retardants: must be PBDE-free products.

e. All insulation, jacket, adhesives, mastics, sealers, etc., utilized in the fabrication of these systems shall meet NFPA for fire resistant ratings (maximum of 25 flame spread and 50 smoke developed ratings) and shall be approved by the insulation manufacturer for guaranteed performances when incorporated into their insulation system, unless a specific product is specified for a specific application and is stated as an exception to this requirement. Certificates to this effect shall be submitted along with Contractor's submittal data for this Section of the Specifications. No material may be used that, when tested by the ASTM E84 89 test method, is found to melt, drip or delaminate to such a degree that the continuity of the flame front is destroyed, thereby resulting in an artificially low flame spread rating.

f. Application Company Qualifications: Company performing the Work of this Section must have minimum three (3) years' experience specializing in the trade.

g. All insulation shall be applied by mechanics skilled in this particular Work and regularly engaged in such occupation.

h. All insulation shall be applied in strict accordance with these Specifications and with factory printed recommendations on items not herein mentioned. Unsightly, inadequate, or sloppy Work will not be acceptable.

1.4 SUBMITTALS

a. PRODUCT DATA:

Provide product description, list of materials, "k" value, "R" value, mean temperature range, and thickness for each service and location.

b. OPERATION AND MAINTENANCE DATA:

i. Samples: When requested, submit three (3) samples of any representative size illustrating each insulation type.

ii. Manufacturer's Installation Instructions: Indicate procedures that ensure acceptable standards will be achieved. Submit certificates to this effect.

1.5 DELIVERY, STORAGE AND HANDLING

a. Deliver, store, protect, and handle products to the Project Site under provisions in "General Specification" Sections.

b. Deliver materials to Site in original factory packaging, labeled with manufacturer's identification including product thermal ratings and thickness.

c. Store insulation in original wrapping and protect from weather and construction traffic. Protect insulation against dirt, water, chemical, and mechanical damage.

d. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulation cements.

2. PRODUCTS

2.1 MATERIAL SCHEDULE

All insulations shall be approved with related authorities with certification and shall be as per following schedule:

a. CHILLED & HOT WATER

Piping below 50 mm Ø	Elastomeric foam insulation 40 mm thickness, 64 kg/m^3
Piping above 50 mm Ø	Elastomeric foam insulation 50 mm thickness, 64 kg/m^3

b. CONDENSATE PIPING AND REFRIGERANT PIPING

Cold Condensate	Elastomeric Foam Insulation 15mm thickness
FCU Condensate	Elastomeric Foam Insulation 15mm thickness
Refrigerant pipes	Elastomeric Foam Insulation 20mm thickness

c. STEAM AND STEAM CONDENSATE PIPING

Piping below 1-1/2" Ø	Glass fiber Insulation 38mm thickness
Piping above 2" Ø	Glass fiber Insulation 75mm thickness

d. SHEET METAL DUCTWORK

Indoor Cold Air Ducts	Elastomeric Foam Insulation 25mm thickness
Exposed Cold Air Ducts	Elastomeric Foam Insulation 25mm thickness
Fire Ducts	Rockwool Blanket with GI wire mesh 96 Kg/m3 density, 50mm thickness, finished with insulating cement and painted for conditioned space
Kitchen Hood Ducts	Rockwool Blanket with GI wire mesh 96 Kg/m3 density, 50mm thickness, finished with insulating cement and painted for conditioned space

e. EQUIPMENT

Material and Finishes

Hot Water Converters and Hot Water Expansion Tanks:
50mm thick, 96 kg/m3 density, rigid board, fiberglass insulation

Expansion tanks:
25mm thick, Elastomeric Insulation

Emergency Generator Exhaust Gas Flue Piping and Generator Muffler:
50mm thick asbestos free, calcium silicate block insulation

2.2 ACOUSTIC DUCT LINER

a. Fiber glass duct liner with fabric on air side, to ASTM C1071 type 2 rigid board type, 48kg / m³ density; 121°C maximum service temperature: maximum face velocity on fabric side 20.3m/s; noncombustible; 25mm thick.

b. Application: Minimum 3 meters from FCU outlets and 6m from AHU's / FAHU's outlets whether shown on drawings or not.

2.3 FIBER GLASS INSULATION – FOR INDOOR AND OUTDOOR DUCTS

a. Insulation: ASTM C547; rigid molded, noncombustible
   i. 'k' ((btu*in)/(hr*ft2*deg F)) value : ASTM C335

Temperature (˚F)	Maximum 'k' value (Btu.in/h.ft^2.˚F)
75	0.23
100	0.24
150	0.25
200	0.28
300	0.34
400	0.42
500	0.51

   ii. Minimum Service Temperature : 0˚F
   iii. Maximum Service Temperature : 1000˚F
   iv. Maximum Moisture Absorption : 0.2% by volume

b. Vapor Barrier Jacket
   i. ASTM C1136, White Kraft paper reinforced with glass fiber yarn and bonded to aluminized film
   ii. Moisture Vapor Transmission: ASTM E96; 0.02 perms
   iii. Secure with self-sealing longitudinal laps and butt strips
   iv. Secure with outward clinch expanding staples and vapor barrier mastic

c. Vapor Barrier Lap Adhesive: MIL-A-3316C, Class 2, Grade A compliant. Compatible with insulation. VOC Limit 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

d. Insulating Cement: ASTM C195; hydraulic setting on mineral wool. VOC Limit 70 g/L (multipurpose construction adhesive).

e. Fibrous Glass Fabric: Cloth, untreated; 9 oz./sq.yd. weight with 1.0 lb./cu.ft. density blanket.

f. Indoor Vapor Barrier Finish: Vinyl emulsion type acrylic, compatible with insulation, white color. VOC Limit 50 g/L.

2.4 CELLULAR ELASTOMARIC FOAM INSULATION

a. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet
   i. 'k' ((btu*in)/(hr*ft2*deg F)) value: ASTM C177 or C518; 0.22 to 0.28 at 60˚F

ii. Minimum Service Temperature: 20˚F
iii. Maximum Service Temperature: 180˚F
iv. Maximum Moisture Absorption: ASTM C209; 0.2 percent by volume
v. Moisture Vapor Transmission: ASTM E96; 0.08 perm inches
vi. Maximum Flame Spread: ASTM E84; 25
vii. Maximum Smoke Developed: ASTM E84; 50
viii. Connection: Waterproof vapor barrier adhesive
ix. Provide documentation indicating that product contains no urea formaldehyde
x. Fittings: Pre-fabricated closed cell fittings of like material and thickness as adjacent pipe insulation
xi. In all exposed finished areas without jacketing, provide white insulation, otherwise use black

b. Elastomeric Foam Adhesive:
MIL-A-24179A, Type II, Class I, compliant. Air dried, contact adhesive, compatible with insulation. VOC Limit: 50 g/L or less when calculated according to 40 CFR 59, Subpart D.

c. Foam Hangers:
i. Closed-cell, lightweight polymeric rigid, high-compressive strength foam insulating pipe support, that is lined with closed-cell EPDM foam rubber, and encased in a zero-perm, weather-proof, corrosion-proof, EPDM polymer membrane with a high-performance pressure-sensitive closure system
ii. Insulation will not compress or crush under loads imposed by active piping systems and their contents resting on the insulation material between the pipe and the pipe hanger.
iii. Shall provide an anti-abrasion surface for contact with all types of piping materials, and absorb the vibrations associated with operational pipe systems
iv. Shall be UV and moisture resistant

d. Outdoor Duct Insulation:
i. Service temperature range from –60 degrees F to 180 degrees F.
ii. Meets ASTM C 177 or C 518 and shall have minimum ‘k’ value of 0.27 Btu-in. /hr-ft2-degrees F at minimum density measurement of 3 lb./cu.ft.
iii. The insulation and outside surface must be protected with a flexible clad/membrane system like white Thermo Plastic Rubber Membrane or as approved by consultant, which must be formulated to:
- Be resistant to UV, and ozone, acid rain, and physical elements produced from outdoor weather per ASTM E 96 Procedure A.
- Have flames spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with the test method for surface burning in ASTM E 84.
- Show no evidence of continued erosion, delaminating, cracking, flaking, or peeling when tested in accordance with the test method for erosion resistance

in UL181. Be resistant to mold growth resistance, ASTM G 21/C 1338 resistant to fungi, and resistant to bacteria growth per ASTM G 22.

2.5 INSULATION BLANKETS - STEAM AND CONDENSATE FLANGED VALVES AND EXPANSION JOINTS

Tight-fitting, reusable insulation blanket consisting of high-density insulation (fiberglass, mineral wool, ceramic fiber) covered on outside with coated glass fabric having heavy adjustable straps with buckles. Inside of blanket shall be covered with fabric suitable to specified temperature of stainless steel square mesh woven wire cloth. Insulation shall be a minimum of 1-1/2" thick and shall be suitable for temperatures up to 500 Deg. F.

2.6 JACKETS AND FACINGS

PVC Plastic:

a. Jacket: ASTM C921, One piece molded type fitting covers and sheet material, white color.
   i. Minimum Service Temperature: 0˚F
   ii. Maximum Service Temperature: 150˚F
   iii. Moisture Vapor Transmission: ASTM E96; 0.002 perm inches
   iv. Maximum Flame Spread: ASTM E84; 25
   v. Maximum Smoke Developed: ASTM E84; 50
   vi. Thickness: 20 mil
   vii. Connections: Brush on welding adhesive or pressure sensitive color matching vinyl tape

b. Covering Adhesive Mastic: Compatible with insulation and PVC jacket. VOC Limit 50 g/L according to 40 CFR 59, Subpart D (EPA Method 24).
   i. Aluminum Jacket: ASTM B209
   ii. Thickness: 0.040 inch
   iii. Finish: Smooth
   iv. Joining: Longitudinal slip joints and 2 inch laps
   v. Fittings: PVC pre molded fittings
   vi. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel

3. EXECUTION

3.1 EXAMINATION

a. Verify that piping and ducting has been tested before applying insulation materials.

b. No installation shall be applied to any surface, until all foreign matter has been removed from the surface to be installed. All insulations shall be applied in a manner consistent with good practice and method.

3.2 INSTALLATION

a. Install materials in accordance with manufacturer's instructions.

b. Painting of cellular foam insulation is not allowed.

c. On exposed piping, locate insulation and cover seams in least visible locations. For cellular foam insulation tape ALL visible seams with tape matching insulation color.

d. Insulation shall be continuous through floors, walls, partitions, etc. except when otherwise indicated or specified. Where space will not permit application of insulation in wall or slab chase, the chase shall be packed full of 85% magnesium mineral wool asbestos rope, or fiber glass and protected with covers plates as approved by the consultants.

e. Cold air ducts, fiberglass insulation shall have vapor barrier jacket with approved quality adhesive as specified in Section 2.4 above. Care shall be taken such that vapor barrier is not damage / pierced during installation, and any damage will be repaired with the same quality of vapor barrier. The installation shall be firmly fixed on the ducting / plenums with approved quality adhesive compound recommended by the installation manufacturers or as specified above. Adhesive to be approved by Consultant. The adhesive shall cover at least 25% duct area on the side and top, and 50% area at the bottom. All circumferential and longitudinal joints shall be lapped at least 50 mm and fully sealed with adhesives. Where rectangular ducts are 600 mm in width or greater, the insulation shall further mechanically secured to the ducts, and at least 25 mm wide metal bands shall be applied at the corners so that the mechanical fastener does not pierce the insulation and vapor barrier.

f. The insulation shall be applied to the full length of the ducts, including portions where internal sound absorber liner etc. is fixed.

g. All access doors and removable panels shall be insulated and jacketed separately. The insulation jacket ends on the duct and door or panel shall be sealed with 50 mm wide PVC vapor seal self-adhesive type tape to prevent damage to the insulation due to use and servicing. External and weather exposed insulated ducting shall be insulated as specified and then protected with a jacket of 20 kg roofing felt, all joints sealed with hot bitumen PBS PB4 or approved equal. The jacket shall be further mechanically secured to the duct with 6 mm wide soft aluminum bands, generally spaced at 450 mm. Indigenous coarse cloth, canvas roofing felt and asphalt impregnated kraft paper of approved quality are to be used.

h. All cements and adhesives shall be as recommended by the manufacturer of the insulation. Insulation, insulation jacket, canvas and adhesive shall be fire retardant with a flame spread not larger than 25 and a smoke developed rating not larger than 50 11 when tested in accordance with standard E 84-61 of the ASTM. All adhesives must meet the acceptable VOC

limits <50 g/L.

i. Insulation shall be installed in accordance with the manufacturer's printed installation instructions.

j. Valves and fittings shall be insulated with the same material as the pipe.

k. At each hanger or support for chilled water piping, the contractor shall install a section of high-density insulation between the pipe protection saddle and the pipe. Only the lower half of insulation, at hanger, will be replaced by an insert of high-density material so the top of pipe insulation and vapor barrier can be continuous. The high-density insulation shall be calcium silicate or a polymeric rigid EPDM foam rubber. Seal with vapor barrier mastic.

l. Insulation for diesel or gas engine exhaust pipe and muffler shall be 50mm (2") thick calcium silicate. Do not insulate expansion bellows. Insulation shall be protected with 1.0mm aluminum cladding.

m. Where pipes are exposed to outside or unconditioned exposed spaces, they shall be covered with 0.8 mm thick Aluminum cladding.

n. Insulation for pipes, duct and other equipment in mechanical rooms and where exposed to weather; shall be enclosed in 0.8mm thick aluminum cladding with all joints sealed and arranged to shed water.

o. Where thermal insulation is applied to the outside, equipment and plant used to convey, store or generate fluids or gases at temperatures lower than the design ambient dew point temperature a water vapor barrier shall be provided. The vapor barrier shall be applied such that it is continuous and gives protection to the whole surface of the insulation, which it protects. It shall not be pierced or otherwise, damaged by supports or by the application of external cladding. At points of support, means of load distribution shall be provided as necessary.

p. Apply insulation in strict accordance with manufacturer’s recommendation including all seals and adhesive taking care of compatibility of such adhesives with the insulation. Submit manufacturer’s data and compatibility recommendations for review.

q. Fiberglass insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:

    i. Provide vapor barrier jackets, factory applied or field applied.
    ii. Insulate fittings, joints, flanges, unions, strainers, flexible connectors, and valves with molded insulation of like material and thickness as adjacent pipe. PVC or aluminum covers are required in all exposed locations as in mechanical rooms.

iii. Finish with glass cloth and vapor barrier adhesive.
iv. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
v. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

r. Cellular foam insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:

i. Insulate fittings, joints, flanges, unions, strainers, flexible connectors, and valves with molded insulation of like material and thickness as adjacent pipe. PVC or aluminum covers are required in all exposed locations as in mechanical rooms.
ii. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
iii. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
iv. Provide rigid foam hangers as specified above between hanger and pipe.

s. Fiberglass insulated pipes conveying fluids above ambient temperature:

i. Provide vapor barrier jackets, factory applied or field applied.
ii. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. PVC covers are required in all exposed locations.
iii. Finish with glass cloth and adhesive.
iv. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
v. For hot piping conveying fluids, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
vi. For steam and condensate piping, insulate flanges and unions.

t. Finish insulation at supports, protrusions, and interruptions.

u. For pipe exposed below 10 feet above finished floor, finish with PVC jacket and PVC fitting covers.

v. For piping exposed in mechanical rooms below 10 feet above finished floor, finish with aluminum jacket and aluminum fitting covers.

w. All valves in insulated systems shall have valve stem extensions. Insulation installer shall notify the contractor and Owner if valves without stem extensions are encountered. All valves without stem extensions in areas where stem extensions are required shall be replaced.

x. Install insulation blanket on steam and condensate valves.

y. Provide insulation clearance and access to valves and fittings in hangers and from structure

and other equipment. Insulation shall be continuous through all hangers and supports. Foam or closed cell insulation on black or galvanized iron pipe operating below ambient temperature is not permitted.

X ---------- END OF SECTION ---------- X

SECTION 23 07 21

PRE-INSULATION DUCT WORK

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the "Common Work Results for HVAC Works", Section 23 05 00.
c. For installation, follow the details provided in the Drawing Package.

2. PRODUCTS

2.1 MATERIALS

The following preferred ductwork system to be installed:

a. ALP SYSTEM/π-PAL pre-insulated aluminum ductwork made of aluminum/polyisocyanurate sandwich panels, comprising an expanded polyisocyanurate rigid foam board faced on both sides by aluminum foil.

b. Physical characteristics of the panels shall be as follows for supply air, return air, fresh air and exhaust air ducts except exhaust duct for parking areas, Kitchen exhaust, smoke exhaust and stairwell pressurization ducts (which shall be metal ducts).

Parameters	Air-Conditioned Areas	Shafts	Exposed to Weather
Thickness of panels	21 mm	30 mm	30 mm
Thickness of aluminum	80/80 Microns	80/200 Microns	80/500 Microns
Density of the foam	48 kg/m^3	48 kg/m^3	48 kg/m^3
Finishing of aluminum	Embossed	Embossed	Embossed

c. Both sides of the aluminum foils shall be lacquered with a 3 g/m^2 weatherproof and ultraviolet ray's protection polyester lacquer.

d. All the panels shall have to be embossed with the name of the manufacturer and production date.

e. Thermal insulation characteristics shall be as follows:
   i. Insulating material: Close cell rigid expanded polyisocyanurate foam, CFC free, density 48 Kg/m^3, material physiologically and chemically inert and insoluble, vermin proof, fungus proof, non metabolisable
   ii. Thermal conductivity: 0.021 W/m.K or better
   iii. Water absorption shall be less than 0.5% by 24 hours immersion test
   iv. Water vapour diffusion: M = infinity resistance
   v. The aluminum foil covering the panel to be maintained intact after installation to ensure vapour barrier continuity

f. Fire retardant characteristics shall be as follows:
   i. Class 0 according to BS 476 Parts 5, 6 & 7

2.2 PRESSURE AND TEMPERATURE

a. TEMPERATURE RANGE:

No relevant reduction of insulation, chemical or physical characteristics of the panels to be measurable, when conveying air in the temperature range of –35˚C to +110˚C.

b. PRESSURE RANGE:

No relevant modification of insulation, chemical or physical characteristics of the panels to be measurable, when conveying air up to the pressure of 1750 Pascal.

3. EXECUTION

3.1 GENERAL - INSTALLATION

a. Installation shall be supervised & certified by the manufacturer's representative and 5-years guarantee shall be offered.

3.2 JOINT SYSTEM

a. The joints between the ducts shall be using aluminum invisible flanges and slide-in-channel and to be connected by special cover corners, having a holding pin, which goes inside the flange and the insulation, to avoid any field connection and to give the system more strength.

3.3 DUCT SUPPORTS

a. Ductwork and plenums shall be fabricated, using aluminum/polyurethane thermo insulating ALP system panels, approved manufacturers shall be as per list of approved manufacturers.

b. Ductwork shall be installed, using supports, as described in DW144 & according to manufacturer's requirements. Maximum distance between supports shall not exceed:
   i. 4000mm for ducts with section not exceeding 1200 x 1000mm
   ii. 2000mm for ducts with section exceeding 1200 x 1000mm

X ---------- END OF SECTION ---------- X

SECTION 23 23 00

REFRIGERANT PIPING

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the "Common Work Results for HVAC Works", Section 23 05 00.

2. PRODUCTS

a. Refrigerant pipe work shall be refrigerant quality copper tube to BS 2871 Table 2 (Material C106), fully annealed (For sizes up to 28mm) and Hard pipes for sizes greater than 28mm, internally degreased and cleaned, with capillary fittings.

b. Piping shall be supported to prevent strains or distortion in the connected equipment, valves and control valves. Piping shall be supported to allow for removal of equipment, valves and accessories with a minimum of dismantling and without requiring additional supports after these items are removed.

c. All pipe openings through walls, partitions and slabs shall have UPVC sleeves of an internal diameter at least 25 mm larger than the outside diameter of the pipe or of the insulation for insulated services. All building expansion joints shall also be provided with pipe sleeves.

d. The pipe with insulation shall be carried through the walls, floor or roof slab and pipe sleeves through them shall be projected minimum 50 mm on either side of the walls, floor and roof slab.

e. Pipes passing through interior partitions shall be provided with sleeves of UPVC set flush with finished wall surfaces.

f. Joints in copper pipe shall be flanged, flared (up to 19.05 mm O. D. only) or brazed (with or without capillary fittings). Brazing shall be carried out to the requirements of the HVCA Code of Practice – Brazing and Bronze Welding of Copper Pipe and Sheet.

g. Screwed joints shall not be accepted in refrigerant pipes except on the equipment accessories. In such cases the threads shall either be of taper form and used in conjunction with PTFE tape or an anaerobic sealant, or of parallel form associated with machined joint faces and a suitable joint.

h. Copper pipe work shall be used as feed piping for all pressure gauge or similar fittings.

i. Compression fittings shall not be accepted on refrigerant pipe work.

j. Refrigerant pipe work shall not be arranged for running compressors in parallel (i.e. with common suction and/or discharge in pipes). The use of a number of compressors each having an independent refrigerant circuit in a common evaporator shall be permitted provided pressure tests between adjacent refrigerant circuits in the evaporator are carried out during manufacture.

k. The pipe work shall be designed so that oil in the refrigerant leaving the compressor (and passing any oil separator fitted) shall be carried through the system and back to the compressor at the lowest stage of capacity unloading.

l. Pipe work shall be firmly supported and secured to minimize vibration. Vibration eliminators shall be fitted to the compressor suction and discharge pipes to minimize transmission of vibration or noise.

m. All refrigerant equipment shall have a strength and leakage pressure test after manufacture in accordance with the Table below or as per recommendations of manufacturer:

Refrigerant	**High Side Test Pressure (KPa)**	**Low Side Test Pressure (KPa)**
R410a	3000	1700

n. A pressure test equal to the low test pressure quoted in the table of equipment test pressures shall be applied to the refrigerant system after all piping has been fitted. This test shall be in addition to the pressure test on each unit at completion of the manufacture.

o. Provision shall be made for the supply of up to 3 sets of pressure test sheets for each machine and system. It shall be the Works Contractor's responsibility to ensure the sheet content and presentation is acceptable to the Engineer.

p. Refrigerant pipe work shall be insulated in accordance with QCS requirements. Manufacturer's recommendations shall likewise be considered. The insulated pipe work shall be additionally wrapped with 200 gm. / sq.m. quality glass cloth and painted with two coats of approved weather proofing compound and finally provided with 0.63 mm aluminum cladding for outdoor piping.

3. EXECUTION

3.1 INSTALLATION

a. Install refrigerant piping and refrigerant containing parts in accordance with ASHRAE Standard 15 and ASME B31.

i. Install piping as short as possible, with a minimum number of joints, elbow and fittings.

ii. Install piping with adequate clearance between pipe and adjacent walls and hangers to allow for service and inspection. Space piping, including insulation, to provide 25 mm (1 inch) minimum clearance between adjacent piping or other surface. Use pipe sleeves through walls, floors, and ceilings, sized to permit installation of pipes with full thickness insulation.

iii. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing.

iv. Use copper tubing in protective conduit when installed below ground.

v. Install hangers and supports per ASME B31.5 and the refrigerant piping manufacturer's recommendations.

b. **JOINT CONSTRUCTION:**

i. Brazed Joints: Comply with AWS "Brazing Handbook" and with filler materials complying with AWS A5.8/A5.8M.

ii. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper tubing.

iii. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

iv. Swab fittings and valves with manufacturer's recommended cleaning fluid to remove oil and other compounds prior to installation.

v. Pass nitrogen gas through the pipe or tubing to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.

c. Protect refrigerant system during construction against entrance of foreign matter, dirt and moisture; have open ends of piping and connections to compressors, condensers, evaporators and other equipment tightly capped until assembly.

d. Pipe relief valve discharge to outdoors for systems containing more than 45 kg (100 lbs) of refrigerant.

e. **FIRESTOPPING:**

Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Division 23.

f. **SEISMIC BRACING:**

Refer to specification Section 13 05 41, SEISMIC RESTRAINTS REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS, for bracing of piping in seismic areas.

3.2 FIELD QUALITY CONTROL

a. Prior to initial operation examine and inspect piping system for conformance to plans and

specifications and ASME B31.5. Correct equipment, material, or work rejected because of defects or nonconformance with plans and specifications, and ANSI codes for pressure piping.

b. After completion of piping installation and prior to initial operation, conduct test on piping system according to ASME B31.5. Furnish materials and equipment required for tests. Perform tests in the presence of Engineer. If the test fails, correct defects and perform the test again until it is satisfactorily done and all joints are proved tight.
   i. Every refrigerant-containing parts of the system that is erected on the premises, except compressors, condensers, evaporators, safety devices, pressure gages, control mechanisms and systems that are factory tested, shall be tested and proved tight after complete installation, and before operation.
   ii. The high and low side of each system shall be tested and proved tight at not less than the lower of the design pressure or the setting of the pressure relief device protecting the high or low side of the system, respectively, except systems erected on the premises using non-toxic and non-flammable Group A1 refrigerants with copper tubing not exceeding DN 18 (NPS 5/8). This may be tested by means of the refrigerant charged into the system at the saturated vapor pressure of the refrigerant at 20 degrees C (68 degrees F) minimum.

c. TEST MEDIUM:

A suitable dry gas such as nitrogen or shall be used for pressure testing. The means used to build up test pressure shall have either a pressure limiting device or pressure-reducing device with a pressure-relief device and a gage on the outlet side. The pressure relief device shall be set above the test pressure but low enough to prevent permanent deformation of the system components.

d. REFRIGERATOR/FREEZER START UP AND PERFORMANCE TESTS:

Specification // Section 11 41 21, WALK-IN COOLERS and FREEZERS // Section 11 53 23, LABORATORY REFRIGERATORS // Section 11 78 13, MORTUARY REFRIGERATORS //.

3.3 SYSTEM TEST AND CHARGING

a. **SYSTEM TEST AND CHARGING:**

As recommended by the equipment manufacturer or as follows:
   i. Connect a drum of refrigerant to charging connection and introduce enough refrigerant into system to raise the pressure to 70 kPa (10 psi) gage. Close valves and disconnect refrigerant drum. Test system for leaks with halide test torch or other approved method suitable for the test gas used. Repair all leaking joints and retest.
   ii. Connect a drum of dry nitrogen to charging valve and bring test pressure to design pressure for low side and for high side. Test entire system again for leaks.
   iii. Evacuate the entire refrigerant system by the triplicate evacuation method with a vacuum pump equipped with an electronic gage reading in mPa (microns). Pull the

system down to 665 mPa (500 microns) 665 mPa (2245.6 inches of mercury at 60 degrees F) and hold for four hours then break the vacuum with dry nitrogen (or refrigerant). Repeat the evacuation two more times breaking the third vacuum with the refrigeration to be charged and charge with the proper volume of refrigerant.

X ---------- END OF SECTION ---------- X

SECTION 23 31 00
HVAC DUCTS AND CASINGS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the “Common Work Results for HVAC Works”, Section 23 05 00.

1.2 SUMMARY

a. Metal Ductwork applicable to all indoor supply, return, toilet exhaust, kitchen exhaust, parking exhaust, smoke exhaust and all duct work on roof and in shafts (including supply air, return air, exhaust air and fresh air).

b. All duct sizes shall be verified by contractor against actual selected machine flow and to be resized if necessary to limit total system flow resistance and noise. Total system resistance and fan power shall be limited in accordance with ASHRAE 90.1 2016.

1.3 SUBMITTALS

a. **SHOP DRAWINGS:**
Submit duct fabrication drawings indicating:
   i. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
   ii. Duct layout, indicating sizes in plan view.
   iii. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.
   iv. Manufacturer's Installation Instructions: Submit special procedures for glass fiber ducts.

b. Record actual locations of ducts and duct fittings. Record changes infitting location and type. Show additional fittings used.

1.4 QUALITY ASSURANCE

a. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

b. Construct ductwork to NFPA 90A and NFPA 96 standards.

c. For Pre-insulated Ducts, no relevant reduction of insulation, chemical or physical characteristics of the panels to be measurable, when conveying air in the temperature range of –35°C to +110°C and pressure of 1.75kPa.

1.5 ENVIRONMENTAL REQUIREMENTS

a. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

b. Maintain temperatures during and after installation of duct sealant.

c. Protect all duct openings from dust and debris during construction.

2. PRODUCTS

2.1 GENERAL

a. Access doors of adequate size and proper design shall be provided in all ductwork and air chambers to permit inspection and maintenance of valves, controls, dampers, coils, filters and bearings and must be shown on drawings. Access doors to be provided at 3 meter centers in Kitchen exhaust ducts to allow access for regular cleaning. No access ducts or hatches are acceptable in the Lobby area.

b. Manual volume dampers shall be provided in each branch duct for balancing and must be shown on the drawings.

c. Instrument test holes shall be provided for balancing.

d. All duct work with in three meter of fan coil units' outlets shall be acoustically lined.

e. The following ductwork shall be of pre-insulated phenolic foam ductwork:
   i. Fan coil units' ductwork
   ii. Fresh air supply branch ductwork to floor levels after VCD

f. All other ductwork (extract air branch to floor levels after VCD, risers, at roof and mechanical floors) shall be in galvanized sheet steel.

g. All kitchen exhaust ductwork shall be black steel (1.2mm) with welded construction, pitched back toward the hood with cleaning access doors every ten feet and at each elbow. No turning vanes or dampers are allowed. Fire insulation, not less than two-hour rated (or the minimum required by code), is applied to ductwork. Provide the cooking exhaust fan housing with a drain connection at the bottom to allow the cleaning solution to manually

drain.

h. Kitchen range hood duct work shall be constructed of black steel with welded seams and liquid tight joints. The system shall be designed in full compliance with NFPA 96 and the applicable local codes having jurisdiction.▪Provide 50 mm foil faced mineral woof solution around all grease exhaust ducts with 0.7 mm aluminum jacketing and as per ASHRAE/NFPA/SMACNA codes. Cleanouts and access shall be provided as per NFPA 96.

i. Branch duct work from moisture emitting equipment, e.g., dishwashers, pot sinks, etc., and indoor swimming pools, shall be constructed of copper, stainless steel or aluminum, with water tight joints, pitched back toward the equipment. Electrolytic isolation shall be provided at connections to iron duct work. Fire dampers shall be provided in branches where connections are made to the Kitchen hood exhaust duct work.

j. Smoke extract Fire rated ductwork shall be galvanized steel without additional coating. The construction shall conform to BS 476 Part 24 for stability and integrity up to 2 hours. Ducts shall be with valid approval certificates from Local Civil Defense.

2.2 MATERIAL

a. Ducts shall be constructed of galvanized iron unless specifically noted otherwise. Conforming to ASTM A-525 and having a minimum coating of 0.275kg/m² z-27. The galvanizing shall be carefully done and the sheets shall be of such quality that they may bend flat on themselves with no fracture to the coating or the base metal.

b. The recommendations of ASHRAE/SMACNA shall be used as a guide for sizing, minimum gauges, bracing and construction details.

c. Fiberglass ducts, bearing the UL label and constructed in accordance with SMACNA standards, may be considered for use in low pressure systems.

d. Duct work exposed in B.O.T.H. areas shall be galvanized and not fiberglass.

e. GI duct work will be applicable for exhaust duct work for parking area.

f. Provide Welded non-corrosive exhaust ducts in steam areas.▪

g. Where duct is acoustically lined, duct dimensions shown are net, clear internal dimensions.

h. All round ductwork shall be shop or factory fabricated conduit "consisting of helically wound galvanized iron strips with spiral lock seam. Each duct section and fitting shall have a plain end and a belled or swaged end to permit a sliding fit with overlap not less than 100mm. Ninety degrees elbows shall have smooth center line -radius of 1.5 times duct diameter.

Alternatively, they may be of five pieces construction. Forty-five degree elbows shall be of three piece construction.

i. Fire dampers shall be installed where required by NFPA 90A and the applicable local codes having jurisdiction and must be shown on the drawings. A schedule of fire dampers is to be provided as part of the maintenance manuals.

j. **FLEXIBLE DUCTS**

i. Flexible Ducts shall be used as shown on drawings.
ii. They shall not pass through floors or fire walls and shall not exceed 1.5 m in length. Flexib1e ducts shall not be installed in inaccessible locations, such as above gypsum board ceilings without prior approval from the consultant.
iii. The flexible duct shall have a flame spread not exceeding 25 and smoke development not exceeding 50 per UL 723 test method.
iv. Thermal resistance of duct shall be more than R-1.06
v. The flexible duct shall have an air leakage not exceeding 0.00151l/s at 11.94kPa static pressure
vi. The duct shall be rated for a maximum air velocity of 12.5 m/s.
vii. Flexible insulated ducts shall be UL 181 listed. Exterior jacket shall be metalized polyester vapor barrier with 2 ply black polyester core with aluminium foil exterior finish. Insulation shall be fiberglass, R-0.74 Core shall be double ply polyester laminated with carbon steel wire helix. The flexible duct shall have an inner air barrier factory applied insulation equal 40 mm thick flat insulation

k. **PHENOLIC PREINSULATED DUCTWORK:**

i. The pre-insulated ductwork system shall be installed for the indoor duct installation except the duct risers within shafts and outdoor ductwork which shall remain in GI material.
ii. Pre-insulated ductwork shall be made of aluminum & closed-cell phenolic panels that are UL 181 listed.
iii. Non-metal Ductwork fabricated from closed-cell Phenolic panels, UL Listed Class 1 Air Duct, to Standard for Safety UL 181 (Factory Made Air Ducts & Air Connectors).
iv. The ductwork shall have a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84. Ducts shall be with valid approval certificate from Local Civil Defense.
v. All insulation materials shall be manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and Low Global Warming Potential (GWP<5).
vi. All insulation materials shall be CFC / HCFC Free.
vii. The vapor barrier shall be granted by the reinforced aluminum foils covering both faces of the hard foam.
viii. Non-metal Ductwork and plenums shall be fabricated according to manufacturer's

construction method, using adequate materials and accessories. All the insulation panels shall have to be printed with the name of the manufacturer and the production date.

ix. The non-metal ductwork shall be thermoset phenolic, physiologically and chemically inert and insoluble, vermin proof, fungus proof, anti-bacterial and non-metabolisable.

x. The panels shall have the following characteristics:

PARMETERS	AIR-CONDITIONED AREAS
Minimum Thickness	20 mm
Minimum Thickness	80 Microns
Density of the foam	55 – 60 kg/m^3
Thermal Conductivity	0.021 W/m.K

xi. Both sides of the aluminum foils shall be lacquered with a 2 g/m2 weatherproof and ultraviolet ray's protection polyester lacquer.

xii. The Phenolic duct construction shall be according to SMACNA standards or equivalent.

xiii. Ductwork and plenums shall be fabricated & joined in accordance with manufacturer's instructions.

xiv. The joints between the ducts to be installed in air-conditioned areas and plant rooms shall be made, using aluminum flange with aluminum slide-in bayonet.

xv. The joints between the ducts will be completed with the installation of adhesive gasket to reduce air leakage.

xvi. Ductwork shall be installed, using supports, as described in SMACNA or DW144 & according to manufacturer's requirements. Maximum distance between supports shall not exceed:

- 4000mm for ducts with section not exceeding 1200 x 1000mm
- 2000mm for ducts with section exceeding 1200 x 1000mm

xvii. The Phenolic ductwork shall have the following properties:

- Thermal Conductivity : 0.021 W/m.K
- Operating temperature : -26 C to 85˚C
- Minimum compressive strength
  At 10% compression (BS EN 826:1996) : 200 KPa
- Nominal density of insulation : 55-60 Kg/m3
- Minimum closed cell content : >90%
- Design Pressure : Positive of 1000 Pa, and
  Negative of 750 Pa
- Fire retardant characteristic : Class 0 as per BS 476 Part 6 & 7

3. EXECUTION

a. All sheet metal ducts shall be as per size and location on drawings. If changes of size or location of ducts are found necessary because of building construction, these may be done with prior submission to and approval by the consultant. All dimensions shall be checked on site before ductwork manufacture is commenced.

b. All laps shall be in the direction of air flow and all edges and slips hammered down so as to leave smooth finished surface inside the ducts.

c. All ducts shall be braced and stiffened and shall be tight so that they will not breathe, rattle, vibrate or sag. Cross-break or transverse bead all rectangular ducts with heights or widths of 300mm or larger.

d. Duct sealant by an approved manufacturer shall be used. Brush joints with the compound before and again after assembly. Exposed ducts shall be sealed on the inner surfaces only.

e. Flexible duct connections shall be by an approved manufacturer and shall be provided at each building expansion joint, air handling unit and fan duct connection. Connections shall be 20 oz. minimum fire retardant canvas. For fan discharge connections in excess of 1000 Pa or where located outdoors, provide connections of fire retardant glass fibre cloth with a neoprene coating. Connection material shall be reviewed by the Engineer before installation.

f. Flexible duct connections shall be Class 1, corrugated aluminum flexible duct suitable for 120°C and 1.5 kPa and shall be Underwriters Laboratories listed. Flexible duct connections shall be insulated with 25mm insulation complete with vapor barrier.

g. Bends in flexible ducts shall have center line radius of not less than 10 x diameter. Collars to which flexible ducts are attached shall be a minimum of 50mm in depth. Insulation and vapour barriers on factory-fabricated ducts shall be fitted over cone connection and supplementally secured with a drawband.

h. Where ductwork passes through a wall or floor, other than when a fire damper is required, pack around the duct using a fire resistant material to ensure a sound and air tight joint.

i. Access ports (32 mm round) at convenient locations in all main ducts and main branch take offs, complete airtight covers and extension sleeves through insulation shall be provided to allow air meter readings.

j. Manual duct dampers as shown and as required for proper balancing of the system shall be provided and installed. Dampers shall be of galvanized steel 18 U.S. ga. or heavier. Dampers for ducts up to 300mm deep shall be single blade carried on a 10mm square steel rod mounted inside the duct. Dampers for ducts of greater depth than 300mm shall be multi-blade, opposed-acting

type and shall have blades mounted in 40mm channel frame, and interconnected for operation from one locking type hand quadrant.

k. Splitter dampers as shown and as required for proper balancing of the system shall be provided. The splitter shall be made of at least the same thickness of galvanized steel as the duct in which it is installed, down to a minimum of 20 U.S. gauge, and shall be securely hinged at the air leaving edge, and made of two thicknesses, so that the entering edge presents a round nose to the air flow. The length of the splitter shall be at least 1.0 times the width of the smaller branch duct, but in no case less than 300mm long. Splitter hinge shall be attached and hinged to the splitter near the air entering edge, and shall pass through a clamp on the side of the duct which is most accessible far adjustment, to permit positioning and anchoring of the damper.

l. Gravity backdraft dampers shall be multi-blade louver type, constructed of light grade aluminum. Blades shall be joined with a tie bar and have rust-proof shafts rotating in oil impregnated bronze or plastic bushings.

m. Motorized dampers for control operation are specified under specification Division 25, Building Management System.

n. Fire dampers shall be UL listed. Unless otherwise permitted by the Engineer all curtain-type fire dampers shall be Type B with curtain completely clear of the air stream. Fire dampers shall be installed the manner in which they were twisted and shall meet all applicable codes. Fusible links shall be rated for 100°C unless otherwise damper shall have the same fire rating as the wall in which they are installed Fire dampers installed in duct where air flow may still exist during a fire shall be dynamic type.

o. Access panels as shown on drawings and as required for convenient access shall be provided at all fire dampers, gravity dampers, motorized dampers, coils, fan' bearings or similar equipment requiring occasional maintenance or inspection. Panels shall be 600mm x 450mm or full width of duct if less than 450mm width. Panels shall be of double wall construction shall be internally insulated on insulated ducts. Frame shall be of structural angle welded corners, gasketed to receive the panel. Panel shall be held in place with 4 win o sash locks. All access doors for fire dampers shall be labeled "Fire Damper and their location shall be indicated on “shop” and "as-built" drawings.

p. All ductwork shall be installed securely and in a rigid manner with hangers provided as per schedules below:

    i. For Horizontal Rectangular Ducts:

HORIZONTAL RECTANGULAR DUCT	
Max. Duct Dimension (mm)	**Hanger Construction Dimensions (mm)**
Up to 500	two 25 x 16 U.S. ga. straps on 2400 mm centers with, two screws on side of duct, one on bottom
501 to 1500	25 x 25 x 6 trapeze hanger with two 10 mm rods on 2400 mm centers.
1501 to 3000	50 x 50 x 6 trapeze hanger with two 10 mm rods on -2400 mm centers.
3001 to 6000	63 x 63 x 5 trapeze hanger with two 10 mm rods on 1200 mm centers.

ii. For Horizontal Round Ducts:

HORIZONTAL ROUND DUCT	
Duct Diameter, 41 (mm)	**Hanger Construction Dimensions (mm)**
up to 150	One 25 x 16 U.S. ga. hanger ring supported from one 25 x 16 U.S. ga. hanger strap on 2400 mm centers.
151 to 450	One 25 x 14 U.S. ga. hanger ring supported from one 25 x 14 ga. hanger strap on 2400 mm centers.
451 to 900	One 25 x 12 U.S. ga. hanger ring supported from one 25 x 12 U.S. ga. hanger strap on 2400 mm centers
901 to 1200	One 38 x 12 U.S. ga. hanger ring supported from one 38 x 12 U.S. ga. Hanger strap on 2400 mm centers
1201 to 2100	Two 38 x 12 U.S. ga. hanger connected to the 32 x 32 x 3 mm angle girth reinforcing of duct, hangers on, 2400 mm centers

q. All vertical ducts shall be supported at each floor with angles, riveted to the ducts.

r. Construct low pressure rectangular duct as follows:

Low pressure ducts : Duct Velocities less than 0.944m³/s, and
Static Pressures in duct 5.97 kPa or less.

Dimension Longest Side (mm)	Sheet Metal all 4 sides (U.S. g.a.)	Reinforcing Between Joints (Angle)	Joints and Reinforcing at Joints	Height of Standing Leg (mm)
0 to300	24	None	Drive slip(sides only) Plain "S" Slip	25
301-450	24	None	as above	25
451-760	24	25 x 25 x 3 at 1500 centers	Hemmed "S" Slip Bar Slip3040 centers	25
761-1060	22	25 x 25 x 3 at 1500 centers	Alternate or reinforced 25x3 Bar Slip 3040 centers	25
1061-1370	22	38 x 38 x 3 at 1200 centers	Alternate or reinforced 38x3 Bar Slip2400 centers	38
1371-1520	20	38 x 38 x 3 at 1200 centers	Reinforced 38x3 Bar Slip 2400 centers	38
1521-2130	20	38 x 38 x 3 at 600 centers	Reinforced 38x3 Bar slip 1200 centers	38
2131-2430	18	38 x 38 x 3 at 600 centers angles	Companion 38x38x3 at 1200 centers	38
2431-3040	18	50 x 50 x 4 at 600 centers angles	Companion 50x50x4 at 1200 centers	50

s. Bracing spacing shown above shall be maximum spacing between two bracings or between bracing and joint. Locate bracings mid-way between joints.

t. Pre insulated Ductwork shall be installed, using supports, as described in DW144 & according to manufacturer's requirements. Maximum distance between supports shall not exceed:

i. 4000 mm for ducts with section not exceeding 1200 x 1000 mm
ii. 2000 mm for ducts with section exceeding 1200 x 1000 mm

u. Longitudinal joints shall be Pittsburgh lock seam at edge of duct and grooved seam on face of duct.

v. Construct medium pressure rectangular ducts as follows:

Max Duct Dimension (mm)	**Sheet Metal (U.S. ga.)**	**Transverse Join Connection and Bracing Dimensions (mm)**
Up to 300	24	25 standing seam, 16 welded flange, 1 pocket lock no bracing
301 to 450	24	25 standing seam, 22 welded flange, 1 pocket lock, bracing 25 x 25 x 16 U.S. ga. at 1200
451 to 600	22	38 standing seam, 35 welded flange, 28 pocket lock, bracing 25 x 25 x 3 at 1200
601 to 900	22	38 standing seam, 38 pocket lo'1k, bracing 25 x 25 x at 800
901 to 1200	22	50 standing seam or 50 flanged joint, bracing 12 x 3 at 760
1201 to 1500	20	38 standing seam or 38 flanged joint with tie rod in center, bracing and 50 x 50 x 3 at 600
1501 to 1800	20	50 standing seam or 38 flanged joint with tie rod in center, bracing 63 x 63 x 5 at 600
1801 to 2100	18	50 standing seam or 38 flanged joint with tie rod in center, bracing 63 x 63 x 5 at 600
2101 to 2400	18	50 standing seam or 38 langed joint with tie rod in center, bracing 38 x 38 x 3 at 600, with tie rod in center
Over 2400	18	50 standing seam or 50 langed joint with tie rod at 1200, bracing 50 x 50 x 3 at 600 with rod in center

w. Bracing spacing shown above shall be maximum spacing between two bracing or between bracing and joint. Bracings shall be located mid-way between joints.

x. Longitudinal joints shall be Pittsburgh lock seam at end of duct and grooved seam on face of duct.

y. The joints between the pre insulated ducts shall be using aluminum invisible flanges and slide-in-channel and to be connected by special cover corners, having a holding pin, which goes inside the flange and the insulation, to avoid any field connection and to give the system more strength.

z. All ductwork, exposed to view wilt be painted as per Section 09 90 00.

X ---------- END OF SECTION ---------- X

SECTION 23 33 13.13
VOLUME-CONTROL DAMPERS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the "Common Work Results for HVAC Works", Section 23 05 00.

2. PRODUCTS

a. Furnish and install all dampers of the specified capacities and sizes as shown on the drawings, complete in all respects.

b. All dampers shall be of rigid construction, free of vibration, balanced, and control air volume properly.

c. Quadrant volume control damper shall be multi-leaf, double skin, aerofoil section, opposed blade type, with a maximum blade length of 2200 mm and width of 200 mm.

d. Dampers shall be constructed of sheet metal, two gauges heavier than the duct gauge.

e. Double skin blades shall be made out of 22 gauge galvanized steel sheet with seamed edges.

f. Dampers frames shall be galvanized made out of steel sheet. The thickness shall be 18 G for max duct width of 900 mm & 16 G for duct sizes of width exceeding 900 mm.

g. Blade ends shall be gasketed to minimize air leakage.

h. They shall be operated by quadrant operators manufactured of brass or of cast metal construction, marked OPEN and SHUT. Single skin blades shall be fabricated from 18 gauge galvanized steel sheet.

i. Operators shall be provided with standoff mountings on thermally insulated ducts to provide clearance between the duct surface and operator, equal to the thickness of the insulation. Quadrant operator shall be heavy duty, capable of being locked at desired position conveniently.

j. The control linkage shall be outside the air stream. Clear airflow area equal to the duct size shall be maintained within the damper frame. Maximum clearance between the blades and the frame shall be limited to 3 mm. Indication of damper blade position shall be provided.

k. The dampers shall have sturdy corrosion resistant construction.

l. Dampers, after fabrication, shall be provided with a baked enamel finish.

m. All dampers shall be of approved quality to meet the Engineers satisfaction.

n. Non return dampers shall be manufactured similar to duct dampers but shall incorporate additionally, felt rubber or neoprene strips on long edges of blades to ensure positive shut-off and quiet closure. Dampers on fresh air inlets shall be similar edged to prevent ingress of dust and sand particles.

3. EXECUTION

a. Volumes control dampers shall be placed in ducts at every branch supply or return air duct connection whether or not indicated on the drawings for the proper volume control and balancing of the system.

b. Provide necessary blank off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.

c. Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.

d. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.

e. Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.

X ---------- END OF SECTION ---------- X

SECTION 23 33 13.16
FIRE DAMPERS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the "Common Work Results for HVAC Works", Section 23 05 00.

2. PRODUCTS

2.1 GENERAL

a. Furnish and install all dampers of the specified capacities and sizes as shown on the drawings, complete in all respects.

b. Provide fire dampers in all ducts over 125 sq.cm. In area, in the following locations and in accordance with fire & life safety drawings for fire walls location:
   i. Duct entering and leaving duct shafts
   ii. Ducts passing through designated fire walls
   iii. Ducts through floors, and not encased in fire shafts
   iv. Ducts leaving and entering plant area
   v. Ducts entering and leaving storage areas

c. All dampers shall be of rigid construction, free of vibration, balanced, and control air volume properly.

d. Access panels for dampers shall be provided and their accessibility shall be secured.

e. All dampers shall be of approved quality to meet the Engineers satisfaction.

2.2 CURTAIN TYPE FIRE DAMPERS

a. Construction: Curtain type, positive spring closure, with frame and blades out of air stream, galvanized steel channel frame, interlocking galvanized steel blades, factory-furnished steel sleeve, UL-listed 100˚C F fusible link, 2 hour fire protection rating, vertical or horizontal mounting, factory-furnished retaining angles, and mounting hardware. Fire dampers shall be not lighter than 1.6 mm.

b. Steel sleeves shall be equal to or thicker than the connecting ductwork, and at least the

manufacturer's minimum recommended thickness, but in no case shall it be less than 18 gauges.

c. The dampers shall be leakage rated class 1 according to UL 555S or equivalent standards and fire rated 2 hours resistance.

d. Fire dampers shall be provided with thermal release fusible links for release temperature of 72˚C.

e. Both the curtain and fusible link shall be accessible for servicing through air tight inspection doors placed up or down stream wherever possible.

f. Fire dampers with fusible links shall be fixed in ducts at all floor crossings, wall crossings of kitchen and crossings of fire rated walls, irrespective of it being shown on the drawings or not, without any additional cost.

g. All fire dampers shall be UL classified and labeled for assured closure.

h. Provide flexible metal jamb seals for lowest leakage.

2.3 SMOKE DAMPERS

a. Construction: UL classified and for operation in dynamic systems, labeled, multi-blade type, 150 mm wide, 1.3 mm stainless steel blades, 3 Vee type with three longitudinal grooves for reinforcement positive closure, stainless steel sleeve bearings, steel tie bar linkage, 12 mm O.D. operating shaft, UL-listed electric leakage rated, smoke damper operator.

b. Blades shall be completely symmetrical relative to their axle pivot point, presenting identical resistance to airflow and operation in either direction through the damper (blades that are non-symmetrical relative to their axle pivot point or utilize blade stops larger than 12 mm. are unacceptable).

c. Damper frames shall be stainless steel formed into a structural hat channel shape with reinforced corners. Bearings shall be stainless steel type rotating in extruded holes in the damper frame.

d. Jamb seals shall be stainless steel compression type.

e. Provide flexible metal jamb seals for lowest leakage.

f. UL555S classified and labeled for all sizes indicated as a Class I Leakage Rated Smoke Damper and a temperature rating of 180˚C.

g. Dampers shall have a UL555S operational airflow rating equal to or greater than the airflow at its installed location and an operational pressure rating of 0.1 kPa.

h. Damper actuators shall be factory mounted and qualified for use with the damper in accordance with UL555S. Damper actuators shall be electric type for 24 volt operation. Manufacturer's submittal data shall indicate actuator space requirements around the damper.

i. All UL555S Dynamic Closure Ratings, Operational Ratings and Leakage Ratings shall be qualified for airflow and pressure in either direction through the damper. UL ratings shall allow for mounting damper vertically (with blades running horizontal) or horizontally.

j. The Damper Manufacturer's submittal data shall certify all air performance pressure drop data is licensed in accordance with the AMCA Certified Ratings Program for Test Figures 5.2, 5.3 and 5.5. Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D.

2.4 COMBINATION FIRE AND SMOKE DAMPERS

a. Construction: UL labeled as a fire damper and Class I smoke leakage rated multi-blade type, automatically resetting for smoke, 16 gauge galvanized steel channel frame, 150 mm wide steel blades, 150 mm on center, positive closure spring, stainless steel sleeve bearings, steel tie bar linkage, 12 mm O.D. operating shaft, fail-safe closed UL-listed fire and smoke damper operator with a 120 volt electric operator, UL-listed 212 degrees F fusible link, 1 1/2 hour fire protection rating, duct sleeves and mounting hardware.

b. Provide flexible metal jamb seals for lowest leakage.

2.5 SILENCERS

a. Silencers shall be installed when required to achieve the specified noise levels.

b. At shop drawing stage the contractor will undertake calculation for every unit and every area and determine the insertion loss required to meet the stated noise criterion. Supply and return duct noise must be considered as well as duct breakout noise.

c. Materials of construction shall be galvanized sheet metal and mineral fibre acoustic fill which is inorganic, inert, moisture and vermin resistant. Silencers shall be so constructed as to prevent erosion and pregnability of the acoustic fill.

d. Silencers shall have available certified test data concerning insertion loss. This must be available when required, in advance of ordering units. Where a silencer is made under license, or part assembled locally, then tests must also be made after assembly and

witnessed by the engineer.

e. Locally manufactured silencers shall be with an international certifying affiliated company which shall perform periodic testing & inspections on manufacturer's products.

f. The static pressure loss of any required silencer must be considered in air handling equipment original selection.

3. EXECUTION

3.1 INSTALLATION

a. Fire dampers, smoke dampers and combination fire/smoke dampers workmanship quality shall be as required by the manufacturer's instructions to conform to the installation used for the rating test, and in accordance to recommendations of UL and any other relevant standards and Local Regulations.

b. Fire dampers shall be installed for all fire zone penetrations.

c. Install fire dampers in registers where indicated.

d. Coordinate the selection of damper with the fire resistance rating of the structure being penetrated.

e. Install fire dampers, smoke dampers and combination fire/smoke dampers at locations indicated and where ducts penetrate fire rated and/or smoke rated walls, shafts and where they can be readily inspected, serviced, adjusted, and maintained.

f. Install transitions where required to match duct size to damper dimensions.

g. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges per UL and NFPA. Bolt, screw, or tack weld fire damper enclosure to sleeve.

h. Demonstrate re setting of fire dampers and operation of smoke dampers to the Resident Engineer.

i. Install access doors in ductwork at each fire/smoke damper. Locate access doors to provide access to smoke damper actuator, smoke detector, and fusible link. Provide multiple doors if required. Label locations of access door and ceilings per building code.

j. Coordinate installation of access panels.

k. After damper installation is complete, Contractor shall operate each damper through all positions to assure operation is smooth, free from binds, and complete.

l. Firestop all wall penetrations at all fire dampers per damper manufacturer's written instructions. Use only firestop materials that are compatible with damper construction and operation.

m. Maintain a current, legible copy of the damper manufacturer's installation instructions at the Project site for all fire dampers being used on the Project. Make installation instructions available on request for all inspecting authorities.

n. Smoke detectors shall be provided by the Electrical Contractor.

o. The HVAC Contractor shall extend 24 volt power wiring through auxiliary contacts provided with each smoke detector, and wire smoke dampers to close upon the detection of smoke. The HVAC Contractor shall provide the 24 volt power supply.

3.2 INSPECTION

At final acceptance inspection, approximately 10% of all fire dampers, as randomly selected by the Owner or Engineer, must be demonstrated by the Contractor to be accessible, in proper position, and in operational order. Failure of any one of the demonstrated dampers shall require the Contractor to check and demonstrate operation and accessibility to all dampers, and take corrective measures at no cost.

3.3 CERTIFICATION

Certify in writing that all dampers were checked by operation at installation and that all are in proper position and functional order.

X ---------- END OF SECTION ---------- X

SECTION 23 33 43

FLEXIBLE DUCT CONNECTORS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the "Common Work Results for HVAC Works", Section 23 05 00.

1.2 RELATED WORK

Refer Section 23 31 00 for related works.

1.3 SUMMARY

a. Flame proof flexible shall be fitted on all intake and discharge connections of fans and air conditioning units for preventing the transmission of vibration through the ducts to occupied spaces.

b. Flexible connections shall also be provided where ductwork passes across building expansion joints.

2. PRODUCTS

a. Flexible duct connections shall be Class 1, factory fabricated from chemically impregnated fire retardant canvas.

b. Flexible duct connections shall be suitable for 120°C and 1.5 kPa and shall be Underwriters Laboratories listed.

c. Flexible duct connections shall be insulated with 25mm insulation complete with vapor barrier.

d. The material shall have a penetration time of at least fifteen minutes when tested in accordance with BS 476 and shall remain flexible and without strain or distortion.

e. Flexible connections shall be 150 mm minimum and 250 mm maximum in width.

f. Burning characteristics shall conform to NFPA 90a.

g. Connection material shall be reviewed by the Engineer before installation.

3. EXECUTION

a. Where duct connections are made to fans, air terminal units, and air handling units, install a noncombustible flexible connection of 822 g neoprene coated fiberglass fabric approximately 150 mm wide.

b. Connections shall fit closely and be secured in airtight fashion to connections to ductwork, fans and apparatus.

c. For connections exposed to sun and weather provide CSM coating in lieu of neoprene.

d. Securely fasten flexible connections to round ducts with stainless steel or zinc coated iron draw bands with worm gear fastener.

e. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center.

f. Fabric shall not be stressed other than by air pressure.

g. Allow at least 25 mm (one inch) slack to insure that no vibration is transmitted.

X ---------- END OF SECTION ---------- X

SECTION 23 33 46

FLEXIBLE DUCTS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the "Common Work Results for HVAC Works", Section 23 05 00.

1.2 RELATED WORK

Refer Sections "23 31 00", "23 07 21", and "23 33 43" for related works.

2. PRODUCTS

a. Flexible ductwork shall be manufactured with a core of double ply polyester laminated with carbon steel wire helix, surrounded by 25 mm thickness of 24 kg/m3 density fiber glass, all wrapped in a reinforced aluminum outer jacket. The overall K-factor shall be less than 0.23 Btu/hr. deg. Ft. Ductwork shall meet the standards of NFPA 90A, and be UL listed or to meet BS 476 and BS 413.

b. Exterior jacket shall be metalized polyester vapor barrier with 2 ply black polyester core with aluminum foil exterior finish.

c. Flexible ducts installed in an externally insulated duct system shall be factory insulated with glass fiber insulation not less than 25 mm thick and a density not less than 24 kg/m3, and covered with an acceptable vapor seal.

d. Flexible ducts installed in internally (acoustic) insulated duct system, shall be factory insulated with glass fiber insulation not less than 20 mm thick and a density not less than 24 kg/m3, faced on air side with PVC coated glass cloth having an open area not more than 25%, and on room side with material specified above.

e. Flexible Ducts shall be used as shown on drawings.

f. The flexible duct shall have a flame spread not exceeding 25 and smoke development not exceeding 50 per UL 723 test method.

g. The flexible duct shall have an air leakage not exceeding 0.00151l/s at 11.94kPa static pressure

h. The duct shall be rated for a maximum air velocity of 12.5 m/s.

i. Flexible insulated ducts shall be UL 181 listed.

j. Flexible duct connections and shall be by an approved manufacturer and as per Specification 23 33 43.

3. EXECUTION

a. Flexible duct installation shall be in accordance with manufacture's instruction. Joints between factory insulated flexible ducts and field insulated ductwork shall be sealed and taped under this section.

b. Flexible Ducts shall not pass through floors or fire walls and shall not exceed 1.5 m in length.

c. Flexible ducts shall not be installed in inaccessible locations, such as above gypsum board ceilings without prior approval from the consultant.

d. Flexible ducts shall be supported at their mid sections if length exceeds 500 mm

e. Bends in flexible ducts shall have center line radius of not less than 10 x diameter.

f. Collars to which flexible ducts are attached shall be a minimum of 50 mm in depth.

g. Insulation and vapour barriers on factory-fabricated ducts shall be fitted over cone connection and supplementally secured with a drawband barrier factory applied insulation equal 40 mm thick flat insulation.

X ---------- END OF SECTION ---------- X

SECTION 23 34 00
HVAC FANS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the “Common Work Results for HVAC Works”, Section 23 05 00.

2. PRODUCTS

2.1 GENERAL

a. Each fan shall be statically and dynamically balanced at the factory and shall operate quietly and without pulsation.

b. Published performance fan ratings shall be provided to the Engineer for approval in accordance with the procedures as set forth by the AMCA test code for air moving and fans shall be rated as per AMCA Standard 210 –74 or ASHRAE 51-75 or equivalent.

c. The manufacturer's certified sound power ratings with an octave band analysis and the basis on which they have been established shall be submitted Consultant for approval as part of the fan shop drawings, and one set of these curves shall be given to the supplier of sound and vibration isolation equipment.

d. For belt-driven fans, fan and motor shall have one-piece base with adjustable motor mount. Each fan shall be provided with fan sheave, motor sheave, matched V-belts and belt guard. Where motor is 10 hp (7.5 kW) or less, motor sheave shall be variable pitch. Where motor exceeds 10 hp (7.5 kW), motor sheave shall be fixed pitch, to be replaced with a correctly sized pitch sheave after air balancing. Drivers shall be designed for 150% of motor nameplate rating.

e. Fans of capacity 100 l/s and larger shall not have permanently lubricated bearings. Bearings on shafts 24mm and larger shall be split pillow block, self-aligning ball roller bearings with seals less grease nipple. In addition, bearings on shafts, 37mm and larger shall have grease nipple and grease relief valve. Bearings on shafts smaller than 24mm shall be pillow block, self-aligning ball bearings with seals and with grease nipple. Flanged bearings may only be provided for shafts 24mm and smaller. They shall be heavy duty; four bolt, self-aligning with seals and with grease nipple. It is preferred that all bearings be accessible for lubrication and service. Where it is difficult to provide such access, extended lubrication lines shall be

provided. When such lines extend to split pillow block bearings, a grease relief valve shall be provided. Bearings shall have a minimum average life of 100,000 hours.

f. All fans, without ducts or dampers on inlet or outlet, including fans in plenums, shall have protective screens on openings. Fans used for exhaust shall be provided with self – closing louvers and rain protection hoods (if required), where motorized dampers are specified or shown drawings, these shall be provided.

g. All Fans shall be mounted on rubber-in-shear vibration isolators with the fan housing, so that no vibration is transmitted to building or structure. Vibration isolation shall be as specified under Article entitled 'Vibration and Noise Control. Fan Motors for outdoor application or if located in air stream shall be totally enclosed fan cooled type.

h. Fan installed in corrosive environment shall be treated both internally and externally with two coats of epoxy paint and shall be of aluminum construction. Motors shall be TEFC type.

2.2 IN-LINE CENTRIFUGAL FANS

a. Furnish, install and connect up complete, all supply, return, exhaust, transfer and exhaust fans. All fans shall be of the non-overloading centrifugal type.

b. Fans shall have direction of rotation, discharge direction indicated on the casing. Fan arrangement shall be selected to suit the space conditions.

c. Fan housing shall be rigidly built and braced. Where fan scroll is 480 mm or more in width, provide access door with frame and gasket. All access doors shall be so fabricated that the inner surface is flush with the inside of the scroll. Raised frame doors of the pan type shall be provided on all fans where insulation is required. The doors shall be secured to the frame by hand grip latches and shall be provided with lift handles. Bolted doors are not acceptable,

d. Fans shall not produce excessive noise as compared to units of like size and power when used in conjunction with the specified vibration isolation. Fan manufacturers shall furnish for approval for each fan, certified sound power ratings with an octave band analysis and also the volume horsepower pressure characteristic curves from shut off to free delivery. Wheels shall have ample strength and shall be statically and dynamically balanced to avoid vibration and shall have blades designed to ensure quiet efficient operation.

e. Fans, unless otherwise indicated, shall be belted to respective motors by "V" belt drives. Sheaves shall be cast steel. Drives requiring 2 grooves or more shall have variable pitch motor sheaves and companion type fan sheaves. Belts shall have a rated capacity of not less than 150% of the motor horsepower. All "V" belt drives for integral horsepower motors shall have not less than two belts and shall have sufficient belt capacity to drive fans with one belt broken. Sheave ratio shall be selected so that top fan speed is not less than 105% and

not more than 110% of rated speed. Drives for fractional horsepower motors may have one belt rated at 200% of motor horsepower. If to balance an air system, a fan other than the one provided should be required, necessary changes shall be made in the "V" belt drive by the Contractor at his expense. Supply and install belt guards of perforated metal, or as approved, for all sheaves and belts. Belt guards shall be grommetted at fan and motor shafts for ease in taking tachometer readings.

f. Each fan motor shall be sized to drive its respective fan when fan is operating at a speed (due to pulley adjustment) of 10% in excess of that required to meet fan performance, and when the fan requires the maximum power at this speed.

g. All fans shall carry the AMCA, or similar approved Certification Association performance and construction seal.

h. All fans shall be factory coated with one coat of primer and one coat of machine enamel. The interior of all fans and all wheels shall be painted as per manufacturer's standard.

i. All fans discharging directly up through the roof shall be equipped with a 38 mm casing drain which shall be piped to the nearest floor drain.

j. All fans scheduled to be arranged as belted vent sets shall have overhung wheels and motors mounted on a common base with the bearings. All such belted vent sets shall be furnished with weatherproof motor housings where located outdoors.

k. All double width, double inlet fans shall be provided with galvanized steel inlet guard screens.

2.3 AXIAL FANS

a. Axial flow fans shall be capable of giving the design flow when tested to B.S. 848.

b. Each fan shall be supplied with a suitably rated contactor/ starter/ isolator of approved pattern.

c. Fan casings shall be constructed of mild steel plates with angle stiffeners, with the casing hot dip galvanized after manufacture. The inlets and outlets of the axial flow fans shall be flanged for connection to the system. A drain plug shall be fitted and the casing designed to permit removal of the impeller.

d. An access door is to be provided on the casings of all fans. Casings shall cover both impeller and motor so that fans can be removed without disturbing adjacent ductwork or other components of the system. A flameproof external terminal box shall be fitted on the casing.

e. All lubrication points are to be extended to the outside of the casing and in a position that will permit access in relation to the adjacent plant, services or building structure.

f. Impellers shall be die cast in Aluminum alloy and X rayed during manufacture. The impellers shall be capable of running continuously at 20% in excess of the rated speed. The impeller shall be keyed and locked onto the shaft, which shall be statically and dynamically balanced and tested at over speed before dispatch from the Manufacturer's works.

g. Flexible connections shall be supplied and installed at both inlet and outlet of each fan.

h. The fan bearings shall be of the sleeve type wherever possible. The bearings are to be truly aligned and rigidly mounted on to the casing.

i. Graphs of the performance curve of each fan are to be forwarded to the Consultant together with a test report on the sound level at three diameters in a free field condition prior to the order being confirmed.

j. Blade angle shall be adjustable over at least a 30-degree range, with markings at the root to indicate the blade angle.

k. Axial flow fans are to be driven by electric motors of commercially silent pattern carrying a Makers guarantee in this respect. The motors shall be totally enclosed, fan cooled.

l. All motors are to be positioned to permit effective ventilation of the motor and all component parts of the fan and motor are to be suitable to withstand the temperature conditions expected in the fan.

m. Electrical connections to the motors shall be in a totally enclosed terminal box secured to the exterior of the casing. Wiring within the axial flow fans shall be suitable for the conditions within the casings

n. A suitable steel support is to be provided for each fan, and the frame is to be fabricated from rolled steel channel with adequate cross members for bolting the fan into position. The frame shall be of welded construction with anti-vibration mountings.

o. The anti-vibration mountings are to be rubber in shear pattern and of a type that are bolted to both the fan and the support

2.4 SMOKE EXTRACT FANS

a. Smoke extract fans shall comply with the requirements BS EN 12101-3.

b. Fans and ancillaries shall be constructed to withstand the rated temperatures for the

required duration as indicated and shall be suitably accredited to BS EN 12101-3. Motors and drives shall be similarly constructed or protected and ventilated to ensure that they are not subjected to fire conditions.

c. Units shall be suitable for normal operation in ambient conditions up to 50°C and high temperature conditions up to 400°C for 2 hours.

d. Impeller with High efficiency air foil blades, variable pitch angle in still position, in cast aluminum. Balancing according to UNI ISO 1940 norm.

e. Axial flow fans shall be of the long casing pattern with a heavy gauge, steel sheet casing flanged and drilled at each end. Casings shall be epoxy Coated and fully air tight.

f. Motors shall be pre-wired with high temperature rated cable to an external terminal box through high temperature flexible conduits. All components shall be rated for the operating conditions.

g. Fans shall incorporate inlet and outlet flanges with pre-drilled bolt holes, and an external terminal box to IP55. The motor shall be foot mounted and protected to IP55 (shall be either 4, 6 or 8 poles), class H insulated and shall have sealed for life bearings.

h. Axial fan motors shall have non-overloading characteristics within the normal working range.

i. Fans shall be suitable for either vertical or horizontal mounting. They shall be mounted on purpose made supports incorporating anti-vibration mountings and mounting feet.

j. Air-tight inspection doors shall be provided giving access to fan impeller and motor and other components requiring regular servicing or maintenance.

k. Rotors shall be statically and dynamically balanced.

l. Motors in the air stream shall be totally enclosed air over or totally enclosed fan cooled squirrel cage induction

m. Control Panel for the Smoke Extract Fans shall be interfaced with the Fire Alarm Panel.

2.5 SINGLE FAN EXTRACT UNITS

a. Unit casing shall be manufactured in epoxy coated aluminum alloy and shall house fan assemblies, each comprising double inlet forward curved centrifugal impellers running in an individual scroll. Impellers may be either direct driven or belt driven depending upon the fan duty. Motors shall be manufactured to BS 5000, TEFV type with sealed for life bearings.

Motor insulation shall be Class 'F'.

b. Fans shall be fitted with air flow sensors and shall discharge into a common plenum chamber through a linked shutter system. Motors and flow sensors shall be prewired to fitted isolator accessible from outside.

c. Units shall be supplied for either roof mounting or plant room use as indicated on the drawings. Units shall be supplied with auto changeover panels with duty / stand by selector switch, run/fail indication lamps, cyclic relay for duty sharing. Starter / Auto changeover panels shall be incorporated within electrical power supply panels as indicated on electrical schematic drawings.

2.6 IN-LINE FAN EXTRACT UNITS

a. Unit casing shall be manufactured in epoxy coated aluminum alloy and shall house twin fan assemblies, each comprising double inlet forward curved centrifugal impellers running in an individual scroll. Impellers may be either direct driven or belt driven depending upon the fan duty. Motors shall be manufactured to BS 5000, TEFV type with sealed for life bearings. Motor insulation shall be Class 'F'.

2.7 STAIRWELL PRESSURIZATION FANS

a. Blowers shall be efficient, forward curved axial fan designed in strong, die formed steel housings.

b. Housing shall be of epoxy coated, reinforced, galvanized steel.

c. Fan motor shall be totally enclosed squirrel cage. Motor carcass shall be constructed of aluminum alloy of cast iron dependent upon the temperature of operation. The grade of motor insulation shall be suitably selected to meet the requirements of high temperature smoke venting. Motors shall have as safety margin of an average of twice the expected survival times. Motors shall be two speed when scheduled.

d. Motor bearings and greases shall be selected to provide long life at normal ambient temperature and still survive the emergency condition during this life time.

e. Motors shall be totally enclosed with class 'F' insulation.

3. EXECUTION

a. Install fans such that access doors can be opened and proper maintenance can be carried out.

b. For vibration isolation, refer to Division 1, Section (Vibration, Noise and Seismic Control).

c. Install all kitchen exhaust fans to NFPA 96 requirements and as per manufacturer's recommendation

d. Contractor shall supply and install fans based on actual calculated external and static pressure requirements dully approved by Engineer

e. Manufacturers authorized representative to certify that fans are installed as per manufacturer's recommendation and assist during testing, balancing and commissioning.

X ---------- END OF SECTION ---------- X

SECTION 23 34 33
AIR CURTAINS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the “Common Work Results for HVAC Works”, Section 23 05 00.

1.2 SUMMARY

Air curtains shall be ambient type units suitable to operate at 50°C, 100% RH ambient conditions and designed for concealed fixing with only the discharge grille on view. The units shall be suitable for a recommended mounting height of 4.0 meters. Air curtain shall be industrial type with GI blades.

2. PRODUCTS

2.1 Fans

Fans shall be double inlet, double width, directly driven centrifugal type, producing an outlet velocity of 7.5 m/s in a "Standard" unit and 11.0 m/s in a 'Super' unit.

2.2 Motors

Motors shall be 220 volts, single phase, 50 Hz, dual speed (900 and 1400 rpm). They shall be resiliently mounted into fan casings with 'Sealed-forlife' bearings with power factor correction capacitor to maintain 0.95 p.f. lagging and be manufactured to the latest European Standards.

2.3 Unit Construction

The body of the unit shall be robustly made from zinc plated mild steel. The finish color to be specified by the Architect during construction. The unit is to be factory painted.

2.4 Discharge Grille

The discharge grille shall be a linear adjustable blade type. It shall be constructed from stainless steel 320, No.8 finish with adjustable depth suitable for mounting with or without a false ceiling.

3. EXECUTION

a. Install Air Curtains as per the details provided in the drawing and manufacturer's recommendations.

b. Provide all necessary power and control connections as per manufacturer's recommendation.

X ---------- END OF SECTION ---------- X

SECTION 23 37 13

DIFFUSERS, REGISTERS AND GRILLES

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the "Common Work Results for HVAC Works", Section 23 05 00.

1.2 SUBMITTALS

a. Product data sheet for each type of air outlet and inlet and accessory indicating construction, finish 2nd mounting details.

b. Performance data including airflow throw and drop static pressure drop and noise ratings for each type of outlet and inlet.

c. Assembly drawing and submittal showing compliance to design performance indicating material 2nd method of assembly of components.

d. Schedule of diffuses, registers and grilles indicating drawing designation, room location, quantity, model number, size and accessories furnished.

1.3 QUALITY ASSURANCE

a. **NFPA COMPLIANCE:** Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilation System".

b. Sound pressure levels shall be determined by using AHRI Standard 885-2008 "Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Outlets".

c. **TESTING:** Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets".

2. PRODUCTS

2.1 GENERAL

a. Refer to details and drawing for diffuser sizes and types.

b. All grilles, diffusers and registers shall be tested to the requirements of ASHRAE 70, AMCA and ADC and AR1. Products that have not been independently tested to any of these standards will not be accepted for use on this project.

c. All volume and air pattern devices shall be fully adjustable from the face of the diffuser, register or grille. Diffusers connected to VAV systems shall be the non-dumping type.

d. Noise generated by diffusers at peak volume shall be such that room noise level at occupant level does not exceed noise criterion specified in Section 134800 (Vibration, Noise and Seismic Controls)

e. Select all diffusers to provide uniform air coverage without overlap. Air velocity up to a height of 1.8m above the floor shall be 0.13 - 0.25 m/s.

f. All Grilles and diffusers should be made of extruded Aluminum with powder coating finish and color shall be conforming by the Architect.

g. Size of all round flexible or rigid duct connections to diffusers shall be the same size as diffuser inlet diameter. The Engineer shall approve color and all finishes shall be in baked enamel unless noted otherwise.

h. Where door louvers are shown on drawings these shall be vision proof, V Shapes louvers of 20 gauge steel, 25mm deep 12.5 mm centers. The 20 gauge steel frame shall be provided with an auxiliary frame to give a finished appropriate on both sides of door with factory prime coat finish or equal

i. For Jet Flow Nozzles actual pressure drop calculation and noise generation in terms of NC / dB should be provided.

j. Diffusers, registers and grilles shall be arranged for flush mounting in lay in type ceilings and overlap mounting in plaster, mineral tile and similar ceilings, with concealed fixings unless otherwise directed.

k. Grilles, register and diffuser locations shall be adjusted to suit reflected ceiling drawings, or Consultant's site instructions. All grilles, registers, diffusers, louvers shall be from one manufacturer.

l. Provide plaster frame for grilles, and diffusers installed in plaster ceilings.

m. All diffusers, grilles and registers shall be supplied completely factory powder coated. Finish color shall be to the approval of the Architect / ID. The interior of all grilles and diffusers is to be factory painted matt black.

n. All supply grilles and diffusers shall have black colored opposed blade balancing dampers. All will have foam rubber sealing band around the edge to seal to the structure. All pivots will be round section, not of formed sheet, and not relying on a spring steel locking wire.

o. Unless otherwise specified basic grilles and diffuser materials shall be Aluminum extruded sections. Sections in the airstream shall be carefully selected to minimize turbulence.

p. All grilles and diffusers supplied on this project shall be tested and rated in accordance with ASHRAE Standard 70 72, ADC Test Code 1062 GRD and ISO 3741.

q. 12.5mm centers pressed into a notched steel retaining bar. The core can be either welded into the cuter frame, or, where the grille is used in a sill application, held in the outer frame by spring clips fixed to the core retaining bar.

r. The outer frame shall be 35mm deep and shall have a visible flange 25.4 mm wide. Mitered end caps shall be welded to give a near invisible joint.

s. The grill shall be complete with an opposed blade damper painted matt black, and shall be fixed with universal mounting brackets. Both the damper and the fixing brackets shall be accessible through the face of the grille.

t. Continuous grilles shall be provided with positive alignment strips, which fit into special keyways extruded into the frame of the grille to ensure clean unbroken lines.

2.2 CEILING DIFFUSERS

a. Ceiling Diffusers shall be multicore giving 4 way horizontal discharge.

b. The three center cones of the diffuser shall be manufactured from pressed aluminum, with the remaining cones and the outer frame fabricated from extruded aluminum welded at the corners to give near invisible joints.

c. One, two, and three way pattern cores shall be used as indicated on schedules. All cores shall be interchangeable.

d. The core shall be removable without the use of special tools, but for safety, shall be fixed to the outer frame by a small length of chain.

e. The diffuser shall be complete with an opposed blade damper painted matt black.

2.3 WALL REGISTERS / GRILLES

a. Wall registers shall be double deflection fabricated from aluminum, the front vanes being

horizontal, the rear vanes vertical. This grille shall be complete with an opposed blade damper painted matt black and adjustable from the face of the diffuser.

b. Both sets of vanes shall be fully adjustable without the use of special tools.

2.4 EGG-CRATE GRILLES

a. Egg-crate return or extract grille shall be provided with a steel lattice core of 12.7mm x 12.7mm openings, giving a free area of 90%.

b. The core shall be fixed into an extruded aluminum frame, with welded corners and a 25mm face flange.

c. The grille is complete with an opposed blade damper painted matt black and adjustable through the face of the diffuser.

2.5 LINEAR SLOT DIFFUSERS

a. Linear Slot diffusers shall provide an unobtrusive continuous air diffusion with a pleasing aesthetic appearance. Hairline butt joints shall ensure clean unbroken linear runs for active and dummy sections.

b. The diffusers shall be complete with pattern control blades, fully adjustable from face of diffuser through 180 degrees and shall be fitted with end caps at each end.

c. The diffusers shall be with hit and miss sheets or OBD to adjust air flow.

d. The diffuser members shall be constructed from high quality aluminum extrusions to BS 1474 while the pattern control blades shall be of black rigid PVC.

2.6 EXHAUST VANES

Exhaust valves shall be manufactured from highly quality sheet steel spinning's protected by a stove enameled or powder coated paint finish. Flanges shall be fitted with sealing gaskets.

2.7 PLENUMS

Provide square uniform height plenum for ducted return and exhaust application of scheduled neck size.

2.8 EXTRACT AIR LOUVRES

a. Louvers shall be extruded Aluminum frame with Aluminum blades of not less than 2 mm

thickness, and shall be firmly fixed so as not to vibrate. Unsupported blade width shall not exceed 1800 mm

b. Behind each louver shall be an insect mesh screen 76 x 6 mm made from 2 mm diameter wire. The screen will be clamped by a 20 mm frame and will be firmly fixed to the outer edges of the louver. The screen and frame shall be hot dip galvanized after fabrication.

c. The connection to the louver shall be flexible and shall ensure no duct load is transmitted to the louver.

d. Louvers shall be provided with powder coated finish to the approval of the Architect.

2.9 SAND TRAP LOUVRE FOR AIR INTAKE

a. Sand trap louvers shall have a double deflection inlet passage to separate sand from incoming air by means of centrifugal forces.

b. Separation efficiency particle size 350-700 shall not be less than 90% at a face velocity of 1m/Sec and not less than 70% at a face velocity of 2m/sec.

c. Sand trap louver shall be of aluminum construction, self-cleaning and maintenance free. The base of the louver shall have self-emptying sand holes.

d. Pressure drop at 2 M/Sec average face velocity shall not exceed 120 Pascals.

e. Insect mesh shall be included.

f. Sand louvers shall be provided with powder coated finish to the approval of the Architect.

g. Sizing of sand louvers shall consider minimum 85% efficiency.

2.10 ACOUSTIC LOUVERS

Fixed Aluminum acoustic wall louver. Extruded aluminum construction frame with channel profile and mechanically fastened, with continuous recessed caulking channel each side; tested to ASTM E90-09. Acoustical blades shall be solid on exterior and perforated material on interior for noise absorption. Blades shall have acoustical insulation fill. Absorption material should be fire resistant and in accordance with DIN 4102 Class A2. Insertion losses should comply with ISO 7235:2003 and Air borne sound insulation should be of the minimum following values and should comply with ISO 140-3:1995

Octave Band Frequency (Hz)	63	125	250	500	1K	2K	4K	8K
	10	8	10	14	21	22	16	14

3. EXECUTION

3.1 EXAMINATION

Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

a. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, coordination drawings, original design, and referenced standards.

b. Install diffusers, registers, and grilles with airtight connection to ducts.

3.3 ADJUSTING

a. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

b. Adjustable outlet diffuser: adjust pattern for draft-free air distribution.

3.4 CLEANING

After installation of diffusers, registers, and grilles, inspect exposed finish, Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

X ---------- END OF SECTION ---------- X

SECTION 23 81 26

DX SPLIT SYSTEM AIR CONDITIONERS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works.
b. Conform to the "Common Work Results for HVAC Works", Section 23 05 00.

1.2 SUMMARY

a. Electrically operated, Refrigerant-HFC 410A split units cooling type air conditioner with remote air cooled condensing unit of minimum capacity as specified in Schedule of Equipment.

b. The condensing unit to be complete with compressors, air cooled condensers, condenser fans, fan motor, controls, casing and safety devices and all other accessories to complete the unit.

c. The fan coil unit to be suitable for installation within the space and as indicated on the drawings.

2. PRODUCTS

2.1 INDOOR UNIT

a. Type of indoor unit shall be as per the drawing and schedule.

b. The casing shall be constructed of galvanized steel.

c. The decorative units shall be provided with decorative plastic side panels and return grille/filters on the front of the unit.

d. Drain pan shall be double walled insulated, epoxy resin coated rolled steel plate insulated with fire retardant foam coating with removable drain pan extended beyond coil to serve connections.

e. Fans shall be forward curved centrifugal direct driven type double width double inlet type. Bearings shall be permanently lubricated sealed ball bearings.

f. Motors shall operate on 220 volt 50 Hz power and shall be suitable for multi- speed control from manual selector and shall be tapped wound permanent split capacitor type with UL listed thermal overload protection.

g. Maximum sound power level shall not exceed 56 dB at 250 cps.

h. The direct expansion cooling coil shall be fabricated of copper tubes with mechanically bonded aluminum fins, and tested to 31 bar pressure and suitable for working pressures up to 24.1 bar.

2.2 CONDENSING UNIT

a. The air cooled condenser shall have ample surface area to meet the specified capacity requirements, weather proof construction with galvanized steel casing, copper tubes with mechanically bonded aluminum fins, working pressure 24.1 bar, propeller or axial flow type galvanized fans with vertical upward or side air discharge, totally enclosed fan motors with automatic direct on line magnetic starters.

b. The condenser should preferably have liquid sub cooling arrangement.

c. The compressors shall be hermetically sealed reciprocating or Rotary type complete with suction and discharge valves with connections for pressure gauges, suction gas cooled motor having internal thermal over load protection in each phase winding, internally spring mounted to provide quiet free floating operation forced feed lubrication system with built-in anti-sludging device.

d. The unit shall be complete with operating charges of refrigerant and oil and all interconnecting piping controls and accessories.

2.3 CONTROLS

a. Provide thermostat and three speed on-off selector switch for each unit suitable for remote wall mounting.

b. The tenderer shall supply the following information:
   i. Capacity of unit
   ii. Motor BHP
   iii. CFM capacity and static pressure of DX evaporator
   iv. Manufacturer's performance guarantee certificate
   v. Over all dimensions

3. EXECUTION

3.1 INSTALLATION

a. Installation work shall include all rigging, setting, aligning and grouting necessary to prepare equipment and its integral parts for normal continuous operation.

b. All installation work shall be done according to best practice and recommendations of equipment manufacturer.

3.2 COMMISSIONING

a. The unit shall be commissioned and tested complete in all respect as per manufacturer's recommendations.

b. The contractor shall be required to submit a commissioning & testing report on forms to be supplied later on by the Consultant and obtain approval.

X ---------- END OF SECTION ---------- X

TECHNICAL SPECIFICATIONS
(PLUMBING & SANITARY WORKS)

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING SERVICES

1. GENERAL

1.1 REFERENCE

Conform to the General Requirements and Conditions for MEP Works, Section 01 00 00.

1.2 SUMMARY

This Section includes the following:

a. General Plumbing Requirements specifically applicable to all Division 22 Sections.
b. Some piping material and installation instructions common to most piping systems.
c. Grout.
d. Plumbing Demolition (when indicated on the drawings).
e. Equipment installation requirements common to equipment sections.
f. Concrete bases.
g. Supports and anchorages.

1.3 DEFINITIONS

a. **Finished Spaces:** Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

b. **Exposed, Interior Installations:** Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

c. **Exposed, Exterior Installations:** Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

d. **Concealed, Interior Installations:** Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

e. **Concealed, Exterior Installations:** Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

f. The following are industry abbreviations for rubber materials:
   i. **EPDM :** Ethylene-Propylene-Diene Monomer Rubber
   ii. **NBR :** Acrylonitrile-Butadiene Rubber

1.4 APPLICABLE CODES AND STANDARDS

The editions recognized by latest the following are hereby included in and made a part of this section:

IPC	International Plumbing Code
NFPA	National Fire Protection Association
UL	Underwriters' Laboratories, Inc.
NEMA	National Electrical Manufacturer's Association
NEC	National Electric Code
ASME	American Society of Mechanical Engineers
AWS	American Welding Society
ANSI	American National Standards Institute
OSHA	Occupational Safety and Health Act

1.5 QUALITY ASSURANCE

a. Electrical Characteristics for Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

b. All work to meet in-force local plumbing code. In the case of discrepancies between the project contract documents and the in-force local code, the most stringent shall govern.

c. Plumbing staff shall walk through and inspect all plumbing work prior to walls or ceilings being closed up, deficiencies shall be noted and given to the project manager in writing.

1.6 DELIVERY, STORAGE, AND HANDLING

a. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

b. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

a. Contractor shall coordinate the work of the different trades so that interference between piping, equipment, structural, and electrical work will be avoided. All necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work properly shall be furnished complete in place at no additional cost.

b. Unless otherwise stipulated under a particular heading, the following rules relative to responsibilities of the Contractors and Subcontractors will apply:
   i. Make-up water piping connections shall be provided by the Plumbing Contractor to within five (5) feet of the required point of connection to the equipment and there terminated with a shut-off valve. Each trade shall make the final connection to the equipment it installs.
   ii. Ceiling access panels will be installed by the General Contractor at locations determined by the Plumbing Contractor.
   iii. The Plumbing Contractor or subcontractor shall install all roughing-in pertaining to his trade for each item of equipment furnished under another Section of the Specifications or by the Owner.
   iv. The Plumbing Contractor shall make final connections of equipment to rough-ins.

1.8 EQUIPMENT START-UP

a. Start-up of all plumbing equipment shall be video-recorded by the plumbing contractor. Two DVD copies shall be turned over to the Owner's maintenance staff.

1.9 TESTING AND REPAIR

a. All piping and ductwork systems shall be thoroughly cleaned and flushed prior to final testing.

b. Pressure testing shall be completed for the following piping systems:
   i. Domestic water, sanitary and vent, storm and gas piping systems, and other systems as noted on the plans.

c. All testing must be witnessed and accurately recorded noting methods of testing, times, dates, and results.

d. Any damage as a result of tests shall be repaired or damaged materials replaced at no cost to the Owner.

1.10 FINAL COMPLETION

a. All work shall be cleaned prior to issuance of Substantial Completion.

b. Retouch or repaint factory painted prime and finish coats where scratched or damaged.

c. Deliver any equipment as required by this Specification to Owner and obtained signed receipts of delivery.

d. Clean equipment, restore damaged materials, and leave the Work in acceptable condition.

e. Remove all site tools, equipment, surplus materials and rubbish continuously at no additional cost to the Owner.

f. Contractor shall submit written certificates warranting each item of equipment.

2. PRODUCTS

2.1 EQUPMENT AND MATERIALS

a. All equipment and materials shall be furnished in strict accordance with the equipment named and according to Specification requirements. Each bid shall be based upon one of the materials or manufacturers specified.

b. Equipment and materials specified shall be considered to have prior approval, but submittal for approval is required. Furnish construction drawings to other Contractors when required to coordinate construction.

c. Where multiple manufacturers are named the drawings and specifications are based on the requirements and layouts for the equipment of the first named manufacturer. Any change required by the use of other named manufacturers such as revisions to foundations, bases, piping, controls, wiring, openings, and appurtenances shall be made by the Contractor at no additional cost to the Owner.

2.2 PIPE, TUBE, AND FITTINGS - GENERAL

a. Refer to individual Section of Piping for pipe, tube, and fitting materials and joining methods.

b. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 GROUT

a. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
   i. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   ii. Design Mix: 5000-psi, 28-day compressive strength.
   iii. Packaging: Premixed and factory packaged.

3. EXECUTION

3.1 PLUMBING DEMOLITION (WHEN INDICATED ON THE DRAWINGS)

a. Refer to applicable Sections covering cutting, patching and selective structure demolition for general demolition requirements and procedures. Follow the instructions of client and consultant before execution.

b. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

c. All unused waste, water and vent that is no longer in service shall be removed from ceilings, walls and floors. No dead piping will be allowed to stay. Underground piping shall also be removed. If piping cannot be removed underground it shall be capped at the main and the pipe shall be pumped and filled with a flow able fill.

d. A MOP will be required when filling abandoned sewers, old water mains or any plumbing piping that is buried in the ground.

e. Before abandoning any plumbing piping underground, the piping shall be inspected and mapped on an As-Built for record.

f. After completion of all work, all of the sewer systems involved with the project in their entirety, shall be thoroughly cleaned out to remove all grit, or other foreign

matter. This shall include the use of a camera and recording to a flash drive or DVD and a copy of the recording included with the close out documents.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

a. All materials and/or equipment shall be installed per manufacturer's recommendations and instructions.

b. When temporary water is required, an approved backflow device shall be used and testing reports from device shall be sent to the consultant for verification.

c. Install piping according to the following requirements and details mentioned in the Sections specifying piping systems.

d. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

e. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

f. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

g. Piping shall not project beyond walls or steel lines nor shall it hang below slabs more than is absolutely necessary. Particular attention shall be paid to the required clearances.

h. Offset piping where required to avoid interference with other work, to provide greater headroom or clearance, or to conceal pipe more readily. Offsets shall be properly drained or trapped where necessary.

i. Provide swing joints and expansion bends wherever required to allow the piping to expand without undue stress to connections or equipment.

j. Exposed piping around fixtures or in other conspicuous places shall not show tool marks at fittings.

k. Isolate pipe from the building construction to prevent transmission of vibration to the structure and to eliminate noise.

l. Install piping such that any equipment connected to piping may be removed by disconnecting two (2) flanges or unions and removing only one or two pipe sections. All equipment shall have bolted or screwed flanges or unions at pipe connections.

m. Install fittings for changes in direction and branch connections. T-drill system for mechanically formed tee connections and couplings, and Victaulic hole cut piping system are not allowed.

n. Do not route piping through transformer vaults or above transformers, panel boards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

o. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

p. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

q. Install piping to permit valve servicing.

r. Install piping at indicated slopes.

s. Install piping free of sags and bends.

t. Install piping to allow application of insulation.

u. Eccentric reducing couplings shall be provided in all cases where air or water pockets would otherwise occur due to a reduction in pipe size.

v. Cap and plug all openings in pipes during construction with suitable metal plugs or cap to keep out dirt and rubbish until equipment is connected.

w. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

x. Select system components with pressure rating equal to or greater than system operating pressure.

y. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Section for General Requirements for “Firestopping Materials”.

z. Provide proper access to materials and equipment that require inspection, repair, service, or maintenance. Minimum service access size for materials equipment / components above ceilings shall be 24" square.

3.3 PIPING JOINT CONSTRUCTION

a. Join pipe and fittings according to the following requirements and details mentioned in the Sections specifying piping systems.

b. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

c. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

d. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   i. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   ii. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.4 PIPING CONNECTIONS

Pipe sizes indicated shall be carried full size to equipment served. Any change of size to match equipment connection shall be made within one foot of the equipment. At temperature control valves with sizes smaller than connected lines, reduction shall be made immediately adjacent to valves.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

a. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

b. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

c. Install Plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

d. Install equipment to allow right of way for piping installed at required slope.

3.6 CONCRETE BASES

Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

a. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Install dowel rods to connect concrete base to concrete floor.

b. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

c. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

d. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

e. Install anchor bolts to elevations required for proper attachment to supported equipment.

f. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

g. In general, use 3000-psi, 28-day compressive-strength concrete and reinforcement.

Follow the instructions provided by the Civil Consultant.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

a. Refer to the Details provided in the Drawings and Specification Section of "Metal Fabrications" for structural steel.

b. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor Plumbing materials and equipment.

c. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

a. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

b. Clean surfaces that will come into contact with grout.

c. Provide forms as required for placement of grout.

d. Avoid air entrapment during placement of grout.

e. Place grout, completely filling equipment bases.

f. Place grout on concrete bases and provide smooth bearing surface for equipment.

g. Place grout around anchors.

h. Cure placed grout.

X ---------- END OF SECTION ---------- X

SECTION 22 05 16

PIPE EXPANSION, EXPANSION JOINTS GIDE ANCHORS

1. GENERAL

1.1 REFERENCE

Conform to the General Requirements and Conditions for MEP Works, Section 01 00 00.

2. PRODUCTS

2.1 MATERIALS

a. Expansion joints for 200 mm (8 in.) diameter pipe and larger shall be packless bellows type with equalizing rings, stainless steel bellows, limit stops, internal telescoping sleeves and carbon steel beveled welding ends.

b. Expansion joints for 150mm diameter and smaller shall be packless bellows type with stainless steel bellows, anti-torque device, limit stops, guides and threaded pipe ends, or Victaulic style 150 mover expansion couplings complete with style 07 rigid couplings with nitrile gaskets.

3. EXECUTION

a. Provide for the expansion and contraction of all pipes. Install expansion joints to have sufficient flexibility to prevent end thrust and movements caused by thermal expansion or contraction causing detrimental distortion or damage of connected equipment. Provide offsets between mains and equipment of sufficient length to safely absorb the expansion of the main. Provide guides as necessary.

b. Provide expansion joints for all pipes crossing building expansion joints.

X ---------- END OF SECTION ----------X

SECTION 22 05 19
PLUMBING INDICATION INSTRUMENTS

1. GENERAL

1.1 REFERENCE

Conform to the General Requirements and Conditions for Works, Section 01 00 00.

2. PRODUCTS

2.1 GENERAL

a. Adequate instrumentation shall be provided for system operation evaluation, system adjustment and system malfunction indication.

b. Pressure gauges shall be fitted with shutoff cock, read in the pressure range of the system, minimum 120 mm (6 in.) diameter case, white face with black numbers and pointer.

c. Thermometers shall be installed with separable sockets. Bronze sockets shall be used in nonferrous systems and stainless steel in ferrous systems. Thermometers shall be mercury actuated, 120 mm (6 in.) dial, adjustable angle face, white face with black figures and pointer.

d. Alarm switches, floats, etc., shall be provided, including an alarm panel, for immediate indication of system malfunction and/or abnormal operating conditions. Alarms shall be sent to the Building Automation System.

2.2 SCHEDULE OF INSTRUMENTATION

Item	Location
Cocks only	Water In and Out, Each Heat Exchanger Water In and Out, Water Softening Equipment PRV Stations, Each Stage. In and Out (other than fixture branches)
Thermometers	Water In and Out, Each heat Exchanger
Wells Only	Water Inlet - Each Circulating Pump
Thermometer Well	Balancing Rigs Domestic

Item	Location
Alarms	High Temperature, Each Hot Water Heater
	High Water - Each Ejector Pit
	Low Water - Each Sump Pit
	High Water - Each Fire Tank
	Low Water - Each Fire Tank
	Running Indication - Each Fire Pump
	High Pressure - Each PRV Outlet (except Branch Fixture PRV)
	Softener Regeneration Indication

2.3 MATERIALS

a. Provide pressure gauges on incoming water line where shown. Pressure gauges shall be 114mm dial type with dial range to cover twice the average working pressure. Gauge shall have phosphor bronze Bourdon tube, bronze or nylon movement, cast or spun aluminum, brass or cast iron case, white dial, black pointer and markings. Gauge shall be complete with shut-off valve. Pressure gauge shall be provided with scale range appropriate for the given application, acceptable units' kPa (kilopascals) and bars. Install a pressure snubber on any gauge installed near a pump or in any location where damping is required to prevent rapid oscillation of the pointer. Pressure gauges shall have an accuracy of + 0.5%.

b. Provide and install pressure gauge connection with cock, across each pressure reducing valve should be provided so that when required, the operator can install thermometers and gauges for taking readings. The gauge connection shall further be capped.

c. Provide and install, pipe insertion type thermometers of the industrial, red reading, mercury type. Thermometers shall have 228.6 mm scales, separable sockets and shall be located as follows:
   - At the water inlet and outlet of heat exchangers.

3. EXECUTION

a. Furnish and install gauges and thermometers (including wells) as per manufacturer's recommendation as shown on drawings and as specified.

b. Instruments should be installed such that they are easily readable and parallax errors are minimized due to difficult locations of instruments.

X ---------- END OF SECTION ---------- X

SECTION 22 05 23

PLUMBING GENERAL DUTY VALVES

1. GENERAL

1.1 REFERENCE

Conform to the General Requirements and Conditions for Works, Section 01 00 00.

2. PRODUCTS

2.1 GENERAL

a. The contractor shall make all reasonable attempts to ensure the manufacture of valves is consistent throughout the whole of the installation in order to minimize stock holding of spares.

b. All valves and stopcocks shall comply with the regulations of the Ministry of Electricity and Water, Water Department and shall be dezincification resistant.

c. Valves shall be provided as shown on the drawings and detailed below or similar approved and shall conform to BS 5154 made of gun metal, non-rising stem, screwed bonnet, one piece wedge type and tested to 16 bars hydraulic pressure. They shall be of even thickness throughout, clean and smooth from scale. All stuffing boxes shall be packed with material specially selected and recommended by the manufacturer for the particular service in which each valve is used.

d. All valves shall be submitted to the Consultant for approval obtained in writing prior to ordering.

e. All valves shall be fitted in readily accessible positions.

f. Valves installed in insulated piping shall have stem extension.

g. Valves shall be suitable for the following working pressures:

- Hot and cold water services > 1725 kPa
  (Preceding the PRV/gravity feed greater than 60m vertical riser)
- Hot and cold water services > 860 kPa
  (After the PRV/gravity feed up to 60m vertical riser)

2.2 GATE VALVES

a. Up to 65mm diameter shall be bronze pattern with threaded ends screw gun metal wedge disc, high quality packing and gland, solid wedge disc for rising stem type and hollow disc for non-rising stem.

b. Gate valves above 65mm dia. shall be flanged bronze, bronze trim wedge disc type complete with hand wheels, bolted bonnet and stuffing box. Valve stem shall be manganese bronze and seats shall have shouldered seal rings of bronze screwed into the valve body.

2.3 GLOBE VALVES

a. Up to 65mm diameter shall have threaded ends with bronze body and trim screwed (renewable seat and disc), screwed bonnet suitable for re-packing under pressure.

b. Globe valves 80mm and larger shall be bronze body, bronze trim flanged, outside screw and yoke, renewable seat and disc. Plug globe valves used for circuit regulation shall have characterized discs.

2.4 NON-RETURN VALVES

a. All non-return valves shall be screwed BSPT or flange BSEN 1092- 2: 1997 in accordance with the valve schedule in this specification.

b. All non-return valves shall be suitable for both vertical and horizontal mounting and shall be fitted in readily accessible positions.

c. Non-return valves shall be made of gun metal and tested to 16 bars hydraulic pressure conforming to BS 5154.

d. Check valves up to 65mm diameter shall be threaded bronze pattern swing type with renewable leather disc and screw-in cap.

e. Above 65mm diameter shall be flanged bronze swing type with renewable seat and disc components.

2.5 STRAINERS

a. All strainers shall be fitted in a readily accessible position and adequate access shall be allowed for maintenance and cleaning of strainer basket. All strainers shall be manufactured by specialists and have a stainless steel 80 mesh screen basket.

b. Strainer shall be suitable for withstanding the maximum operating temperature and pressure of the pipeline in which they are installed.

c. The strainers shall be complete with cast iron body and quick release cover to BS 1452-14, perforated stainless steel basket to BS 970 EN58J with mesh.

2.6 BALL VALVES

a. 100 mm and smaller shall be MSS SP-110, class 15, 41.40 bar CWP, ASTM B584 bronze body and bonnet, 2- piece construction with chrome-plated brass ball standard port for 15mm valves and smaller and conventional port for 20 mm and larger.

b. Valves shall be blow out proof with bronze or brass stem, Teflon seats and seals.

c. The operator shall be a vinyl covered steel lever handle.

2.7 BUTTERFLY VALVES

a. Butterfly valves shall be Kitemarked to BS5155 (or equal). Valves shall have two high strength, low friction bearings for upper and lower shafts restrain shaft deflection, and ensuring effective stem sealing Nitrile Rubber Liner (WRC approved) shall be bonded to the body by the transfer molding process.

b. Open and close limit Supervisory switches to be mounted on Butterfly valves where shown on drawings

2.8 AUTOMATIC AIR VENTS

a. Automatic Air Vents shall be fitted at all high points in the system and other points where necessary. They shall be made of high pressure type made of DZR brass.

b. All air eliminators shall be manufactured by specialists and a discharge pipe shall be run from the automatic air vent to a convenient position to drain.

2.9 FLOAT BALL VALVES

a. Float Ball Valves on the mains shall be of equilibrium type, full bore, 6 bar medium/high pressure to BS 1212 Part 1.

b. Float ball valves shall be of delayed action type if specified or shown on drawings.

c. The fixing components and members for delayed action ball valves shall be stainless steel.

2.10 FLOAT SWITCHES

a. Float Switches sited to the water tanks shall be a mercury switch in a plastic casing suspended from its own cable.

b. The float switch casing shall be made of polypropylene and cable shall be sheathed with PVC compound.

c. It shall be suitable for water temperature up to 50°C.

3. EXECUTION

a. Valves shall be provided to isolate each item of plant and each main branch.

b. Valves and cocks of any tank or vessel not within a secure building shall be lockable.

c. Any valves and cocks exposed to public view, shall be of the easy clean pattern and have a polished finish.

d. All drain cocks shall be of the same manufacturer and be in accordance with BS 2879. Generally drain cocks shall be provided at all low points in the system and other points where necessary and as directed by the Consultant.

e. Valves in plant room, tank rooms, etc., shall be of the hand-wheel pattern.

f. All Non return valves shall be installed in discharge line of pumps and other locations directed by the Engineer to prevent reversal of flow.

g. Control valves shall be located so as to provide easy access for manual operation and servicing Control valves shall normally be installed in horizontal lines with stems vertical.

h. Ball, Globe and oblique valves shall be used on service pipelines where regulation is required, and shall be supplied and fitted in positions indicated on the Contract Drawings. Valves shall be of the same nominal bore as the pipeline in which they are indicated.

i. Valves shall always be installed in accessible locations to permit easy operation and maintenance.

j. Special care must be exercised in the installation of screwed valves to avoid straining their bodies, and preventing the gate or seat from closing tight. The wrench shall always be applied to the side being attached to the valve. When attaching pipe to a valve already in place, a second wrench shall be used to hold the valve while the pipe is being tightened. A pipe shall not be screwed so far into a valve as to damage the seat.

k. The strainers shall be complete with cast iron body and cap Steel screen rods and standard perforated stainless steel screens unless otherwise indicated on the drawings or elsewhere herein. Connections shall be as described elsewhere herein.

l. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance and equipment removal without system shutdown.

m. Contractor must provide and install valves compatible with each type of piping material specified for various services.

X ---------- END OF SECTION ---------- X

SECTION 22 05 29

PIPES HANGERS AND SUPPORTS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.

2. PRODUCTS

a. Adjustable clevis type pipe hangers shall be galvanized steel.

b. Pipe rolls shall have cast iron rollers, shaped to accept the outside diameter of the pipe. All components shall be galvanized.

c. **HANGERS, INSERTS AND PIPE SUPPORTS**

i. Provide suitable and substantial hangers and supports for all piping. As a minimum, for metallic pressure piping systems, support horizontal piping in accordance with the following schedule:

Pipe Size	Max. Hanger Spacing	Rod Sizes
25mm and smaller	2.40 m	9.50 mm
32mm to 50mm	2.70 m	9.50 mm
65mm to 100mm	3.04 m	12.70 mm
125mm and larger	3.65 m	12.70 mm

ii. Support hangers from approved concrete inserts where concrete slabs exist.
iii. Support cast iron hub and spigot pipe and fittings on not more than 1.52 m. centers, or a minimum of one hanger per each length of pipe. For No-Hub cast iron pipe installations, provide a minimum of two hangers per each length of pipe. Hangers shall be installed on each side of joint. Where an excessive number of fittings are installed between hangers, provide additional hangers or reinforcing as required. Securely anchor fittings to the building construction at changes of direction to eliminate all horizontal movement.
iv. Suspend all piping in Equipment Rooms connecting with the various pieces of equipment with hangers utilizing vibration isolating elements.
v. Allow for expansion in risers and distribution and in connections from risers to fixture branches.
vi. Detail wiring diagrams must be furnished with all pertinent information to assure proper

connection, operation and control of equipment, including interlocks, automatic and safety control circuits.

vii. For PPR pipes the following hanger spacing schedule to be used:

Pipe Size (mm)	max. Hanger spacing (mm)
20	600
25	750
32	900
40	1000
50	1200
63	1400
75	1500
90	1600
110	1800

3. EXECUTION

a. Plastic pipelines internal or external shall be supported at certain intervals according to type of materials pressure and temperature. Hanger spacing shall be as per manufacturers printed recommendations.

b. The permissible deflection of 0.25cm between consecutive brackets or hangers shall be acceptable.

c. The inner diameter of the pipe bracket shall exceed the outside diameter of the pipe for providing free movement of pipes as a result of expansion and contraction by varying temperatures.

d. Inside edges of pipe support or bracket must be such that the pipe surface cannot be damaged.

e. Hangers support shall be used in situation where pipes change direction and free movement of the pipe is allowed.

f. All external pipe work or materials which require protection against atmospheric corrosion shall be so fixed as to give free access all-round the pipe, for the application of paint or other protective coating.

g. The minimum clearance between the pipe and structure shall be 32 mm.

h. Invert or horizontal pipes to give constant soffit.

i. The front on vertical pipes to give pipes to constant distance between walls and pipes.

j. Pipes embedded in floors and walls shall be securely banded with bituminous impregnated tape

and so fixed to allow movement due to expansion and contraction. Alternatively the pipes may be accommodated in sleeves for inert material which shall extend through the full finished thickness of the floor or walls and be secured against movement.

k. Plastic pipe work shall have expansion joints at every fixed point. In vertical runs, the expansion joint shall be immediately above the fixed point. Spacing of expansion joints shall be in accordance with the manufacturer's recommendations.

l. It is the contractor's responsibility to fully ensure that the manufacturers printed recommendations regarding type and spacing of supports for each type of piping material are fully implemented to ensure no problems due to expansion, contraction, deflection and leakage occur. Manufacturers' recommendations to be followed for the actual temperature and pressure of the find each type of pipe is transporting.

m. Manufacturer's recommendations for supports for buried piping to be fully complied with.

X ---------- END OF SECTION ---------- X

SECTION 22 05 73
DRAINAGE MANHOLES

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.

2. PRODUCTS

a. The nominated sub-contractor shall supply and fix cast iron manhole covers and frames bitumen coated as follows:

Situation	Grade of Cover (BS 497)	Specification	Clear Opening
Road, car parks, public footpaths	A2	Double Triangular, Heavy Duty, D.I	600x600
Private footpaths	C	Single seat air tight solid top heavy duty	600x600
Inside building	C	Double seat double cover air tight recess top screw down tight duty	600x600

b. The invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section. Inverts shall be formed directly in the concrete of the manhole base. Steep slopes outside the invert channels shall be avoided. Changes in size and grade shall be made gradually and evenly. Changes in direction of the sewer and entering branches or branch shall have true curves of as large a radius as the size of the manholes will permit.

c. Manholes shall be provided with built-in steps of galvanized, wrought iron. The rungs shall be not less than 250mm in width and spaced approximately 300mm apart, and alternate rungs shall be staggered or offset 150mm. Bars or rods when used for steps shall not be less than 25mm diameter.

d. Manhole frames and covers shall be in accordance with the requirements shown on the drawings provided in accordance with details shown on architectural drawings. The manhole frames and covers shall be so set that the top of the cover will be flush with the finished grade.

e. Concrete foundations for manholes shall be constructed of 1000 kg concrete, proportioned 1 cubic meter cement, 2 cubic meter sand, 3½ cubic meter stone, not less than 22 bags of cement per cubic meter of concrete in place and maximum water content of 90 liters/m^3 (quantity includes water in aggregates). The manhole walls shall be constructed from 200mm thick concrete internally rendered on a 200 concrete base.

3. EXECUTION

a. Install systems to the approval of the local Drainage Department.

b. Manholes and gully-traps shall be vented in accordance with local authority and/or BS requirements.

X ---------- END OF SECTION ---------- X

SECTION 22 05 76
PLUMBING CLEANOUTS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.

2. PRODUCTS

2.1 MATERIAL

Provide cleanouts of the types and size as shown on drawings and as follows:

a. Cleanouts in furred ceiling spaces shall extend up through floor slab above, except where the consultant gives specific approval to its location the ceiling space.

b. Cleanouts in terrazzo, tile or carpeted floors shall be complete with plastic frame and square or round full opening plastic access cover having terrazzo, tile or carpet recesses to permit in setting of the applicable flooring or, floor covering material. Flat top cleanouts without recesses will not be acceptable.

c. Cleanouts in concrete floors shall be complete with polished bronze frame and scoriated nickel bronze tractor duty cover and internal brass or bronze plug.

d. Cleanouts in floors with a waterproof membrane shall be similar to the cleanouts specified above but with a flashing clamp device for attaching to the waterproof membrane below finished floor level.

e. Cleanouts in parking areas shall be complete with iron body and adjustable housing with heavy duty Nickel alloy scoriated secured round top and suitable for vehicular traffic.

f. Cleanouts shall be provided at the base of each vertical stack and rainwater leader.

g. Cleanouts extending through walls in finished areas shall have stainless steel covering plates to permit access to cleanout plugs.

h. Cleanouts in ceiling spaces shall be proprietary screwed type as supplied by the plastic, piping manufacturer.

2.2 SUBMITTAL

All cleanouts proposed shall be submitted to the engineer for approval.

3. EXECUTION

a. Cleanouts shall be installed at each change of direction of drainage pipes inside the building, and where indicate on the drawings. Cleanout shall be not more than 10m apart in horizontal lines. A cleanout shall be provided at or near the foot of each vertical waste or soil stack.

b. Cleanouts on concealed piping shall be extended through and terminate flush with finished wall or floor. Pits or chases may be left in the wall or floor, provided they are of sufficient size to permit removal of the cleanout plug and proper cleaning of the system.

c. Where it is necessary to conceal a cleanout plug, a heavy duty stainless steel covering plate shall be provided, which will permit ready access to the plug.

d. Cleanouts shall be of the same nominal size as the pipes up to 100mm pipe diameter and not less than 100mm for larger piping.

e. Cleanouts shall be so installed that there is a clearance of not less than 450 mm for the purpose of rodding and cleaning.

f. Cleanout location shall be located coordinated with floor tiling pattern so as to fit within one tile.

X ---------- END OF SECTION ---------- X

SECTION 22 07 00
PLUMBING INSULATIONS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.

1.2 QUALITY ASSURANCE

All thermal insulation shall comply with British Standard BS 5970: 1981 and BS 5442: 1977.

1.3 SCOPE OF WORKS

All domestic hot and cold water pipes which are exposed to sun shall be insulated and aluminum cladded.

2. PRODUCTS

2.1 GENERAL

a. Thermal insulation to pipe work shall be carried out by specialists and strictly in accordance with this specification.

b. All cements and adhesives shall be as recommended by the manufacturer of the insulation. Insulation shall be fire retardant with a flame spread rating not greater than 25 and a smoke developed rating not greater than 50 when tested in accordance with Standard E84 of the ASTM.

c. All hot and cold water piping shall be insulated with elastomeric foam insulation with an insulating value of not less than 0.038W/m.K. Valves, fittings and all other appurtenances through which water passes shall be insulated with mitred sections of preformed insulation of a thickness equal to the insulation on the adjoining pipe. Permeability factor shall be greater than or equal to 7000. Density shall be between 65 to 80 kg/m^3. Fire rating per BS Part 7 shall be minimum Class 1, surface spread of flame shall be to BS 476 Part 5- Class P and fire propagation shall be to BS 476 Part 6 Class 0. Water vapor permeability shall be maximum 0.09 microgram/N.h.

d. The following piping shall be insulated for extreme weather conditions:
   i. First 3m of vertical rainwater leader closest to the roof drain plus exposed portion of roof drain
   ii. Horizontal or sloping rain water leaders and all elbows connecting this pipe to vertical leaders
   iii. Condensate drains from fan coil units and air handling units
   iv. Any piping exposed to weather
   v. Water transfer piping

e. Insulation shall be installed by Contractors specializing in this type of work. Materials shall have fire retardant non-toxic qualities.

f. All insulation jackets, facings, membrane, adhesives, mastics, coatings and accessory materials shall be listed and labeled by Underwriters Laboratories, Inc. for a Fire Hazard Classification, as tested under ASTM E 84, NFPA 255 or UL 733 procedures not to exceed the following:
   - Flame Spread 25
   - Fuel Contributed 50
   - Smoke Developed 50

g. The ratings for insulation with factory applied jackets or facings shall be on a composite basis of insulation, jacket or facing, and the adhesive used to adhere the jacket or facing to the insulation.

h. Hot pipe insulation may be fastened with staples, but all cold pipes must include vapor barrier and be sealed. For cold piping, insulation shall be sealed off at valves, fittings, and flanges and at each 6 meters (20 feet) of continuous run.

i. Insulation exposed to weather must be additionally protected with weatherproof jacketing.

j. Equipment, such as tanks, shall be insulated with fiber glass board and finished with open weave glass cloth and finish coats of adhesive.

k. Thickness of applied insulation must conform to local energy codes.

2.2 INSULATION SCHEDULE

a. FOR COLD WATER PIPING

Piping Materials	Elastomeric Insulation Thickness (mm)
Cold Water Mains and Branches	15
Cold Water Risers (Including Pump Discharge)	15
Cold Water Fixture Risers	15

Cold Water Fixture Branches in Pipe Spaces	15
Cold Water Fixture Branches, Exposed	15
Cold Water Fixture Branches above Ceilings	15

*** Subject to evaluation of water temperatures and dew points.*

b. FOR DRAIN PIPES

Piping Materials	**Elastomeric Insulation Thickness (mm)**
Horizontal Leader and Horizontal Storm Drain (Including Vertical Stub to Roof Drain)	15
Horizontal Drains Serving Dehumidifiers (Above Hung Ceilings)	15
Wastes from EWC or Chilled Water (Above Hung Ceilings)	15

c. FOR HOT WATER PIPES

Piping Materials	**Elastomeric Insulation Thickness (mm)**
Hot Water and Hot Water circulating	15 (min.)
Hot Water Fixture Branches, Exposed	25
Hot Water Fixture Branches in Pipe Spaces	25
Hot Water Piping	25

*** Drains and Risers Design Engineer to evaluate BTU losses vs. circulation required, vs. increase in insulation thickening.*

d. FOR EQUIPMENT

Piping Systems Equipment	**Density of Fibre Glass Board**
Hot Water Preheaters	0.0381m - 2.72kg
Hot Water Heaters	0.0381m - 2.72kg
Cold Water Pneumatic Tanks	0.0381m - 2.72kg with vapor seal
Cold Water Meters	0.0381m fibre glass with foil facings, and with an open weave glass cloth jacket sealed.

2.3 SUBMITTAL

All applicable insulations samples and technical literature of approved manufacturer shall be submitted to the engineer for approval.

3. EXECUTION

a. Insulation shall be applied to clean, dry pipe only.

b. No insulation shall be applied unless the piping or apparatus to be covered has been tested according to specifications.

c. In order that tests may be made of the thickness of insulation to be applied to each pipe size and equipment, the contractor shall allow for the cost of cutting away one section for each size of pipe and equipment for inspection by the consultant. If the insulation proves to be of the thickness specified, then the cut section shall be made good and the whole installation completed. Should any cut section show a deficiency of thickness, further sections shall be cut at the direction of the consultant for inspection.

d. If a deficiency of thickness or any other defects are found, the contractor shall remove the whole of the insulation installed or as the consultant directs and then shall supply, deliver and apply new insulation complying with the specification and restore it to the satisfaction of the consultant. This work shall be carried out at the contractor's own expense.

e. Insulation shall be installed in accordance with manufacturer's printed installation instructions.

f. All insulation shall be finished smooth. The outline of pipe insulation shall be true circular and concentric in shape. The outline of fitting insulation shall be shaped to blend with adjacent covering.

g. All piping insulation installed outdoors, on the service floors and plant room in the parking lot shall be covered with 0.8mm aluminum jacketing and sealed water-tight.

h. Pipes to be installed embedded in concrete wall or slabs, are to be wrapped in corrosion resistive tape prior to installation.

i. Thermal insulation shall be applied to all valves, strainers, non-return valves, drain cocks, automatic air vents and bosses for gauges/test points. Insulation of these components in the pipe work system up to and including 65-mm diameter pipe work shall be carried out using sectional insulation cut to suit and of the same size as the line pipe work.

j. No insulation shall be concealed within false ceilings or vertical and horizontal builders’ work shafts prior to inspection and approval by the consultant.

k. Insulation supplier/manufactures shall supervise the installation of all insulation and shall provide a written grantee against faulty installation practices that shall be affected for a minimum of 5 years from the date of hand-over.

I. Where exposed to view, the insulation shall be painted with two coats primer and one finishing coat rubberized paint to an approved color prior to the fixing of aluminum bands at 1.2 m centers. The finishing color shall be to British Standard BS 1710: 1975, identification of pipelines complete with direction arrows.

X ---------- END OF SECTION ---------- X

SECTION 22 08 00

TESTING AND COMMISSIONING OF PLUMBING SYSTEM

1. GENERAL

1.1 REFERENCE

Conform to the General Requirements and Conditions for Works, Section 01 00 00.

2. EXECUTION

2.1 TESTING OF PIPING SERVICES

All pressure tests on the pipe work installations shall be carried out in sections as the work proceeds, to suit the general construction program. All isolation and other temporary works shall be carried out by the Contractor at no additional cost to the Contract. The whole of the testing gear required, including all plugs, caps, tees and drain fittings, shall be supplied by the Contractor.

2.2 TESTING OF EQUIPMENT

a. After complete installation, all equipment shall be tested for performance and proper functioning, for demonstrating to the full satisfaction of the consultant that the equipment meets design requirements as shown on the drawings and as specified.

b. In the event that any equipment should prove defective, unsatisfactory or does not comply with the drawings or Specification, the Contractor shall correct, repair or replace such equipment, or his own account as directed by the consultant. After correction is made, subsequent tests shall be performed until equipment is proven to fulfill the requirements to the entire satisfaction of the Engineer / Consultant.

c. The data to be measured on equipment shall be of such items as given on the schedule of equipment shown on the drawings.

2.3 REJECTION OF EQUIPMENT

a. Sufficient ground for equipment to be rejected is, if:
   i. It has a capacity less than specified
   ii. It's electric motor is overloaded
   iii. It causes objectionable noise or vibration

2.4 TESTING AND COMMISSIONING AT SITE

a. The Contractor shall thoroughly Clean, lubricate as necessary, and ensure free, operation of all plants and installations prior to testing and commissioning.

b. After each pump has been fully installed, a final check of lubrication, alignment between pump and motor, electrical connections discharge and suction gauge readings and pump balance shall be made under the supervision of a representative of the relevant manufacturer. The Contractor shall ensure the direction of rotation of the driver matches that of the pump.

c. The Contractor shall secure certification from the manufacturer stating that the check items meet their recommendations and shall submit the letter to the Engineer / Consultant.

d. Pumps shall be properly aligned as per manufacturers written instructions.

2.5 TESTING AND ADJUSTMENT OF CONTROLS

a. All controls and instruments shall be operated simultaneously with the equipment or system that they control and tested for proper, accurate and dependable functioning and operation.

b. All controls and instruments shall be calibrated and adjusted to the satisfaction of the consultant.

2.6 GOVERNMENT AND LOCAL AUTHORITIES

The contractor shall perform at appropriate times during the currency of site work and no additional cost, all tests required by governing municipal and Local Authorities who may from time to time have jurisdiction over the work, and obtain the necessary certificates of approval. Local regulations shall be strictly followed.

2.7 DOMESTIC WATER PIPING STERILIZATION AFTER COMMISSIONING

On completion of the potable water supply services system, it shall be sterilized by the application of chlorine. The minimum requirements for chlorination shall be to flush the pipe work thoroughly to remove dirt. Chlorine shall then be added to the storage tanks and water drawn from all, draw-off points until chlorine is detected at each outlet point. The mains are then to be allowed to stand for a period of 24 hours, after which the outlets are to be tested for chlorine. If chlorine is not found to be present, all the above shall be repeated until residual chlorine is detected. After this, the system is to be completely flushed with clean water and precautions taken to avoid subsequent contamination of the installation. An independent laboratory test report shall certify the sterilization of pipes & portability of the water shall be submitted to certify the consultant.

2.8 DRAINAGE PIPING

All drainage piping shall be air pressure tested at a pressure equal to 2.4 bar or as per manufacturer's recommendations to ensure that all piping and are free from any leakage to the satisfaction of the consultant.

2.9 TESTING PRESSURES

a. Hydrostatically test domestic water piping (hot and cold) to a pressure of 10.35 bar, or at least 1.5 times the working pressure, whichever is greater. High pressure piping shall be tested to a pressure of 28 bar.

b. Hydrostatically test chilled water piping to not less than 1.5 times the working pressure but no less than 10.35 bar (for 24 hour period), whichever is greater.

c. Hydrostatically test fire lines to 13.8 bar for 2 hour in accordance to NFPA 14 and the local municipality's requirements. However, vertical risers of high pressure piping to be tested to 28 bar.

X ---------- END OF SECTION ---------- X

SECTION 22 10 00
PLUMBING PIPES AND FITTINGS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.

1.2 QUALITY CONTROL

a. MANUFACTURER

All pipes and fittings of a particular material shall be from a single manufacturer, who is fully experienced, reputable and qualified in the manufacture of the pipe to be furnished. The pipe shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications.

b. STANDARDS

- American National Standards Institute (ANSI)
- American Society for Testing and Materials (ASTM)
- International Standards Organization (ISO)
- European Standards
- Manufacturer's printed recommendations

c. COMPATIBILITY

Contractor is responsible for compatibility between pipe materials, fittings and appurtenances.

d. WARRANTY

The pipe manufacturer shall provide a warranty against manufacturing defects of material and workmanship for a period of ten years after the final acceptance of the project by the owner. The manufacturer shall replace at no expense to the owner any defective pipe/fitting material including labor within the warranty period.

e. PIPE IDENTIFICATION

i. The following shall be continuously indent printed on the HDPE pipe or spaced at intervals:
- Name and/or trademark of the pipe manufacturer
- Nominal pipe size
- Dimension ratio
- The letters PE followed by the polyethylene grade in accordance with ASTM
- D1248 followed by the hydrostatic design basis in 160's of psi, e.g., PE 3408
- Manufacturing standard reference, e.g., ASTM F714 or D-3035, as required
- A production code from which the date and place of manufacture can be determined

ii. UPVC Pipe work shall carry the following marks:
- Manufacturer's identification
- Nominal size and Class
- Serial number of pipe
- Year of manufacture
- Standards reference
- Batch number

f. CERTFICATION

i. Manufacturer of supplier are required to provide a copy of the certificate and testing report from any recognized certification body.
ii. Tests report required should be those tests conducted within a year period.

g. SUBMITTALS

The supplier shall submit the Test Certificate to the S.O., copies of all test results (Routine and Type), which have been performed on pipes to be supplied.

2. PRODUCTS

2.1 GENERAL

a. Pipe and fittings shall be in conformance with the following unless specified otherwise by local authorities. Obtain and submit approvals by local authorities for all piping before ordering of materials.

b. All pipe sizes for drainage and venting shown on plans are O.D. and for all other series are nominal (not OD) – contractor to supply pipe size based on fixture connection size, temperature and pressure requirements, and life of 50 years for plastic piping.

c. If recycled compounds are required, only those generated in the Manufacturer's own plant from resin compounds of the same class and type from the same raw material supplier shall be used.

2.2 WATER SUPPLY PIPING MATERIAL SCHEDULE

Unless otherwise specified in BOQ or Drawing, pipe materials used for different applications and services shall be as follows:

S. No.	Service	Location	Type
1	Domestic Water Supply Below ground	Below Ground up to 300mm above FFL in buildings / shafts	HDPE
2	Domestic water supply above ground	Inside buildings above ground	PPR Pipes
3	Hot & Cold Water Piping.	Inside buildings above ground	PPR Pipes
4	Underground Irrigation Networks	External Underground	UPVC Class E / HDPE
5	Hot, cold water concealed pipe drop in wall to fixtures	From above false ceiling to fixture	PEX pipes in PVC conduits (Pipe in pipe system.) with DZR fittings.
6	Exposed to Sunlight Pipe Installations	Roof areas and Plant room areas	PPR pipes with 19mm thick elastomeric insulations and covered with 6 oz. canvas cloth and weather proof antifungal foster coating
7	Domestic Hot Water	To and from Electric Water Heaters	Copper Pipe

2.3 WATER SUPPLY AND DISTRIBUTION PIPING

a. WATER TRANSFER PIPING

i. Unless otherwise specified, water supply transfer piping and fitting shall be uPVC class E.

ii. The material used in the manufacture of pipes, joints and fittings shall consist substantially of polyvinyl chloride, to which may be added only those additives that are needed to facilitate the manufacture of the polymer and the production of sound and durable pipes of good surface, finish, mechanical strength and opacity.

iii. None of these additives shall be used separately or together in quantities sufficient to

constitute a toxic hazard, to impair the fabrication or welding properties of the pipes, or to impair the chemical and physical properties of the pipes (in particular long term mechanical and impact strength).

iv. PVC content of the pipe shall not be less than 85% and the content shall be achieved by the use of process control method.

v. When tested by method 120B of BS 2782 (Methods of Testing Plastics), the deformation temperature of the material under load shall not be lower than 75°C.

vi. The pipes, joints and fittings shall be classified in accordance with the Maximum Permissible Working Pressure in table below:

Class of Pipe	Maximum Permissible Working Pressure	
	At 20°C	At 30°C
PN 12 (Class D)	12 bar	9.6 bar
PN 15 (Class E)	15 bar	12

*** The standard length of pipes shall be 4 meters Plain Ended.*

vii. The Contractor shall supply free of charge the extra joints required due to the supply of non-standard pipe length.

viii. A tolerance of +15 mm/-0 mm shall be allowed on the length of an individual pipe but the total length of pipe supplied shall not be less than the total of length ordered.

b. DOMESTIC COLD AND HOT WATER PIPES

i. Domestic cold and hot water pipe and fittings shall be PP-R Type 3 manufactured in accordance with DIN 8077 and 8087. Pipes and fitting shall be PN 20 rated, suitable for use under 10 bar pressure at 65□C fluid temperature (service life 50 years), and resistant to UV rays. For larger pipe sizes, usually 4" PPR and larger, if PP-R not available the pipe material used shall be High Density Polyethylene (HDPE).

ii. Materials used for the manufacture of polyethylene pipe and fittings shall be made from a PE 3408 HDPE resin compound meeting cell classification 345434C per ASTM D3350; and meeting Type III, Class C, Category 5, Grade P34 per ASTM D1238.

iii. High Density Polyethylene (HDPE) pipe shall comply with AWWA Specifications C906 or equivalent.

iv. Dimensions and workmanship shall be as specified by ASTM F714. HDPE fittings and transitions shall meet ASTM D3261. HDPE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All HDPE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.

2.4 DRAINAGE PIPING

a. EXTERNAL DRAINAGE PIPE WORK

Unless otherwise specified, drainage pipe work outside the buildings shall be uPVC pipes and fittings joined by push fit socket incorporating rubber sealing gaskets, all to BS 4660 and 5481. The Nominated Sub-Contractor shall store the pipe work, either in the manufacture's

packs, withdrawing the pipes from the center of each row and working alternatively towards each side of the pack, or if stacked by hand, the stack should be placed on a level surface, with the bottom layer firmly for stability.

b. INTERNAL DRAINAGE PIPE WORK (INSIDE AND UNDER BUILDING)

Drainage pipe work inside buildings shall be uPVC to BSEN – 1329 and BS5255 - 1989. Pipe work shall carry the following marks: nominal size, manufacturer's name and trade mark and BS number. Provide a complete system of sanitary drainage piping for plumbing fixtures. Kitchen wastes, and the like which can be connected to the city drainage scheme.

c. VENT PIPING

Vent piping shall be uPVC Class B.

d. SUBSOIL AND STORM WATER DRAINAGE

Provide and install a subsoil drainage system and a storm water drainage system as shown on the drawings. The systems shall be complete in all respects with clear out, manholes, gravel bed etc. all as shown on the drawings. The subsoil pipe shall be uPVC class D with perforations. The free area of the perforations shall not exceed 45% of the pipe surface. Wherever subsoil / pipe passes through ceilings/shafts/or is not embedded in soil – it shall not have any perforations. Storm water drainage pipe shall be uPVC class D.

3. EXECUTION

a. The contractor shall ensure that joints are cleaning, undamaged and are adequately lubricated. Where pipe work has to be cut to length, the Contractor shall use care to remove any sharp edges before making a joint. Connections to the above ground pipe work shall be through purpose made adapters.

b. The Contractor shall execute trenches of sufficient width to allow adequate working space for pipe joints and inspection. The pipe work shall be laid on well compacted bedding. Backfilling to trenches shall be carried out only after the drains have been tested to the satisfaction of the Engineer. Where the pipe works has 1m cover, or it is run under footpaths, provide buried warning tape.

c. Where pipes are laid under roadways access areas, with 1m or less cover they should be encased in a concrete surround (min. 150 mm thick), with flexible joints (13 mm thick fiberboard, or polystyrene) at 5mm maximum centers.

d. All drains shall be kept free of sand and other obstructions during constructions.

e. All changes of directions shall be gradual and not abrupt; 45 degree fitting shall be of the long sweep. All unnecessary turns and off sets shall be carefully avoided, and run as directly as possible from the sanitary fixtures to the vertical stacks.

f. Sufficient and suitable access shall be provided to enable pipe work to be tested and maintained effectively. The access cover plugs or caps shall be so to facilitate the insertion of testing apparatus and of equipment for cleaning and /or for the removable of blockages. Their use shall not be impeded by the structure of other services. Extra support may be required for the plugs or caps to withstand the head of water, especially at the lower floors.

g. Vertical rainwater pipe work shall be provided with the means of access at or near the foot of stack.

h. Vertical rainwater pipe work shall be provided with means of access near to, but above the spill-over level of the pipe work likely to be affected by a blockage. Where no sanitary fittings are connected on a floor to a stack, the means of access shall be provided at or near floor level.

i. Branch discharge pipes serving ranges of sanitary fittings shall be provided with the means of access at the head of branch and at the connection to the stack.

j. Means of access shall be provided at bends in vertical and in the horizontal plane in long runs.

k. All joints made in pipe work and joints of pipe work to appliances shall be airtight and watertight and shall be taken to ensure that no jointing material projects inside the bore of the pipe.

l. Provision shall be made in the assembly of pipe work to accommodate and control thermal movement.

m. Joints of plastic pipe shall be made in accordance with the manufacturer's instructions.

n. Storm drainage: Provide a complete system of storm drainage piping for all roots, set-back areas and canopies.

o. Take special care in setting roof drains to ensure that they are at an elevation which will preclude formation of puddles.

p. Install connections to roof drains in conjunction with the roofing specified under civil works, so that the building is adequately protected during construction from damage by storm water.

q. Balcony drains and rain water outlets in areas accessible to general public shall be of flat grate type fitting flushed with the floor.

r. Run building drains at a grade of 2% pitch and 1% minimum unless otherwise noted. Run branch

connections to stack from fixtures at 2% where possible.

s. Provide all the required appurtenances to make the drainage system complete in compliance with code requirements including traps, pipe fitting and the like.

t. HDPE Piping shall be installed as per manufacturer's instructions.

X ---------- END OF SECTION ---------- X

SECTION 22 11 00
WATER DISTRIBUTION SYSTEM

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.

1.2 SCOPE OF WORK

Supply, fixing, testing and commissioning of water supply system, including pipes, accessories, valves, etc., as specified in other sections and herein: as shown on drawings and instruction of Consultant.

2. PRODUCTS

2.1 PIPES AND FITTINGS

Pipes and fittings used shall be in accordance with the requirements as specified in Section 22 10 00.

Unless otherwise specified, water supply and distribution piping and fittings shall be as follows:

a. uPVC schedule 80 pipes and fittings with solvent joint will be used for cold water pipes sizes dia. 3" and above.

b. Polypropylene Random (PP-R) pipes and fittings confirming to Din 8077 with fusion jointing will be used for cold water pipe size to (dia. 20 mm to dia. 90 mm).

2.2 VALVES AND ACCESSORIES

Valves and accessories shall be in accordance with the requirements as specified in Section 22 05 23.

a. Unless otherwise specified, valves should be of the same nominal size as the size of the pipe line to which they are connected. All valves that incorporated packed glands should be capable of having glands packed when connected in line and subject to the working line pressure.

b. All isolating valves shall provide tight shutoff in the closed position.

c. All hand wheel valves shall rotate clockwise to close the valve. Check valve should be installed in a plane only which is recommended by the manufacturer and approved by the Consultant/Engineer.

d. Valve bonnets and covers should be easily removable and the gasket and glands should be readily renewable.

e. All gate and sluice valves shall incorporate guides in the body to ensure the correct position of valve discs at all times. The working parts of valves and cock should be bronze and the body casting should be bronze for valves and cocks up to 2" dia. connection and cast iron for valves and cock of 2-1/2" diameter connection and above.

f. Gland rings and spindles should be of a good running fit and stuffing boxes should be fitted with neoprene 'O' ring seals. The exterior finish of all bronze valves bodies should be polished except otherwise specified.

g. Check valves up to and including 2-1/2" diameter should be of 'Y' pattern swing type having regrind able bronze discs with the disc seat integral with the valve body. The disc and seat should be accessible via a screwed cap for regrinding without removal of the disc.

2.3 CAPS, UNIONS AND FLANGES

a. Caps should be of material compatible to piping and it should be machined, gasketed, and with straight threads or bolted type.

b. Unions and Flanges should be furnished and installed at each threaded or flanged connection to all equipment or valves. The faces of flanges being connected should be alike in all cases.

c. Unions and flanges should be located so that pipe can be easily disconnected for removal of equipment, valve or tank.

X ---------- END OF SECTION ---------- X

SECTION 22 11 23
DOMESTIC WATER PUMPS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.
c. Refer to Section 40 92 49 for VFD Specifications

1.2 SUMMARY

Pumps covered in this section include General Duty Plumbing Pump including Submersible Water Transfer Pump.

1.3 SUBMITTALS

a. Submit shop drawings and product data.

b. Submit Manufacturer's literature and data for
   i. Pumps and accessories
   ii. Motors and drives

c. Submit manufacturers' installation, maintenance and operating instructions.

d. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

1.4 QUALITY ASSURANCE

a. Pumps design and manufacturer shall conform to Hydraulic Institute Standards.

b. Pump sizes, capacities, pressures, operating characteristics and efficiency shall be as scheduled.

c. Head capacity curves shall slope up to maximum head at shut off. Curves shall be relatively flat for closed systems. Select pumps near the midrange of the curve, so the design capacity falls to the left of the best efficiency point, to allow a cushion for the usual drift to the right in operation, without approaching the pump curve end point and possible cavitation and unstable operation. Select pumps for open systems so that required net positive suction

head (NPSHR) does not exceed the net positive head available (NPSHA).

d. Pump Driver shall be furnish with pump. Size shall be non-overloading at any point on the head capacity curve, including in a parallel or series pumping installation with one pump in operation.

2. PRODUCTS

2.1 GENERAL DUTY PUMPS

a. All pump motors 3.73kw and larger shall be "high efficiency" and shall be of efficiencies complying IE3.

b. Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard and other accessories specified. Statically and dynamically balance all rotating parts.

c. Furnish each pump and motor with a nameplate giving the manufacturers name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current and motor efficiency.

d. Test all pumps before shipment. The manufacturer shall certify all pump ratings.

e. After completion of balancing, provide replacement of impellers or trim impellers to provide specified flow at actual pumping head, as installed.

f. Allowable Vibration Tolerance for Pump Units: Section 13 48 00, NOISE AND VIBRATION CONTROL FOR MEP SYSTEMS AND EQUIPMENT.

2.2 SUBMERSIBLE PUMPS

a. 2.2.1 Motors shall be totally enclosed, continuous duty, air filled water-tight casing. Class F, 55^{o}C insulation.

b. Pump casing and impeller shall be cast iron. Shaft shall be stainless steel.

c. Pumps shall be arranged so that the pump volute casing is machine matched to the discharge flange and can be removed from the wet well installation by sliding the pump up along guide rails. There shall be no mechanical means of connection. Connection shall be metal-to-metal.

d. Include hinged cover and frame with guide holders, level control cable holder and standard weight galvanized steel guide rails. These shall be furnished for installation under the general construction contract.

e. Provide for lifting lugs or tripod assembly to remove pumps for maintenance and repairs.

3. EXECUTION

3.1 EXAMINATION

a. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation.

b. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

c. Examine foundations for suitable conditions where pumps are to be installed.

d. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

a. Install pumps according to manufacturer's written instructions.

b. Install pumps to provide access for periodic maintenance, including removing motors, impellers, couplings, and accessories.

c. Support pumps and piping separately so piping is not supported by pumps.

d. Set base-mounted pumps on concrete foundation. Disconnect coupling halves before setting. Do not reconnect couplings until alignment operations have been completed.

e. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 19 mm to 38 mm between pump base and foundation for grouting.

f. Adjust metal supports or wedges until pump and driver shafts are level.

g. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

3.3 ALIGNMENT

a. Align pump and motor shafts and piping connections after setting them on foundations, after grout has been set and foundation bolts have been tightened, and after piping connections have been made.

b. Comply with pump and coupling manufacturers' written instructions.

c. Adjust pump and motor shafts for angular and offset alignment.

d. After alignment is correct, tighten foundation bolts evenly but not too firmly.

e. Completely fill baseplate with non-shrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

f. Provide certification of alignment from the manufacturer when the pump is completely installed.

3.4 CONNECTIONS

a. Drawings indicate general arrangement of piping, fittings, and specialties.

b. Install piping adjacent to machine to allow service and maintenance.

c. Connect piping to pumps. Install valves that are the same size as piping connected to pumps.

d. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

e. Install non-slam check valve and globe valve on discharge side of vertical in-line pumps.

f. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

g. Install pressure gages on pump suction and discharge. Install at integral pressure-gage tappings where provided.

h. Coordinate location of thermometer and pressure gauges as per Sections 22 05 19 and 22 10 00.

i. Provide drains for bases and seals for base mounted pumps, piped to and discharging into floor drains.

j. Install electrical connections for power, controls, and devices.

k. Electrical power and control wiring and connections are specified in Electrical specification.

l. Ground equipment: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not

indicated, use those specified in UL 486A and UL 486B.

3.5 COMMISSIONING

a. Verify that pumps are installed and connected according to the Contract Documents.

b. Verify that electrical wiring installation complies with manufacturer's written instructions and the Contract Documents.

c. Perform the following preventive maintenance operations and checks before starting:
   - Lubricate bearings
   - Remove grease-lubricated bearing covers, flush bearings with kerosene, and clean thoroughly. Fill with new lubricant according to manufacturer's written instructions.
   - Disconnect coupling and check motor for proper rotation that matches direction marked on pump casing.
   - Verify that pumps are free to rotate by hand and that pumps for handling hot liquids are free to rotate with pumps hot and cold. Do not operate pumps if they are bound or drag, until cause of trouble is determined and corrected.
   - Check suction piping connections for tightness to avoid drawing air into pumps
   - Clean Strainers
   - Verify pump controls are correct for pump application

X ---------- END OF SECTION ---------- X

SECTION 22 13 00

INTERNAL AND EXTERNAL DRAINAGE SYSTEM

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.

1.2 SCOPE OF WORK

Supply, installation, testing and commissioning of soil, waste and vent system including, laying of pipe, jointing, cutting, excavation, backfilling as specified herein and as shown on drawings and as per instruction of Consultant.

2. PRODUCTS

2.1 DRAIN PIPES AND FITTINGS

Pipes and fittings used shall be in accordance with the requirements as specified in Section 22 10 00.

Unless otherwise specified, drainage piping and fittings shall be as follows:

a. All Soil, Waste & Vent pipes & fitting are UPVC, gravity type. All pipes and fitting shall be assembled in strict accordance with manufacturers written instructions.

b. Unless otherwise indicated drainage, vent and rain water pipes and fittings inside the building (except Commercial Kitchen / Retail areas) shall be of uPVC to BS 4514 for pipe sizes up to 80mm dia. and MuPVC / ABS to BS 5255 for pipe sizes 50mm dia. and smaller. Fittings shall be push fit type.

c. Only UPVC molded fitting and specials will be used and no fabricated fitting will allowed.

d. Drainage pipes for Commercial kitchens shall be of HDPE withstanding high temperatures.

e. Acoustic lagging shall be provided for all horizontal drainage pipes above false ceiling, as detailed in drawings.

f. Drainage pipes buried under ground up to manhole shall be uPVC with rubber ring joints to

BS 4660.

g. Sewage pipe between manholes shall be uPVC Class 'B' with rubber ring joints protected with concrete encasement where as required.

h. All pipes under building and those subject to traffic especially under roads shall be protected with reinforced concrete.

2.2 FLOOR/ROOF/BALCONY DRAINS

a. Floor drains unless otherwise indicated shall have uPVC traps of a minimum water seal of 70 mm, and shall be provided with adjustable and removable strainers. The open area of strainer shall be at least two thirds of the cross sectional area of the drain line to which it connects. Floor drains shall have heavy duty stainless steel cover with a removable strainer and cover plate. Floor drain shall have built in rodding eye.

b. All floor drains/cleanouts must be coordinated with floor tiling layout.

c. Dish washer drains, in kitchen areas, shall include a nickel bronze funnel secured to the grating.
   - Roof Rainwater outlet shall be promenade roof drain outlets, 300x300 mm (12"x12") size, as by Wade, or approved equal.
   - Balcony outlet shall be of C.P Nickel Bronze with trapped or non-trapped sump. Cover to be chrome plated brass.

2.3 MANHOLES/INSPECTION CHAMBERS

a. All manholes shall be constructed to the requirements of the Drainage Department.

b. Internal manhole covers shall be bolt down airtight double seal, recessed top.

c. Covers are to be inside concrete filled, with surface finish to match surrounding floor. All covers are to be medium duty, locking and sealed, with a clear opening of 600mm x 600mm.

d. Covers for external manholes subject to vehicular traffic shall be kite marked, heavy ductile iron single seal, non-rock heavy duty with square push fit seal plate. Covers to be complete with lifting key holes, and generally constructed in accordance with BS. 497:76 and shall have a clear openings of 600x600mm unless otherwise indicated. Double seal covers shall be provided where indicated on drawings.

e. All covers shall be of ductile iron and shall be grey - epoxy coated.

2.4 Gully Trap

a. Where indicated on drawings provide gully unit of uPVC hinged grate, road retaining bar with clear opening size 532x405mm. Unit shall be designed to deter ingress and help prevent blockage. A GRP grid shall be provided as standard.

b. Storm water Dome Type gratings shall be heavy duty UV resisted uPVC, clear openings size as per drawings. Flashing shall be provided to hold the water proofing.

3. EXECUTION

3.1 INTERNAL DRAINAGE

a. **GENERAL**

i. All underground pipes should be laid on a firm and compacted natural bed of earth for its entire length. Clean earth, sand or screened gravel should be placed under, around and above the piping to at least 1 ft. above it, and compacted carefully. Thereafter excavated earth should not be allowed in trench as backfill material.
ii. All horizontal piping should be provided with clean outs/plug as required for roding. An accessible clean out should be provided at the base of the soil and waste stack
iii. All supports and hangers will be provided and installed as per recommendation of pipe manufacturer and approved by the Engineer.
iv. All pipe work will be tested at least 6'.0" of water column cleaner and solvent as recommended by the pipe manufacturer will be used.
v. The pipe and fitting shall be through cleaned with cleaner then solvent shall be applied.

b. **PIPING AND ASSOCIATED WORKS**

i. Vent pipes shall extend through roof and terminate 600mm above it with vent cowl. Vent pipes passage through the roof shall be made watertight by proper flashing.
ii. All changes of direction shall be gradual and not abrupt, 45 degree fittings shall be used wherever possible, and 90 degree fittings shall be of the long sweep type. All unnecessary turns and off sets shall be carefully avoided, and run as directly as possible from the sanitary fixtures to the vertical stacks.
iii. Concealed pipes shall be installed in such a manner as to permit easy accessibility for maintenance this applies particularly to valve locations.
iv. All pipes shall be fixed in neatly arranged lines, and adequately pitched horizontal lines to allow the system to be properly vented and drained. Air pockets, traps and sags shall be carefully avoided.
v. Supports, clamps and hangers shall be made of galvanized steel with rubber internal rubber seal, fixed with drilled plugs. Cutting and pinning of fixings will not be

permitted.

vi. Run building drains at a minimum grade of 2% (1:100) pitch unless otherwise noted, downward in the direction of flow. Pitch branch connections to stacks from fixtures at 3% (1:30) where possible.

vii. Provide all the required appurtenances to make the drainage system complete in compliance with code requirements including traps, pipe fittings, hangers, and the like.

viii. Wherever possible, vent stack offsets shall be made with 45 degree fittings.

ix. Take special care in setting roof drains to ensure that they are set at an elevation which will prelude formation of puddles.

x. Install connections to roof drains in conjunction with the roofing specified under civil works, so that the building is adequately protected during construction from damage by storm water.

xi. No short radius bends to be used. Use short "Tee Wye" fittings in vertical piping only.

xii. Any piping passing through roofs shall be so arranged to be a minimum of 300mm (1 ft.) from walls or other obstructions so as to permit proper flashings which are provided by another trade.

xiii. Where drainage pipe work crosses fire rated partitions, walls and floors, provide proprietary fire rated in tumescent sleeves with a fire rating equal to or greater than the fire rating of the respective wall or floor.

xiv. Horizontally long running soil & waste shall be vented from the top end, weather shown or not on layouts.

xv. Sound lagging shall be provided to the pipes hanging with slab.

c. **CLEANOUT POINTS**

i. Cleanouts shall be installed at each change of direction of drainage pipes, greater than 45 degrees, inside the building, and where indicated on the drawings. Cleanouts shall be not more than 10m apart in horizontal lines. A cleanout shall be provided at or near the foot of each vertical waste or soil stack.

ii. Cleanouts on concealed piping shall be extended through and terminate flush with finished wall or floor. Pits or chases may be left in the wall or floor, provided they are of sufficient size to permit removal of the cleanout plug and proper cleaning of the system.

iii. Where it is necessary to conceal a cleanout plug, a heavy duty covering plate shall be provided, which will permit ready access to the plug.

iv. Cleanout plugs shall be of heavy duty with seal and lock. Final finish shall be to the approval of the Architect.

v. Cleanouts shall be of the same nominal size as the pipes up to 100mm pipe diameter and not less than 100mm for larger piping.

vi. Cleanouts shall be so installed that there is a clearance of not less than 45cm for the purpose of rodding and cleaning.

vii. Provide cleanouts at foot of all stacks, changes of directions, at the ends of branch

runs, in straight runs as required and where indicated. Terminate as specified under "Cleanouts".

3.2 EXTERNAL DRAINAGE

a. GENERAL

i. Pipe connections to manholes, collection tanks and percolating pits shall be made in a completely watertight and approved manner.

ii. Pipes shall be kept clean until final acceptance of the work. Exposed ends of all incomplete lines shall be closed with wooden plugs and adequately secured at all times when pipe laying is not actually in progress.

iii. Pipes shall be installed on a good foundation and adequate means taken to prevent settlement. Pipes laid in trenches shall be provided with a solid uniform bearing throughout their entire length.

iv. Pipes shall not be buried at less than 60 cm below finished grade for protection against mechanical damage. Pipes shall not be run closer than 1m to building bearing walls and footings for protection against building settlement.

v. All pipes shall be laid to a uniform slope. Slopes of sewer drain shall be limited to 1% maximum. The free vertical drop of a sewer pipe into a manhole shall be limited to 45cm between the invert level of the pipe opening and the bottom of the manhole. Where conditions necessitate that the drop would exceed 45cm at the maximum slope of 23% a drop manhole shall be used.

vi. Trenches shall be kept free of water by pumping, use of well points, under drains or other approved means during pipe laying operations so that all pipe joints are made in the dry.

vii. Precautions shall be taken to protect incomplete work from floating due to storms or from any other cause. All pipe lines or structures not stable against uplift during construction shall be well braced or otherwise protected.

viii. All completed underground lines shall be subject to the inspection and approval of the Engineer. All pipes shall be true to line and grade. The full circle of the pipe shall be visible at the manholes.

b. PIPING AND ASSOCIATED WORKS

i. The drains shall be laid truly straight in line and to an even gradient.

ii. Excavations shall be made true and even to falls. The bottoms being trimmed to correct level and well rammed. Remove mud, rock projections, boulders and hard spots and replace with approved fill material well consolidated.

iii. Minimum width of trench shall be 300mm greater than external diameter of pipe.

iv. Any trenches excavated in error to a greater depth than required shall be in filled back to the required level with concrete mix, at the Contractor's expense.

v. Before laying, all pipes and components shall be checked for defects and joint spaces

cleared of dirt.

vi. Socketed pipes to be laid with sockets uphill.

vii. Flexible joints shall be made in strict accordance with manufacturer's instructions.

viii. Where lubrication of the joint is required the pipe manufacturer's recommended lubricant shall only be used.

ix. Lay and compact bed of granular material to provide at least 100mm thickness over the full width of the trench. Scoop out locally at pipe sockets where socketed pipes are used. Adjust pipes to line and level and ensure that pipe barrels rest uniformly on the bedding.

x. Add granular side fill uniformly up each side of pipes compacting by hand.

xi. Any trench sheeting should be lifted before the fill is compacted.

xii. The granular material shall be compacted in 100mm layers by hand up to 100mm minimum distance above top of pipes.

xiii. During bad weather, or in wet fine grained soils such as clays, silts or sands, it is important to prevent the trench bottom being churned up by mean working in the trench. In such cases a blanket of granular material 75mm thick laid over the trench bottom immediately after excavation, or alternatively a sealing layer of weak concrete 50mm thick, is required.

xiv. Provide concrete bed Grade A (CP 301 Table 1 Specified Works Cube Strength at 21 N/mm2 at 28 days) to drain pipes and concrete infill (Concrete Mix 1:15) where drain track is below level of bottom of foundation base and within 900mm horizontal distance from foundation base. The concrete infill to be carried up to the level of the bottom of the foundation base.

xv. Drain tracks beyond 900mm of adjacent foundations and where the bottom of the trench is lower than a depth beneath the foundation equal to the horizontal distance between the nearside of the trench and the foundation less 150mm, shall be infilled with concrete up to that depth.

xvi. Concrete bed and surround shall incorporate movement joints at each drain pipe joint.

xvii. Each joint shall form a plane surface in the concrete above and below the drain and vertical to the drain and center line, and shall separate the lengths of concrete with 13mm thick resilient fiber board or expanded polystyrene pre-cut to pipe diameter and concrete cross section height and width and left insitu.

xviii. Drains below roadways, car parks, and any area subject to vehicular traffic where less than 900mm of cover shall be bedded and surrounded with concrete Grade 'A' (CP 301 Table Specified Works Cube Strength at 21 N/mm at 28days) 150mm minimum thickness all round with provision for movement joints.

xix. Granular fill shall be laid in 100mm layers and had compacted to a level 300mm minimum above top of pipe followed by main backfill material placed and compacted in 300mm layers any trench sheeting being withdrawn as the work proceeds. Heavy mechanical compactors shall not be used until there is at least 300mm cover over the pipes.

xx. Construction vehicles shall not be allowed to cross drain trenches until the final

surface is placed except where timber sleepers or steel plates are positioned to bridge the trench.

3.3 TESTING

a. Before the sanitary fixtures are installed, drainage and vent pipe systems shall be subjected to a water pressure test to ensure and prove their tightness and to a flow test to ensure their freedom from obstructions.

b. The water pressure test shall be applied to the system in its entirety or in sections. All openings in the piping shall be tightly closed with special cast iron pipe plugs or other suitable means and the system filled with water to the point of overflow from the highest opening. The plugs shall be temporarily opened to make sure that all air has been vented and that water has reached all parts of the system.

c. No section shall be tested to less than a 3 meter head of water. In testing successive sections at least the upper 3 meters of the next preceding section shall be tested so that no joint or pipe, except the uppermost 3 meters of the whole system, shall have been subjected to a test of less than a 3 meter head of water.

d. The water shall be kept in the system or in the portion under test for at least 4 hours before inspection starts. While the system is under pressure, a careful inspection shall be made of all pipes and joints and if any leaks in joints or evidence of defective pipe or fitting is disclosed the defective work shall be corrected immediately by replacing defective parts with new joints and materials. No makeshift repairs or application of any repair compound will be permitted.

e. After the correction is made the pressure test shall be repeated until the system is proved tight.

f. Underground drainage pipes shall be tested by plugging the end of the pipe and filling with water to a minimum head of 3 meters. The test pressure shall be maintained for 24 hours. Pipes and joints shall be inspected and approved before backfilling the trench.

g. All drainage systems shall be tested for proper flow to ensure their freedom from any obstruction. The Contractor shall disassemble, clear, repair and re assemble obstructed piping at his own expense. After re assembly the piping shall again be subjected to the pressure test.

X ---------- END OF SECTION ---------- X

SECTION 22 13 16
AUTOMATIC AIR VENTS

1. GENERAL

1.1 REFERENCE

Conform to the General Requirements and Conditions for Works, Section 01 00 00.

2. PRODUCTS

a. Automatic air eliminators shall be provided at all high points in water pipe work system. They shall be installed at the highest points of the sections they are intended to vent. Insect screen shall be provided on all open vents and overflows.

b. Air vents on water system shall be of float type, air eliminator of approved manufacturer, having bottom inlet and top outlet with screwed connections. They shall have a stainless steel float valve and valve seat, incorporate a stainless steel check valve and shall be so designed as to allow the internal parts to be removed for maintenance or inspection without disturbing pipe work. Air vents shall be suitable for the system pressures and temperatures. An air release pipe shall be connected to the air outlet and taken to the nearest suitable discharge point.

3. EXECUTION

Drain isolating valves shall be provided with every air vent.

X ---------- END OF SECTION ----------X

SECTION 22 13 19.26
GREASE REMOVAL DEVICES

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.

2. PRODUCTS

2.1 GREASE INTERCEPTOR

Unless otherwise specified, the interceptor shall be as follows:

a. The interceptor shall be concrete construction with white coated epoxy finish inside.

b. Cover of interceptor shall be heavy duty, Cast Iron, gasketed air and water tight non-skid safety pattern top manhole cover.

c. The bottom of interceptor shall be cascading type which promotes rapid separation of grease from waste.

d. Baffle wall of the interceptor shall be of concrete. The placement shall assure the positive direction of flow reduced turbulence and accelerated separation of grease into the low pressure collecting chamber.

e. Grease interceptor shall be manual cleaning high volume types and a minimum grease capacity of 300 Kg.

f. The unit shall have all necessary fittings. The unit shall be as shown on the drawings.

3. EXECUTION

Install as per good engineering practice and make all necessary inlet, outlet and vent connections.

X ---------- END OF SECTION ---------- X

SECTION 22 13 19
FLOOR DRAINS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.

2. PRODUCTS

a. Floor trap/drain shall be uPVC construction with cast chrome grating and round strainer. Additionally, these shall be vandal proof.

b. Parking floor catch basin/drain shall be uPVC construction, with heavy duty ductile iron grating with ductile iron tractor grate and slotted sediment bucket. Additionally, these shall be vandal proof i.e. they can only be open with a special tool.

c. Linear Shower Drain shall be SS construction V-shaped channel with 2" [50mm] No-Hub center outlet and adjustable secured leveling frame with built-in tile edge.

3. EXECUTION

a. Provide traps at each floor drain to stop seepage of sewer gases into occupied spaces. Provide trap seal primers for all floor drains and funnel drain traps and extend to nearest plumbing fixture. All floor drains shall have 12mm Trap Primer Tapping.

b. Provide transition pieces with mechanical joint connectors to couple drains to pipes specified.

c. All floor drains shall be vented to local authority requirements or as shown on the drawings, whichever is the more stringent requirement.

d. Refer to drawings for drain sizes. Sizes indicated on drawings refer to the outlet pipe size of drain.

X ---------- END OF SECTION ----------X

SECTION 22 14 26.13
ROOF DRAINS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.

2. PRODUCTS

a. Roof drain shall be Dutco coated Cast Iron body with combined flashing clamp and gravel stop, with Aluminum dome. ASTM A112.21.2M-1983.

b. Roof drain shall be as described above except with 150 mm outlet and no-hub connector. ASTM A112.21.2M-1983.

c. Parapet Drain shall be Dutco Cast iron body flashing clamp and loose set grate. ASTM A112.21.2M-1983.

3. EXECUTION

Roof drains connected to vertical rain water leaders with less than 1.2m of horizontal offset shall be complete with expansion compensators.

X ---------- END OF SECTION ---------- X

SECTION 22 14 26.19

FACILITY TRENCH DRAINS (CHANNEL GRATINGS)

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.

2. PRODUCTS

Channel Gratings to be provided where shown on drawings, of size, material and construction details as shown on drawings.

3. EXECUTION

Ensure that drainage system invert level requirements are met.

X ---------- END OF SECTION ----------X

SECTION 22 14 29
SUBMERSIBLE PUMPS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.

2. PRODUCTS

2.1 MATERIALS

a. Submersible sump pumps shall be duplex arranged suitable for pumping sanitary waste and sewerage. Each pump shall have a capacity, as specified in the Pump Schedule.

b. Pumps shall be of stainless steel /plastic construction complete with level control and float assembly.

c. Each sump pump discharge shall be the size shown on the drawings. Fitting shall be including a union, a gate valve and check valve.

d. Motor shall have class B insulation suitable for 400/3/50 AC operation, and be hermetically sealed, oil filled, with ball bearings, and designed for continuous and intermittent operation.

e. Pump and motor shall be suitable for 60 °C liquids pumped continuously, and shall be factory tested prior to shipment.

f. Included with the pump set shall be 2 mercury float type level switches with 4m of water proof cable.

g. An IP 65 rated Lon compliant pump control panel shall be provided, the Panel shall include all contact relay overload protection, HOA switches for each pump, control transformers, automatic alternators, light indicators etc. for suitable operation and dry contacts for IBMS interface shall be provided.

h. The control panel for sump-pump shall have the following features/functions:
   i. Starting and stopping of pump based on signal from float switch
   ii. Provide Hand / Off I auto switch for each pump
   iii. Provide audible alarm for high water level in pit

iv. Provide interface connections to IBMS
v. Pump duty/Pump head selector switch to be provided
vi. Disconnect switch

i. All electrical panels shall be lockable.

j. Pumps and alarms shall be controlled with floatless, sealed electrodes.

k. Pump shall be operated through the level controllers (High and Low level) and shall be part of pump supplier's scope.

l. Sewage ejector stations shall have gas-tight and vented receiving basins.

2.2 TYPE OF PUMPS

Pumps may be either vertical enclosed shaft type or submersible.

a. VERTICAL - ENCLOSED SHAFT

i. Motors shall be non-overloading at any point on the characteristic pump curve.
ii. Pump floor plate, pump casing, impeller, bearing plate, and bearing pedestal shall be cast iron. Shaft shall be stainless steel enclosed in a steel hanger pipe with grease lubricated intermediate sleeve bearings and packed stuffing box at floor plate.
iii. Thrust bearings shall be ball type, heavy duty, suitable for grease lubrication and contained in a moisture and dustproof housing. Impeller wear adjustment shall be provided at the thrust bearing.
iv. Pump and motor shall be mounted on a common cast iron cover plate containing all required piping connections and a manhole.
v. Receiving basin shall be either cast iron, as furnished with the pump, or concrete as provided under the general construction.

b. SUBMERSIBLE

i. Motors shall be totally enclosed, continuous duty, air filled water-tight casing. Class F, 55^{o}C insulation.
ii. Pump casing and impeller shall be cast iron. Shaft shall be stainless steel.
iii. Pumps shall be arranged so that the pump volute casing is machine matched to the discharge flange and can be removed from the wet well installation by sliding the pump up along guide rails. There shall be no mechanical means of connection. Connection shall be metal-to-metal.
iv. Include hinged cover and frame with guide holders, level control cable holder and standard weight galvanized steel guide rails. These shall be furnished for installation under the general construction contract.

3. EXECUTION

a. The basin shall be cleaned of all debris prior to installing the pumps.

b. The pump discharge piping shall be carefully fitted to avoid placing a strain on the pumps.

c. Motor and control wiring shall be installed supported and protected as recommended by manufacturer.

d. A representative of the pump manufacturer shall be present and verify pump and control operation.

e. All components (Hand Reel, chain etc.) should be made of stainless steel [AISI 316L]

f. Sumps to be constructed complete with all inflow parts, venting cable with plug, cable inlet, seal, discharge parts etc.

X ---------- END OF SECTION ---------- X

SECTION 22 40 00
PLUMBING FIXTURES

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Details provided in the Drawings.

1.2 SCOPE OF WORK

Providing and installing complete set of plumbing fixtures, fittings and accessories as per Drawings, Specification and Bill of Quantities, including all labor, equipment and materials required for the satisfactory operation and installation of plumbing fixtures complete in all respects.

2. PRODUCTS

2.1 GENERAL

a. Plumbing fixtures shall be as indicated on the drawings and as specified herein-after with the required supports, accessories and all drainage, vent and water connections to make the fixtures complete. Fixtures shall be "Low Flow" type; all fixtures shall be of color approved by Consultant with seats unless specified otherwise.

b. Valves, fittings, escutcheons, trim, etc., at each fixture shall be polished chrome-plated brass unless otherwise specified.

c. Carriers shall be furnished for all wall-hung water closets, urinals and lavatories. Carriers shall be floor-mounted and suitable for each particular fixture and wall type. Custom made carrier will not be accepted.

d. Flush Tanks shall be of the ‘dual flush’ type.

e. Fixtures shall be as per fixture schedules on drawings.

f. The water consumption of the fixtures shall be complied with ASHRAE 189.1.

g. All units and assemblies of sanitary ware shall be as shown on the Mechanical and Architectural drawings, listed in schedules and as listed below.

h. Unless approved or stated otherwise all sanitary fixtures shall be from one manufacturer.

i. Each plumbing fixture shall be supplied and installed complete with all necessary fittings for operational and maintenance requirements. All fittings exposed to view (i.e. not concealed in chase, void, duct or buried in building structure) shall be heavily chrome plated unless otherwise indicated in the specification schedules or on the drawings.

2.2 WATER CLOSET (FLOOR MOUNTED)

a. Arrangement: Floor mounted pan with totally concealed low level cistern and plumbing.

b. Pan: constructed from vitreous china to BS 3402, 360mm high pan x 540mm projection with box flushing (two stage) and horizontal outlet, wash-down action.

c. Seat: heavy duty seat and universal cover, top fixed easy release plastics hinges and removable covers.

d. Color: as per selection and client's requirement

e. Cistern: Flushing cistern for WC for concealed installation. Dual flush discharge valve, Interruptible, pneumatic low noise, connection from top or back, insulated against condensation. 6L/4.5L, 410x120x430 mm, angle stop valve ½'', fixing bracket, flush pipe, 45 mm protecting block.

f. Wall plate: For two volume flushing cistern, 156x197 mm. Push button and matt chrome, palm operated with low level cistern adapter.

g. Fixing method: plugged and screw fixed to duct wall.

h. Other accessories: Factory built-in spray unit from the same producer.

i. Hand spray with flexible connection and angle valve and all other accessories and support system

j. Exact dimensions be coordinated with the loaded drawings and site requirement and engineering approval

2.3 WASH BASIN

a. Wall hung type or pedestal type

b. Vitreous china to BS 3402, 600x510 mm or equivalent, but not limited to:

i. Single mixer with ceramic cartridge, electronic sensor type with saving water Accessories and fittings shall be with optic sensor. Fully recessed automatic "Sloane" electrical contractor is to provide a 240V 15 amp current and a 220/24V-30VA transformer (if required)
ii. Pop-up waste fitting
iii. Chrome plated trap 32mm dia.
iv. Two angle valves with escutcheon and copper tube flexible connections
v. Wall brackets or support system as approved

c. Exact dimensions to be coordinated with the loaded drawings and site requirement and engineering approval.

2.4 SINK

a. Single/Double Drainer Sink

b. 304 Stainless steel, 1.6 mm thickness kitchen and of overall dimensions as shown on Architectural drawings. The sink shall be complete with the following trim and accessories (but not limited to):
i. Single lever sink mixer 45 mm dia. deck mounted with ceramic cartridge, swivelling tubular spout, mousseur, with adjustable volume and with saving water accessories and fittings.
ii. White ploy propylene bottle traps with multi-fit outlet and 40mm seal. Each trap shall be supplied with a white flange for plastic waste pipe and all other accessories.
iii. Two angle valves with escutcheon and copper tube flexible connections.
iv. Unit to be fixed at 900 mm above finished floor level to top front edge and to be supported as site approval (as shown on Arch. Drawings).

c. Exact dimensions of the sink shall be coordinated with the loaded drawings and site requirement and engineering approval.

2.5 SANITARY ACCESSORIES

a. All Sanitary accessories shall be as shown on the Architectural drawings and engineer approval.

b. Accessories for Disabled Toilet to be added where applicable.

c. Liquid Soap Dispenser
Recessed wall mounted with lock, shall be fabricated of type 304 (18-8), heavy gage stainless steel with exposed surfaces satin finish Capacity 40oz Liquid soap.

d. Soap Dish and Holder
Recessed type, heavy gage stainless steel satin finish, and removable soap tray.

e. Towel Bar
Surface mounted towel bar shall have chrome plated cast brass support posts with satin finish. Towel Bar shall be 1'' Diameter, 18 gage seamless construction with satin finish.

f. Toilet Paper Holder
Recessed single roll toilet tissue dispenser with hinged hood shall be chrome plated brass.

g. Hand Dryer
Surface mounted hand dryer shall be fabricated from porcelain enameled grey cast iron fitted with fixed nozzle and infrared electronic control. Universal type motor, fuse protected, automatic circuit breaker protecting heating element. Wiring single phase .Dryer shall deliver 130CFM air at 140 degrees F. Entire unit U.L. Listed.

h. Paper Towel Dispenser and Waste Receptacle
The waste receptacle shall be fabricated of type 304 (18-8), 22 gage stainless steel with exposed surfaces in satin finish. Reusable heavy duty vinyl liner holds 16.5 gal.

i. Clear Glass Facial Mirror
Plate glass one piece mirror ¼''float glass, triple silver plated with electro-copper plated layer and thermosetting infrared cured paint backing. Guarantee 15 years against silver spoilage. Secure mirror to wall with screws then fasten rosettes to mirror.

2.6 BIB TAP

a. A combined hose union bib tap and double check valve with a test point for verification and drain down purposes, suitable for class 3 contamination risks.

b. Combined double check valve hose union bib tap prevents backflow contamination. Hose tail outlet, Built-in test point and drain down facility, DZR brass body, fits directly into a wall-plate elbow.

c. Manufactured from DZR brass and incorporating a double check valve for backflow protection, and a test point for verification and drain down purposes.

d. Provides protection against class 3 contamination risks, and suitable for use as an external supply, drain off tap, or standpipe.

e. Designed to fit directly into a wall plate elbow via the 1/2" male inlet, and terminates in a hose tail attached to the tap body via a 3/4" BSP union.

f. Materials:

i.	Body	: DZR brass
ii.	Check cartridges	: Acetyl polymer components NBR elastomer seals Stainless Steel spring
iii.	Headwork	: Brass
iv.	Washer	: EPDM elastomer
v.	Ball	: Chrome plated DZR brass
vi.	Seals	: PTFE
vii.	Lever	: Aluminum
viii.	Standard	: 1010 Bib Tap conforms to BS 1010/2.

g. Specifications:

i. Working pressure: 16 bar max.
ii. Working temperature: 90˚C max.
iii. Inlet connection: 1/2" BSP male.
iv. Outlet connection: Hose tail (via 3/4" BSP union)

3. EXECUTION

a. Provide the necessary plates, brackets, cleats, supports etc., for rigidly securing fixtures in place. All roughing-in shall be accurately laid out No offset will be accepted.

b. All fixtures shall be free of defects. Any fixture which, in the opinion of the Consultant, is damaged shall be removed and replaced. Clean and polish all fixtures and trim upon completion.

c. All exposed chromium plated fittings such as pipes, valve etc., shall be protected immediately after installation. During installation strap or padded wrenches shall be used on charge plated pipe and fittings etc.

d. All fixtures shall be set straight and true. The setting shall be level and flush with finished floors and partitions.

e. Fixture mounting heights and spacing shall be as detailed on the Architectural and plumbing drawings.

f. Protect fixture from damage before and after installation.

g. Fasten fixture carriers securely to slab construction with power driven expansion shields and bolts.

h. Wall-mounted fixtures with a back water connection shall have an adjacent access door, unless the pipe space is accessible and is sufficiently wide to allow the water connection to be made from within the pipe space. For this pipe space shall be 200mm minimum clear width.

i. Supply pipe to flush valve shall be anchored inside wall or pipe space to prevent- movement of flush valve when open rated.

j. Wherever shown on the drawings and in all public toilets provide chrome-plated, trigger operated cleansing hose (AB) 1200mm long with suitable wall hanger in the proximity of each toilet.

X ---------- END OF SECTION ---------- X

SECTION 22 67 19.16
REVERSE OSMOSIS WATER EQUIPMENT

1. GENERAL

1.1 REFERENCE

a. Conform to the "General Requirements and Conditions for Works", Section 01 00 00.
b. Conform to the "Common Work Results for Plumbing", Section 22 05 00.
c. Conform to the "Testing and Commissioning of Plumbing System", Section 22 08 00.
d. Conform to the Details provided in the Drawings.

1.2 DESCRIPTION

a. Provide complete Packaged Type Reverse Osmosis (RO) Water Treatment System producing high purity water by removal of dissolved minerals, bacteria, particles and organic impurities.
b. Designed for continuous automatic operation.
c. The system shall include pre-filter, product storage tank and all devices necessary for fully operational system.
d. Operation shall be controlled by the water level in the product storage tank.

1.3 APPLICABLE CODES & STANDARDS

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by their basic designation only.

a. American Society of Mechanical Engineers (ASME):
   B40.100-2013
b. ASTM International (ASTM):
   A269/A269M-2014e1
   D1785-2012
c. American Water Works Association (AWWA):
   B300-2010 Hypochlorites
   B301-2010 Liquid Chlorine
   C651-2014 Disinfecting Water Mains
d. National Electrical Manufacturers Association (NEMA):
   ICS 6-1993 (R2001, R2006)
e. National Fire Protection Association (NFPA):
   70-2014
f. Department of Health and Human Services, Food and Drug Administration (FDA):
   CFR 21, Chapter 1, Part 175.300

1.4 SUBMITTALS

a. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
b. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 67 19.16, REVERSE-OSMOSIS WATER EQUIPMENT", with applicable paragraph identification.
c. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
    i. Catalog cuts, complete description and specifications of all equipment and accessories.
    ii. Accessories including filters, product storage tank, pressure gages and test kit.
    iii. Performance data including normal and maximum flow and pressure drop. Certification that required performance shall be achieved.
    iv. Piping.
d. Complete detailed layout, setting, arrangement, and installation drawings including. Drawings shall also show all parts of the apparatus including relative positions, dimensions, and sizes and general arrangement of connecting piping.
e. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.
f. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 SUBMITTALS

a. Manufacturer shall have been engaged in the manufacture of RO systems as a primary product for at least ten years. The ten year requirement supersedes any conflicting requirement in other parts of the project specification.

1.6 PROJECT CONDITIONS

a. Influent Water Analysis:
    Maximum Silt Density Index (SDI) Rating : _____
    Turbidity, NTU : _____
    Maximum Free Chlorine and/or Chloramine : _____
    Color : _____
    Maximum pH (continuous) : _____
    Minimum pH (continuous) : _____
    Maximum pH (cleaning-30 minutes) : _____

Minimum pH (cleaning–30 minutes) : _____
Confirm the analysis with current samples and tests.

b. Design Parameters:
Normal System Flow : _____L/s (_____gpm)
Maximum System Flow : _____L/s (_____gpm)
Daily Water Usage : _____Liters/day (_____Gallons/day)
Daily Hours of Water Demand : _____
Operating Temperature Range : ____to ____˚C (____to ____˚F)

1.7 AS-BUILT DOCUMENTATION

a. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
b. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be // in electronic version on compact disc or DVD // inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
c. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD version provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.
d. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and a certification that all results of tests were within limits specified.

2. PRODUCTS

2.1 RO SYSTEM

a. Packaged automatic RO system mounted on steel frame, designed for project conditions. Equipment arranged on the frame to allow easy access for operating, maintenance and repair. Unit shall include RO membrane, pressure vessels, pre-filtration system, high

pressure pump and all required piping, wiring and controls for a fully operational system.

b. Performance Requirements:
    i. Membrane reject ratio: 98 percent minimum. TDS of product is 2 percent maximum of input TDS.
    ii. Capture rate: 75 percent minimum. Maximum amount of water to drain 25 percent of input.

c. RO Membrane Elements: Thin-film composite with fiberglass reinforced polyester (FRP) over-wrap, anti-telescoping device, u-cup brine seal. The design salt rejection shall be 98 percent based on 2000 ppm water at 1550 kPa (225 psig) at 25 degrees C (77 degrees F).

d. RO Element Housings: Type 304 stainless steel with PVC end caps held in place with stainless steel bands. Each housing assembly complete with one set of O-rings and O-ring lubricant. (Bio-based materials shall be utilized when possible.) Housings for systems over 34,070 L per day (9,000 gallons per day) shall be constructed of FRP. Provide cleaning connections.

e. High Pressure Pumps and Motors: // Single // Duplex // vertical multistage high efficiency centrifugal type with Type 304 stainless steel casing, shaft, impellers. Tungsten carbide and ceramic shaft seals. Cast iron frame with flanged piping connections. Premium efficiency TEFC motor selected to be non-overloading on the entire performance curve.

f. Manual Valves:
    i. Pump Throttle Valve: Type 316 stainless steel ball valve, socket welded.
    ii. Concentrate Throttle Valve, Recycle Throttle Valve: In-line needle style, stainless steel, rated for 2070 kPa (300 psig) minimum.
    iii. Inlet Isolation Valve, Product and Concentrate Check Valves: PVC with EPDM seats and seals.
    iv. Feed water Sample Valve, Product Water Sample Valve: PVC plug valve with EPDM seats and seals.
    v. High Pressure Sample Valve: Type 316 stainless steel plug valve.

g. Automatic Valves:
    i. Automatic Inlet Shut Off Valve: Solenoid type, diaphragm actuated, normally closed, constructed of glass-filled Noryl thermoplastic.
    ii. Automatic Membrane Flush Valve: Provide for purging the membranes with fresh water upon machine shut down.

h. Piping:
    i. Low Pressure Feed, Reject and Recycle Piping 520 kPa (75 psig and under): ASTM D1785, Schedule 80 PVC, socket welded and flanged.
    ii. RO Product Tubing From Each Membrane Housing: ASTM D1785, Schedule 80 PVC, socket welded and flanged.
    iii. Low Pressure Control and Pressure Gage Tubing: Polyethylene.
    iv. High Pressure Reject and Recycle Piping 520 kPa (above 75 psig): ASTM A269/A269M, Type 304 Schedule 10 stainless steel with butt welded joints.
    v. High Pressure Control and Pressure Gage Tubing: 6895 kPa (1000 psig) burst nylon.

i. Controls:
    i. Electronic // PLC // DDC // controller providing automatic control for all operating functions. Motor starter panel. All in FRP enclosures rated NEMA 4. All wiring factory-

installed and tested. Comply with Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES and NFPA 70.

ii. Auto flush indicator and control to flush RO concentrate at shut down or at predetermined intervals.

iii. Warning Alarms: Low quality product, low feed pressure, high feed temperature. Connect to BAS system.

iv. Automatic Shutdowns and Alarms: Low feed pressure, low product quality, pretreatment out of service, storage tank full.

v. Status Indicators: Low feed pressure, low quality, flow alarm, high feed water temperature, product divert to drain valve open, pretreatment lockout, storage tank full.

vi. Low and High pressure safety switches.

vii. Tank water level control switches.

viii. Pump Motor Starter: Comply with Section 26 29 11, MOTOR CONTROLLERS.

j. Miscellaneous Controls: Elapsed run time indicator, alarm horn, chemical pump receptacles, convenience receptacles, minimum 8 auxiliary contacts 2DI, 2DO, 2AI, 2AO.

k. Instrumentation and Displays:

i. All instrumentation readouts panel-mounted in FRP enclosures rated NEMA 4. All factory wiring. Comply with NFPA 70.

ii. Digital flow indicators for, product, reject, recycle.

iii. Pressure gages for inlet, cartridge filter outlet, RO feed, RO concentrate, and RO product.

iv. Conductivity indicator measuring product quality with digital displays, alarm relays and automatic temperature compensation.

v. Conductivity probe mounted in the RO product.

l. Skid and Frame Assembly: RO machine shall be built on a skid and frame constructed of welded structural carbon steel. The entire surface shall be sand-blasted and coated with high solids epoxy coating. Bio-based materials shall be utilized when possible.

m. Reassembly: Unit shall be shipped to the site completely assembled and tested. If units or sections are to be disassembled at the site to allow for installation in a limited space, the unit shall be reassembled and tested for intended operation by a factory authorized technical representative.

2.2 PRE-FILTER

a. Single multi-media filter sized for the RO machine inlet flow rate. Filter designed for suspended solids removal down to 10 microns and automatic backwash cycle.

b. Media Tank: FRP designed for 1035 kPa (150 psig). Pre-piped internal backwash distributor and filtered water collector.

c. Filter Media: Top layer of anthracite, middle layer of silica sand, bottom layer of multi-grade garnet. Install filter media at job site.

d. Backwash Cycle: Top-mounted, piston-operated control valve with pre-sized drain line flow control orifice. The cycle shall be initiated by and adjustable seven day electronic time clock.

Include RO lockout switch.

e. Replacement Filter Media: Provide elements for one complete replacement.

2.3 ACTIVATED CARBON FILTER

a. Single filter sized for the RO machine inlet flow rate. Designed to remove chlorine and prevent RO membrane damage.
b. Media Tank: FRP designed for 1035 kPa (150 psig). Pre-piped internal backwash distributor and filtered water collector.
c. Filter Media: 12 x 40 mesh bituminous coal-based activated carbon. Install media at job site.
d. Backwash Cycle: Top-mounted, piston-operated control valve with pre-sized drain line flow control orifice. The cycle shall be initiated by and adjustable seven day electronic time clock. Include RO lockout switch.

2.4 RO WATER STORAGE TANK

a. Free-standing, closed-top, flat-bottom, _____cubic meters (_____cubic feet) total volume. Top access man way, PVC bulkhead fittings for high and low level alarm switches, RO permeate inlet, RO permeate discharge and drain. Install 0.2 micron tank vent filter at the top head. Vented to atmosphere.
b. Materials of Construction: Linear polyethylene in one piece.
c. Tank Water Level Control: Adjustable float switch that signal starting and stopping RO pump. High and low level alarm switches.

2.5 PRESSURE GAGES

a. ASME B40.100, Grade A, 1 percent accuracy, 115 mm (4-1/2 inches) diameter, all metal case, and bottom connected. White dials, black hands, graduated from 0 to 690 kPa (0 to 100 psig) and identity labeled.

2.6 WATER TESTING EQUIPMENT

a. Furnish water testing equipment in a portable cabinet specially made for the installed equipment. Include sufficient materials for 6 months of normal testing procedures.
b. Silt Density Index (SDI) apparatus to measure degree of suspended solids feeding the RO membranes. Include pressure regulator, pressure gage, filter holder, 600 mL (20 ounce) beaker, sample valve, tubing and 0.45 micron filter papers.
c. Test kit to measure total water hardness, total iron, free chlorine, pH.

3. EXECUTION

3.1 REQUIRED TECHNICAL SERVICES

a. Provide services of a qualified manufacturer's representative to check complete installation for conformance to manufacturer's recommendations, put system into service, make all adjustments required for full conformance to design and specified requirements, and perform all demonstrations and tests.

3.2 FLUSHING AND DISINFECTING

a. Flush and disinfect new water lines and RO system and tank interiors in accordance with AWWA C651.
b. Material:
    i. Liquid chlorine: AWWA B301.
    ii. Hypochlorite: AWWA B300.

3.3 STARTUP AND TESTING

a. Operating: Tests shall be run in presence of COR.
b. Procedure:
    i. Operate RO system at constant maximum required capacity for one hour after demineralized RO product water is produced. When necessary, waste product water to sewer to maintain above flow rate. Product water production shall begin when a sample shows that demineralization complies with requirements.
    ii. Demonstrate all features of the control system including diagnostics and flow and cycle indications.
c. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Contractor shall provide a minimum of 10 working days prior to startup and testing.

3.4 COMMISSIONING

a. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.
b. Components provided under this section of the specification will be tested as part of a larger system.

3.5 DEMONSTRATION AND TRAINING

a. Provide services of manufacturer’s technical representative for four hours to instruct VA Personnel in operation and maintenance of the system.

X ---------- END OF SECTION ---------- X

SECTION 23 11 23

FACILITY NATURAL GAS SYSTEM

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for Works, Section 01 00 00.
b. Conform to the Regulations of SSGC/SNGPL.
c. Gas meter shall comply with latest version of OGRA Statutory Notification (2009).
d. Gas meter shall be in accordance with ANSI B 109.1-1973 Addenda B109.1-1973 and Addenda B 1091a/O.I.M.L

1.2 SCOPE OF WORK

Providing and installing complete set of plumbing fixtures, fittings and accessories as per Drawings, Specification and Bill of Quantities, including all labor, equipment and materials required for the satisfactory operation and installation of plumbing fixtures complete in all respects.

2. PRODUCTS AND EQUIPMENT

2.1 GENERAL

a. All the material used is the gas distribution network must comply with the specifications of the Local Authorities.

b. The gas distribution system shall be installed as indicated on the Drawings, complete with all valves, regulators, and other required items.

c. At every entrance of gas piping into a building, the piping shall first rise above grade on the building exterior to prevent upstream gas leaks from following the piping inside the building. Provide wrench operated shutoff valve in the horizontal portion of this exterior piping at each location.

2.2 NATURAL GAS DISTRIBUTION SYSTEM

The natural gas system shall be installed using the materials and methods as specified herein and in the following paragraphs.

a. VALVES

The gas regulator bypass globe valve shall be sized to pass only a slightly larger maximum flow rate than the gas regulator. It shall include provision for locking shut with a large padlock.

b. GAS CUTOFF

On the inlet and discharge side of the meter and pressure regulators and at building entrance, install a wrench operated plug cock valve. The flanges of this stop valve shall be dimensioned, drilled, faced and spot faced to conform to the Class 125 American Standard for Cast Iron Flanges (B16.1 1948). Install zone valves on each floor accessible to occupants for shutting off areas of the building under emergency conditions. Gas piping shall be welded up to these zone valves.

c. NATURAL GAS PIPING

i. All pipe used for the fabrication of gas piping systems shall be Schedule 40 black steel pipe that conforms in every detail to Standard Specifications.
ii. No pipe smaller than 3/4", or as detailed for laboratory furniture, shall be used. From the emergency shutoff valve to the outlets the pipe shall be assembled with threaded fittings provided all joints are exposed or within the confines of the laboratory furniture.
iii. All gas cocks and valves shall be accessible for inspection and repair. All gas piping within the building shall be installed above suspended ceilings or exposed to view.

d. FITTINGS

In no case shall the wall thickness of a fitting incorporated in a gas piping system be less than that of the pipe to which it is jointed. All screwed pattern fittings specifically called for shall be Class 150 malleable iron fittings.

e. FLANGES

In all instances in which flanges are required for the installation of flanged fittings for gas lines, the Contractor shall provide Crane or Walworth weld neck pattern, Class 150 forged steel flanges. These flanges shall be dimensioned, faced grilled and spot faced to conform to the Class 150 American Standard for Steel Pipe Flanges and Flanged Fittings (B16.9 1964). See piping section for additional requirements for flanges.

f. HEADERS

i. The gas distribution header installed by this Contractor in the building shall be

fabricate of Schedule 40 steel pipe. The header shall be dimensioned to conform to details shown on the Drawings.

ii. After the header has been completely fabricated, it shall be temporarily sealed and subjected to a pneumatic test pressure of 100 pounds per square inch. While the header is subjected to this pressure, all welded joints shall be given an application of soapy water for the purpose of detecting minute leaks which might not otherwise be observed. These leaks shall not be repaired by any peening operations. Such leaks shall be remedied by chipping and rewelding until the header is devoid of leaks at that pressure. The header shall then be subjected to a hydrostatic test pressure of 200 pounds per square inch. Under these circumstances, the test pressure of the water confined in the header shall not decrease in a four hour period of observation. If leaks are encountered, they shall be eliminated in the manner prescribed by the Owner's duly authorized representative.

iii. The header shall be provided with a one half inch (1/2") drain connection "taken off" the bottom of the header and terminated in a suitable stop cock. This one half inch (1/2") drain connection shall have its origin in a 2" x 1/2" welding reducer having its two inch (2") end so welded to the header as to completely drain that member. Each outgoing branch from the header shall be provided with a cock.

g. COCKS

Near the point at which each outgoing line leaves the gas header, the Contractor shall install a stop valve or cock. These wrench operated valves shall each be provided with an appropriate wrench. Cocks of the same type shall, moreover, be installed at each other point indicated on the Drawings.

h. DRIP PIPES

i. Drip pipes shall be provided throughout the gas piping systems for the purpose of accumulating moisture and condensate. They shall be sized no smaller than the gas piping to which they are connected in each instance. These drip pipes shall be U shaped providing an effective water seal of no less than twelve inches (12") of water. The extremity of each U shaped drip pipe shall be threaded and capped with a suitably sized, screwed pattern, black, standard weight, and malleable iron cap.

ii. All drip pipes shall be located in an accessible position so that the condensate may either be pumped from the system or so that a water seal shall be provided in the event that the water forming the seal evaporates.

2.3 SYSTEM COMPONENTS

a. GAS FLOW METER

Gas meter shall be installed complete in all respects including valves and fittings as per

drawings and manufacturer's recommendation, and to satisfaction of SSGC/SNGCL.

i. Meter shall be suitable for measuring natural gas of specific capacity from 0.5 to 0.7 with ±2% flow measurement accuracy and provide readings in SCFH at 0.5" W.C differential.
ii. Meter shall be suitable for base pressure of 14.65 Psi(a) at 60 F within an operating temperature range of -30 F to 122 F.
iii. Accuracy of gas meter should be independent of gas physical characteristics such as density, temperature and pressure.
iv. Gas meter shall be Diaphragm type gas displacement meter with a synthetic rubber, ling life, and temperature resistant diaphragm.
v. Housing shall be of Pressure die cast aluminum with separate inserted steel ferrule threads NPT male or corrosion resistant steel casing with powdered coating and with re-enforced steel ferrules threaded NPT male.
vi. The glass index should be unbreakable.
vii. Meter shall be class 170 with Top mounted ¾" NPT male threaded / matching straight swivel should be supplied with the meter.

b. GAS DETECTORS (WHERE APPLICABLE)

The gas detectors shall use a pellistor sensor to detect flammable gases and vapors. The sensor shall be housed in a stainless steel, flame proof housing, fitted onto an explosion proof junction box.

c. SOUNDER FLASHER (WHERE APPLICABLE)

A sounder cum flasher unit shall be installed in the vicinity of the panel located in a visible area.

d. CABLES (WHERE APPLICABLE)

MICC cables of at least 1.5 sq. mm area shall be used to interconnect between each detector and the control panel.

3. EXECUTION

3.1 GENERAL

a. Drip pipes of adequate capacity must be installed where traps are formed by such changes in grade. Drip pipes shall terminate a screwed pattern, malleable iron black cap. No drip pipes shall be used as outlets for the attachment of any fixture or gas appliance. Drip pipes must, moreover, be placed at the bottom of all vertical pipes which rise from and connect to the end of any horizontal pipe.

b. All house piping must be securely fastened in place in such a manner as to maintain its grading. Under no circumstances shall extension bars be used for supporting gas piping. Under no circumstances shall any gas piping be used to support any weight other than its own weight. All branch outlet pipes shall be taken from the top or sides of running horizontal lines and not from the bottom. No crosses shall be installed in any horizontal gas line. No unions, gas cocks, or valves shall be used in any concealed location. Every gas cock and valve shall be accessible for inspection and repair.

c. The general arrangement of all gas piping shall be such that the number of threaded joints involved is reduced to an absolute minimum. If obstructions are encountered, pipe shall not be bent to circumvent such obstructions. Wherever gas pipes run through outside brick, stone, or other walls, the opening around the pipe shall be securely and rigidly sealed. Gas pipe sizes shall be at least one pipe size larger than the inlet of the gas appliance which they supply. No bushings shall be used in conjunction with any gas piping.

d. Refer to Sections for other information concerning installation of piping.

3.2 EXAMINATION

a. Verify that excavations are to required grade, dry, and not over excavated.

3.3 PREPARATION

a. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
b. Remove scale and dirt, on inside and outside, before assembly.
c. Prepare piping connections to equipment with flanges or unions.

3.4 INSTALLATION

a. Provide non conducting dielectric connections wherever jointing dissimilar metals.
b. Route piping in orderly manner and maintain gradient.
c. Install piping to conserve building space and not interfere with use of space.
d. Group piping whenever practical at common elevations.
e. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
f. Provide clearance for installation of insulation and access to valves and fittings.
g. Provide access where valves and fittings are not exposed. Coordinate access door location with architectural features.
h. Establish elevations of buried piping outside the building to ensure a minimum of cover.
i. Meter shall be installed complete in all respects including valves and fittings as per drawings and manufacturer's recommendation, and to satisfaction of SSGC/SNGCL.

3.5 TESTING

a. All gas piping systems shall be very carefully tested by the Contractor. These piping systems shall first be subjected to a pneumatic test pressure of 100 pounds per square inch. All hydro and pneumatic tests shall be dead weighted, recorded, and countersigned by the project inspector. A final test shall be performed after casework and lab hook up are completed at 15 psi for a minimum of 4 hours. If leaks are found, they shall be repaired. Alternate testing shall be repeated until gas piping systems are absolutely tight at the pneumatic test pressure indicated above. If leaks occur in the case of threaded joints, such leaks shall be eliminated by legitimate means, i.e., either by replacing leaking fittings or by tightening them properly. Leaking flanged joints shall have flange bolts appropriately tightened or have gaskets causing leaks replaced.

b. Then the entire gas piping systems shall be subjected to a pneumatic test pressure of 100 pounds per square inch. Such gas piping systems must be demonstrated to be absolutely tight when subjected to this pressure for a period of twenty four hours. In all instances in which leaks are then found, they shall be eliminated in the manner designated by the Owner's duly authorized representative. A one half inch (1/2") test connection and cap shall be provided in each branch of the gas piping system.

c. After all pneumatic testing of the entire gas piping system has been completed and all leaks have been repaired and at a time deemed suitable by the Owner's duly authorized representative, the Contractor shall have the gas supply turned on and the gas odorant chemical added by a representative of the gas company. The Contractor shall then bleed gas from every riser and every run-out until the odor is present in the proper quantity at every gas outlet.

3.6 LOGIC OF OPERATION (FOR GAS LEAK DETECTION SYSTEM WHERE APPLICABLE)

a. When low level gas leak is detected in any zone, local internal alarm and indication shall show on the control panel. When high level gas leak is detected in any zone, the following sequence shall occur:

   i. The solenoid valve in the gas distribution channel shall be closed automatically
   ii. External alarm shall be operated

b. Connection to the fire alarm system:
   In the event of a fire alarm signal, the following sequence shall occur:

   i. The solenoid valve in the gas distribution channel shall be closed automatically
   ii. The sprinkler system shall operate

c. In the event of an emergency, it shall be possible to bypass the automatic system and operate the system manually, this shall include:

i. Manual shut OFF/ON of the gas through the emergency shut-off push button
ii. Manual operation of the sprinkler system On/Off
iii. Manual reset

X ---------- END OF SECTION ---------- X

TECHNICAL SPECIFICATIONS
(E. ELECTRICAL AND ALLIED SYSTEM WORKS)

SECTION 26 01 26
TESTING OF ELECTRICAL SYSTEMS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works, Section 01 00 00.
b. Conform to the Common Work Results for Electrical, Section 26 05 00.
c. Follow the Consultant's Instructions and Manufacturer's Recommendations.

1.2 SCOPE OF WORK

a. Prior to acceptance, inspect, operate and test all electrical equipment, materials and, components, whether such tests are detailed in this specification or not. The Engineer, to ensure that the operation of the systems and components satisfies the requirements of the contract documents, will supervise tests.

b. Include any specific testing required by the Authorities, or any other body having jurisdiction over the installation, and as directed by the Engineer.

c. Provide all tools, equipment, labor and materials required to perform the electrical, testing.

d. Provide three copies of the test reports to the Engineer.

e. The Engineer reserves the right to witness factory testing of switch gear, generator and fire alarm equipment; the total cost for which shall be included in the tender price of this Section. Co-ordinate with the equipment manufacturers and notify the Engineer 10 days before any factory testing, to confirm whether he or his appointed representative will be present.

2. EXECUTION

2.1 GENERAL REQUIREMENTS

a. Testing shall be conducted by fully qualified personnel only. Where required, arrange for site testing to be carried out by Independent testing consultants specializing in the type of work for the particular system involved.

b. Test in accordance with the applicable standards issued by the governing organizations, (e.g. UL, NFPA, K-ELECTRIC, IEE), and with the recommendations of the manufacturers.

c. The cost of travel etc. of all client personnel shall be borne by the client. The contractor shall only built in cost of his own travel and the cost of the actual testing in the tender price, whether performed in the field or at the, factory. Inform the manufacturers of the factory and site testing requirements.

d. Make test records in a neat and legible manner, fully identifying the equipment or system being tested, test results and test date. Submit 3 copies to the Engineer after each test.

e. Do not energize distribution or control equipment until the test results have been reviewed and approved by the Engineer.

f. Ensure phasing and phase rotation is the same throughout the, system. Ensure all devices are wired for the same polarity.

g. Test the voltage on the last outlet of each circuit. The maximum permissible voltage drop shall be ±4%.

h. Measure the load on each phase at each switchboard, distribution panel, power panel, lighting panels on each phase as directed by the engineer and recheck the load.

2.2 EQUIPMENT AND SERVICES

a. **BATTERIES**

i. Check battery voltage and specific gravity of each cell in accordance with the manufacturer's instructions.
ii. Charge the battery, discharge at rated load for 112 hour, and recheck battery voltage and specific gravity of each cell. Record all results and forward to the Engineer.

b. **BATTERY CHARGERS**

i. Energize the battery charger and operate until battery full charge is indicated
ii. Discharge the batteries to the fully discharged condition. .
iii. Recharge the batteries. Record the DC voltage and current once per hour for 8 hours. Test the batteries to ensure they have reached at least 95% of full charge.
iv. Continue charge to ensure the charger changes from equalize rate to float rate.
v. Demonstrate that the automatic timer controls the charging and correctly transfers from equalize to float charge after the selected period.
vi. Simulate faults to demonstrate the alarm lights and audible alarms perform as designed.
vii. At the end of the tests, with the batteries in fully charged condition, operate the charger on float for a minimum period of 24 hours to ensure a stable condition is reached and held.

c. **EARTHING**

i. Test the earthing system for compliance with code and the requirements of the electric supply authority i.e. K-ELECTRIC.

ii. Notify the supply and inspection authorities so that they may be present to witness contractor testing. Provide any assistance the supply authorities require for their testing procedures.

d. **INSULATION**

i. Check the insulation resistance to ground and phase to phase of all parts of the electrical installation with a 1000volt Megger.

ii. Test with all panels, switches, socket outlets and branch circuit wiring installed and connected, but without fluorescent fixtures connected.

iii. Complete Insulation test to the engineer's approval before powering any circuit.

e. **1.8 LIGHTING**

i. Verify the correct lamps, position, ballast and operation of all fixtures.

ii. With all Lighting in operation, measure the average illuminance on the floor or tread (by establishing the maximum and minimum levels) in the following locations:

- Exits, public corridors, corridors leading to exits, electrical equipment rooms, elevator machine rooms and hoist way pits
- Offices, storage rooms, service rooms, garages, washrooms and stair ways
- Every place of assembly
- Rooms and areas as directed by the Engineer

iii. With only the emergency lighting in operation, measure the average illumination at exits, l public corridors, floor areas where the public may congregate and other rooms and areas as directed by the Engineer.

iv. Take readings at night, with no outside light contribution.

v. Take readings with a cosine corrected portable digital illuminance meter, or with a video camcorder with suitable software for illuminance measurements. Measuring instruments shall be tested, calibrated and certified accurate to within 2%.

vi. Submit technical, testing and calibration data as well as certification on the photometer.

vii. Plot lighting results on a set of reproducible plans for review by the Engineer and submission to the authorities.

X ---------- END OF SECTION ---------- X

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL SERVICES

1. GENERAL

1.1 REFERENCE

Conform to the General Requirements and Conditions for MEP Works, Section 01 00 00.

1.2 SUMMARY

Provide all materials, equipment, labor and services to complete the installation, wiring, testing and commissioning of the complete and functioning electrical system including, but not limited to, the following:

a. Low Voltage Distribution

b. Power Distribution

c. Lighting

d. Fire Detection and Alarm System

e. Structured Cabling for Voice and Data

f. CCTV System

g. Access Control System

h. Earthing System

i. Triple Play System

1.3 SOURCE OF POWER AND UTILIZATION VOLTAGE

a. Electrical power shall be supplied at 11 kV/400V three phase 50Hz by K-ELECTRIC.

b. The nominal distribution voltage shall be 400V, 50 Hz, 3 phase and neutral, 4 wire.

c. Motors, electric heating controls and distribution devices and equipment shall operate satisfactorily at 50 Hz and within the operation limits established by the codes without

damage to equipment.

d. All electrical equipment shall be designed for operation in 45°C ambient temperature and relative humidity at 50%, unless stated otherwise. Copies of test certificates shall be submitted to the Project Manager for approval prior to ordering equipment.

1.4 UTILITY SERVICE CONNECTIONS

a. The Utility connection from K-ELECTRIC will be arranged and paid by the Client directly. The Contractor shall facilitate on site for access and working.

b. The HV Switch gear and transformers shall be supplied by the Contractor.

c. The Contractor shall include within the Contract all costs associated with attendance on site, liaison and co-ordination with K-ELECTRIC.

d. H. V. incoming cables to the H. V. switchgear will be supplied, installed and terminated by K-ELECTRIC. The Contractor is responsible for conduits/sleeves and cable trays.

e. The Contractor shall be responsible for all necessary crane age for the installation of the transformers and switchgear.

1.5 EXAMINATION OF EXISTING CONDITIONS

a. Examine the site to ascertain the existing conditions before submitting a tender.

b. No consideration shall be given to any claims arising from circumstances, which were visible upon, or reasonably inferable from, an examination of the site prior to submission of the tender.

1.6 RELATION TO WORK OF OTHER DIVISIONS

a. Examine the work of other Divisions upon which the work of this Division interfaces with and/or depends for proper completion. Report any defect or variance to the Engineer. Do not commence work under this Division until such defects have been corrected

b. Co-ordinate the work of the Electrical Division with the work of the other Divisions in all such a manner to ensure proper co-ordination and that there is no interference. In areas where conduits and equipment called for in the Electrical Division are to be installed in conjunction with pipes, ductwork and equipment called for in other Divisions co-ordinate the work with the other Divisions to ensure the best use of the space.

c. Co-ordinate with other Divisions, excavation, backfilling, formwork, shoring and concrete

work for manholes, cable pits, equipment bases, concrete pads, lighting pole bases and all other work of this Division, to be carried out under the appropriate Divisions associated with this Specification.

d. Verify in the field dimensions, location and clearances affecting the work of this Division.

1.7 CODES & STANDARDS

a. Comply with the latest rules and regulations of the IEE, NFPA, UL, IEC, BS, K-ELECTRIC, PTCL, PEC and all local Municipal and Statutory Authorities having jurisdiction over the installation.

b. The standards established by the drawings and specifications shall not be reduced by any of these codes and bodies.

1.8 PERMITS, FEES AND INSPECTIONS

a. The Client shall obtain and pay for all necessary inspections, permits and licenses, and the contractor shall perform all tests required by the Governing Authorities, Municipal and/or Statutory. Provide drawings specifications and other information required for these purposes.

b. The Contractor shall coordinate with Utility and submit a copy of each final approved inspection certificate for the approval of the Engineer before final payment.

1.9 SHOP DRAWINGS

a. Conform to the requirements specified elsewhere in these documents.

b. Submit shop drawings for all floor plans showing lighting, small power and ELV systems along with conduit sizes and number of cables in each conduit, each presented separately using standard symbols, legend and general notes.

c. Submit shop drawings for all equipment supplied under this Division, including dimensioned layouts, schematic diagrams and wiring diagrams for components and A/C systems.

d. Provide additional copies of shop drawings at the Engineer's request, for other Divisions or Authorities having jurisdiction over the installation.

e. Shop drawings shall clearly indicate the materials and equipment being supplied, details of construction, finish, accurate dimensions, capacities all performance. Drawings shall be certified correct and ‘For Construction’ by the manufacturer before submission.

f. Check and sign all copies of each shop drawing before submission, indicating that it conforms to the requirements of the specifications and drawings, and that it has been properly coordinated with related equipment, whether supplied under this or other Divisions. Indicate comments, corrections and changes in green.

g. Each shop drawing for non-catalogue items shall be prepared specifically for this work. Brochures submitted for catalogue items shall be accompanied by a 'parts list', detailing all items proposed to be used, and be marked to specifically indicate the items to be supplied.

h. Unless specific written permission is given, do not begin fabrication or installation, until shop drawings are approved.

i. Shop drawings shall be provided in the form of one (1) reproducible copy and three (3) prints for review. Three (3) additional prints shall be provided once comments have been made for record. The drawings shall have sufficient space in the front for all Engineers' and Contractors' "review" stamps.

j. All shop drawings shall be produced on AutoCAD 2007 or later.

k. All drawings are to be prepared in ample time for review and implementation. Failure to do so, and any problems that arise, shall be the responsibility of the Contractor.

1.10 RECORD DRAWINGS

a. Comply with the requirements specified elsewhere in these documents.

b. Maintain one (1) record Contract set of white prints on site at all times. Clearly mark on these Contract prints in red, as the job progresses, all site changes and deviations from the Engineers "Construction Issue" documents, including the locations of panels, boxes, equipment, underground services and feeders to lighting, distribution, communications and signal panels, and all conduit runs for all systems. Record drawings shall detail existing I systems and/or installations to be retained. The levels of information to be shown shall in be equal to that required by this Specification were the installation carried out by this Division.

c. In addition to the record contract set, keep one (1) up-to-date set of white prints on site at all times.

d. Indicate dimensions of buried services relative to the building column lines, and invert levels relative to finished floor levels or grades.

e. Record revisions or variations covered by authorized changes.

f. The record drawings shall be reviewed at regular intervals of 1 month by the site engineer, and shall be taken into consideration when reviewing the monthly application for Progress Payment.

g. Record drawings shall incorporate all change orders and Engineers Instructions.

h. All record drawings shall be produced on AutoCAD 2007 or later.

i. Record drawings shall be provided in the form of one (1) reproducible copy and three (3} prints for review. Three (3) additional prints shall be provided once comments have been made for record. The drawings shall have sufficient space in the front for all Engineers' and Contractors' "review" stamps.

j. After approval of the record drawings submit three (3) sets of prints, one (1) reproducible and one (1) set of disks containing complete drawing files with the directory structure used and all necessary reference files to the Engineer.

1.11 OPERATION AND MAINTENANCE MANUALS

a. Comply with the requirements specified elsewhere in these documents.

b. The following information shall be included in the maintenance manuals
   i. Name, address and contact numbers of local suppliers for all items included.
   ii. Details of design elements, construction features, component function and maintenance requirements to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of the installation.
   iii. Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items and parts list. Advertising or sales literature will not be acceptable.
   iv. Drawings, data, and shop drawings as reviewed and approved by the Engineer. Only the final copy of reviewed shop drawings shall be acceptable.

c. Provide three (3) sets of operation and maintenance manuals. Provide separate binders for fire alarm systems and security systems.

d. Bind information neatly, in hard covers bearing the name of the project, names of the Owner and Engineer, for submission to the Owner.

e. Review information provided in the maintenance and instruction manuals with the, Owner's operating personnel to ensure a complete understanding of the electrical equipment and systems and their operation for the Owner's continued operation post contract.

f. A list of spare parts and consumables as recommended by the equipment supplier to cover an operation period of one year shall be submitted listing the following:
   i. Catalogue number, characteristic, quantity and price of each item, and validity date.
   ii. Source used for the Contract and alternative sources of supply.
   iii. Details of required maintenance with suggested frequency of actions.
   iv. Details of each item of plant including the name, address and contact numbers of the manufacturer, type and model, serial number, duty and rating.
   v. Indicate on the list items that should be stocked by the Owner due to a long delivery period.

1.12 ELECTRICAL VARIATION

a. Conform to the requirements set out in the Contract and the rates set forth in BOQ.

b. All submission shall be scrutinized by the Engineer and, therefore, require complete detailed breakdown of all materials, labor, unit prices, overhead and profit mark-ups.

2. PRODUCTS

a. All material/equipment should be new and free of all defects.

b. All material/equipment shall be designed, manufactured and tested in accordance with the latest issues of all applicable UL, BS, IEC and industry standards.

c. Certified by UL, BS, IEC or acceptable to the Local Authorities having jurisdiction including special inspection if required.

d. All electrical equipment shall be designed for operating in a 50°C ambient temperature with 100% relative humidity. Copies of test certificates shall be provided prior to ordering equipment.

e. Fire alarm equipment shall be UL or BS and LPC approved. Third Party approval certificates shall be provided.

f. Where more than one of any item is required, all shall be of the same type and manufacture.

g. The products of the specified manufacturers are acceptable only when these products comply with or are modified as necessary to comply with the requirements of the Contract Documents.

h. Items of equipment or material that are not specifically defined herein or “Alternative” equipment/materials shall conform to the general standard of quality established herein. Comparative study shall be included in all submittals of equipment or material not specified or proposed by the Contractor as “Alternative”.

i. The comparative study shall cover all matters related to technical information, cost implication, time impact etc. The Client shall be entitled to any cost saving resulting from the approval of alternative materials. Extra cost resulting from the approval of alternative equipment/materials shall be borne by the Contractor.

3. EXECUTION

3.1 CONCRETE AND FORMWORK

a. All concrete and formwork required for work within Division 16 shall be supplied and installed by Division 3, with co-ordination and the necessary supervision by this Division.

b. Coordinate with the structural consultant prior to the execution of work.

3.2 HANGERS, INSERTS, SLEEVES AND SUPPORTS

a. Provide hangers, inserts, sleeves and supports required to accommodate the equipment and materials of this Division.

b. Do not use high velocity powder activated fastenings. Low velocity powder activated fastenings may be used with the written approval of the Engineer.

c. Except for plywood backboards, do not use wood to fasten outlet boxes or electrical equipment, except where wood forms a part of the building structure at the point of installation.

d. Metal supports, screws, bolts and hardware shall be galvanized, sheradised Class 1, or Stainless steel.

e. Apply cold galvanizing compound on all newly cut ferrous metal surfaces immediately after cutting.

f. Provide separate supports as required for electrical apparatus erected on or in any wall: or partition. All such supporting work shall be approved by the Engineer prior to installation.

g. Do not weld to or drill building steel without the written approval of the Engineer.

h. Electrical equipment mounted against the interior surface of exterior walls shall be re-mounted at least 25mm away from the wall surface.

i. Electrical equipment mounted against interior walls in damp or wet locations or adjacent to liquid piping shall be mounted at least 13mm away from the surface.

j. All supports, screws and hardware in unconditioned areas i.e. car park, pump room, etc. Shall be suitably primed and painted with two coats of zinc enriched paint.

3.3 EXCAVATION, BACKFILL, SHORING AND CONCRETE WORK

a. Excavate the last 1-50mm for underground ducts and conduits.

b. Backfill the first 300mm above underground ducts and conduits.

c. Other excavation, shoring and backfilling will be carried out under relevant specifications for Civil work.

d. Perform all work in accordance with the requirements of the appropriate Divisions of this Specification.

3.4 CUTTING AND PATCHING

a. Perform all cutting and patching required for the work of this Division.

b. Prepare drawings showing all cutting and patching required for the installation of equipment and submits to the Engineer for approval.

c. Co-ordinate all openings with the work of other Divisions.

d. Return all surfaces to the condition encountered before the work. Acceptance of such work shall be at the discretion of the Engineer.

e. Cutting of structural members shall not be permitted without specific written approval from the Engineer. The Engineer reserves the right to dismiss from site any worker who cuts or drills structural members without specification written approval from the Engineer.

3.5 INSTALLATION OF ELECTRICAL EQUIPMENT

a. All work shall be executed in a workmanlike manner and shall conform to the highest standards applicable.

b. Install equipment in accordance with the general arrangement drawings. Unless actual dimensions are indicated, take such dimensions from final reviewed shop drawings and at the site.

c. Line up exposed conduit, trunking and cable trays parallel or at right angles to building lines. Set, plumb and level equipment accurately. Install hanger rods plumb and without offsets.

Install rows of fixtures accurately in line .and level.

d. Flush-mount boxes, panels, cabinets and electrical devices in finished areas and provide suitable flush trims and doors or covers, unless specifically noted otherwise.

e. All areas shall be considered finished unless indicated otherwise.

f. The locations of switches, thermostats, outlets and control devices are shown diagrammatically only. Submit co-ordination drawings, which indicate in elevation the location of wiring devices. Mount switches, thermostats and other controls as close to door Jambs and other openings as possible, maintaining a minimum of 100 mm from trims of doors except where installed in door frames of metal partitions. Ensure that these locations meet with the approval of the Engineer. Check all doors swings and install switches on strike side of door.

g. The location of any outlet may be changed without a change to the Contract Sum providing the relocation does not exceed 1500 mm for lighting, power sockets or telephone outlets and 3000 mm for motor outlets, switches or other electrical power loads.

h. Where the location of any item is shown on the architectural details or elevations, this location shall govern. No change to the Contract Sum shall be allowed for the relocation of any equipment improperly installed because of the failure to check all such details prior to the installation of the equipment. Notify the Engineer where details differ.

3.6 CLEANING AND PROTECTION

a. Store materials and equipment in a dry, clean place and cover with polyethylene covers as necessary.

b. Remove daily from the premises all debris, rubbish and waste material resulting from the work of this Division.

c. Clean all electrical equipment and materials before final acceptance.

d. Replace damaged, lost or stolen materials and equipment at no cost to the Owner.

e. Refinish equipment and building surfaces where damaged by the work of this Division.

f. Return all scratched surfaces to the initial condition by using original paint.

3.7 OPERATION, CARE AND MAINTENANCE

a. Conform to the requirements specified elsewhere in these documents.

b. Instruct the Owner's operating personnel in the proper operation, care and maintenance of the complete installation, at the times arranged with the Owner.

c. Where required, arrange and pay for the services of the applicable manufacturers factory service engineer to supervise the initial start-up of any part of the installation, to check, adjust, balance and calibrate all components, including related wiring and controls, and to instruct the operating personnel. Provide these services for such period and for as many visits as may be necessary to put the applicable portion of the installation in complete working order; and to ensure that the operating personnel are fully conversant with all aspects of the operation, care and maintenance, all to the approval of the Engineer.

3.8 PROVISION FOR FUTURE EXPANSION

In each location where a space is indicated to be reserved for future equipment, leave such space clean and install the conduit, wiring and other work pertaining to this Division in such manner that the necessary connections can be made to the future buildings or equipment without dismantling existing floors, walls or ceilings. Consult with the Engineer wherever necessary for this purpose. Mark the locations of conduit terminations as directed.

3.9 ACCESS DOORS

a. Wherever any item of electrical equipment requiring accessibility, maintenance or adjustments is concealed, ensure adequate access, or provide an access door and arrange for its installation by the Division in whose work it occurs.

b. Access panels shall be by an approved manufacturer, with 12 gauge Stainless steel panel, rust resistant, concealed hinges and positive locking and self-opening screwdriver operated lock. Frame shall be suitable for the wall in which it is being installed and shall have integral keys for plaster walls. Panels in tiled walls shall suit the tile pattern. Minimum size of panels shall be 300 x 450 mm. Where equipment is quite large, the access panel shall be sized to suit.

c. Submit for review by the Engineer, floor plans and shop drawings showing the size, type and exact location of all access doors.

d. Each access panel shall be installed to provide complete access to equipment for maintenance and servicing.

e. All access doors shall be shown on the record drawings. Notations, adjacent to each access door shown on the drawings, shall indicate frequency of maintenance required for item or items above or behind the door.

3.10 CONTRACT DRAWINGS

a. The drawings for electrical work are diagrammatic performance drawings only, intended to convey the scope of work and indicate the general arrangement and approximate location of apparatus and fixtures, and the approximate sizes and locations of equipment and outlets. The drawings do not intend to show architectural, mechanical or structural details.

b. Do not scale or measure drawings, but obtain information regarding accurate dimensions from dimensions shown on the architectural drawings or by site measurements. Follow the electrical drawings for laying out the work.

c. Refer to the co-ordination drawings of other Divisions to become familiar with all conditions affecting the work, and verify suitable spaces exist in which the equipment is to be installed.

3.11 COMPLETION OF CONTRACT

a. All equipment must be cleaned and tested before final acceptance by the Engineer.

b. From the date of issuance of the 'Completion Certificate' all equipment, materials and workmanship, other than Jumps, must be unconditionally warranted for not less than one: (1) year.

c. Replace, at no cost to the Owner, all incandescent lamps burned out during a thirty (30) days period, and all burned-out fluorescent and HID lamps for a period of ninety (90) days after date of issuance of 'Completion Certificate' for the Contract for the building.

d. Defects and deficiencies which originate or become evident during the warranty period must be repaired or replaced at no cost to the Owner.

e. If, during the warranty period, transformers, ballasts or other noise and vibration producing equipment are considered by the Engineer to exceed acceptable standards, then these must be replaced without delay or additional cost to the Owner. All work relating to the replacement of defective items must be carried out after normal working hours and at a time which is acceptable to the Owner.

3.12 DEFINITIONS

Wherever the words "install", "provide", or "supply and install", are used in Division 16 specifications, it shall be understood to mean "provide and install, inclusive of all labor, materials, installation, commissioning, testing and connections" for the item to which it refers.

3.13 FIRE RATING

a. Feeder conduits for the following systems shall be encased in concrete, provided with Engineer approved one (2 hour) NFPA fire rated enclosure, or run as mineral insulated or fire retardant cable etc.
   i. Life Safety (Fire Alarm)
   ii. Elevators (Work covered by Division 14)
   iii. Emergency lighting
   iv. Emergency Motor Starters and MCP's
   v. Fire Pumps

b. Branch wiring for the following equipment shall be encased in concrete, provided with Engineer approved one (2 hour) NFPA fire rated enclosure, or run as mineral insulated or fire retardant cable 2 hours rating complying to UL 1685 for circuit integrity and LSZH.
   i. Circuits for life safety and Evacuation system devices.
   ii. Interface wiring to mechanical system, elevators, FACP equipment, enunciators and security system.
   iii. Branch and control circuits for smoke control, dampers and pumps.

3.14 FIRE SEALS

For details of fire sealing refer to Division 21, Section 21 50 00 "Through Penetration Fire Stopping for MEP Systems.

3.15 WARNING SIGNS

Provide warning signs as specified to meet requirements of Authorities having jurisdiction and Engineer.

3.16 WIRE PULLING LUBRICANT

a. Lubricant shall be non-corrosive and approved for the type of cable used.

b. Lubricants shall be soap or wax based, depending upon application. Use soap based for short runs (not greater than 20m) and for semi-conducting insulated wires, and wax R based for long runs (20m or further).

X ---------- END OF SECTION ---------- X

SECTION 26 05 19

LOW VOLTAGE ELECTRIC POWER CONDUCTORS AND CABLES

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works, Section 01 00 00.
b. Conform to the Common Work Results for Electrical, Section 26 05 00.
c. Follow the Consultant's Instructions and Manufacturer's Recommendations.

1.2 SCOPE OF WORK

The scope of work shall cover the supply, design, manufacture, testing in the factory, packing, insurance, delivery to site, unloading, installation, testing and commissioning of all components with all the necessary accessories in accordance with this technical specification.

2. PRODUCTS

2.1 MATERIALS

a. All cables supplied and installed shall be selected from the following types with stranded copper conductors and shall comply with the appropriate British Standard referred to below as applicable.
   i. Requirements for Electrical Installations – IEE Wiring Regulations (17th edition) BS 7671
   ii. Electric cables – Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U) – General requirements EN50525-1
   iii. Electric cables – Calculation of the current rating BS IEC 60287
   iv. Electric cables – PVC insulated and PVC sheathed cables for voltages up to and including 300/500 V, for electric power and lighting BS.6004.
   v. Luminaires – Particular requirements Specification for fixed general purpose luminaires BS 4533

2.2 COLOR CODING

a. Color code conductors as follows:
   i. 3 phase - Red, Yellow, Blue
   ii. 1 phase - Red
   iii. Control wiring - Orange or Red with cable markers to match the diagrams at Each point of connection and termination.

iv. Neutrals - Black
v. Earth - Green/Yellow striped

b. Conductors shall have the color impregnated into the insulation at the time of manufacture.

c. Painting of conductor insulation will not be accepted.

3. EXECUTION

3.1 GENERAL REQUIREMENTS

a. Wiring of multi-point circuits shall utilize a 'looping-in' system. Joints and connections other than those required for the connection of switches, fuses, socket outlets, motors and the like shall not be allowed.

b. PVC cables shall not be in direct contact with any form of polystyrene used in the building.

c. PVC cables shall not be installed when manufacturers recommended installation temperature. If cable has been exposed to a temperature below recommended value a warming up cable is installed.

d. PVC cables shall not enter any Luminaire or heat-producing equipment. For tungsten luminaires, heat-resisting cables shall be installed from the luminaires to the lighting switches or equivalent. For fluorescent luminaries high temperature PVC cables shall be installed from the lighting switch or equivalent. For recessed tungsten and fluorescent luminaries and heat-producing/emitting equipment, final connections shall be made using heat-resistant flexible cables. Where cables are permitted to traverse channel-ways or similar on continuously mounted fluorescent luminaries, heat-resistant cables shall be used throughout.

e. Soldered connections or lugs shall not be permitted. Conductors requiring bolted connection shall be terminated with compression lugs using an automatic compression crimp tool which will only release after the correct crimp depth has been obtained. All crimped connections shall be contained within an appropriately sized conduit box. Bolted connections shall have spring washers. Pinch screw terminals may not be used for conductors greater than 6.0mm.

f. Single strand cables shall be doubled back on themselves when terminations are made.

g. PVC cables shall not be used for final connections to any appliances containing a heating element or any appliance emitting heat. Where flexible conduit is used as a final connection wiring medium, heat-resistant cables shall be used and these shall commence at the solid conduit end of the flexible conduit provided it is not in a heated area. If this is not possible,

heat-resistant cables shall be run back to the first switch outside the hot area.

h. PVC cables shall not exceed the carrying capacity of the conduit or trunking. The installations shall comply strictly with the IEE Wiring Regulations regarding capacity of conduits and trunking for 450/750V cables, and a space fill factor of 35% shall not be exceeded for trunking.

i. Circuit protective conductors shall be used throughout the installation and shall be the same grade and temperature rating of the live conductors of the circuit.

j. Metal conduit and/or the trunking system enclosure shall not be used exclusively as a circuit protective medium. Separate circuit protective conductors shall be installed and shall be colored green and yellow.

k. No cable installation work shall be carried out in temperatures at which the cable being installed is likely to suffer damage.

l. Each drum length of cable shall be allotted a distinctive and separate reference number. This number shall appear on the test sheet covering the respective length of cable and shall also be clearly marked on the cable drum. The Contractor shall advise the Engineer upon delivery to site of each drum length, quoting this reference number, which shall also appear on the invoices.

m. All cables shall be delivered to site with the manufacturer's seals, labels or other proof or origin intact. These labels and seals shall not be removed until the cable is required for use and shall be retained for inspection by the Engineer.

n. The arrangement of cables and all methods of installation shall be approved by the Engineer.

o. Cables shall be installed from terminal point to terminal point and straight through joints shall not be made unless approved. Where a run of MICC cable is of a length which exceeds the maximum to which the cable can be manufactured, a through joint of approved pattern will be permitted.

p. The radius of each bend or change in direction of the route of any cable shall not be less than that laid down in the relevant table of current issues of IEE Regulations and the relevant British Standard Specifications, and shall generally not be less than eight times the overall diameter of the cable.

q. The spacing of cable supports shall be those laid down for the relevant size and type of cable in the current issue of the IEE Regulations and the manufactures recommendations, but the horizontal longitudinal distance between wire armored support centers of unarmored cable support centers shall not exceed 1 meter, the horizontal distance between support centers

of unarmored cables shall not exceed 800 mm and the distance between support centers for either type of cable on vertical runs is not to exceed 1 meter. Cables of and less than 50 mm eternal diameter shall be supported at not more than 800 mm centers.

r. The cables may be installed in a number of different ways:
   i. Laid direct in the ground
   ii. Laid in ducts
   iii. Installed in covered concrete trenches
   iv. Installed on cable ladders
   v. Installed on perforated steel trays
   vi. Fixed to concrete and brickwork
   vii. Fixed to steelwork

s. Single core cables forming a three phase group shall be fixed in trefoil cleats of a British Insulated Calendars Cables Limited alloy pattern or similar. Flat formation may be used where specified or approved.

t. Unarmored PVC cables and wires shall be enclosed in trunking or conduit unless otherwise stated.

3.2 CABLES DIRECT IN GROUND

a. Cables shall be laid in prepared trenches and the Contractor shall satisfy himself as to the suitability of the trenches.

b. 80mm of fine riddled soil shall, unless otherwise approved, be placed at the bottom of the trench to form a bed for the cables. After the cables have been laid they shall be covered, by the Contractor, with 80mm of fine riddled soil well panned over and around the cables. If the Contractor considers the soil unsuitable for shifting he shall notify the Engineer, and if approval is obtained, well rammed selected sand may be used in lieu of finely riddled soil. All cables must then be covered by interlocking PVC cable tiles labeled in English and Arabic laid in a continuous manner, with PVC warning tape over it at an approved depth.

c. All cables shall be supplied by the Contractor.

d. All cables shall be laid at depth of not less than 600 mm for LV. cables and 800 for H.V. cables at all points and where this depth is not possible approved mechanical protection shall be provided. All underground cable routes shall be marked at 15 meter intervals, at changes of direction and at straight through cable joints by approved markers.

e. The contractor shall supervise and be responsible for all trenching and backfill operations irrespective of who carried out the work.

f. The contractor shall, before laying any power cable satisfy himself that the conditions on Site are such that the maximum current carrying capacity is maintained over the whole route.

g. If the Contractor considers that the conditions are such as to reduce the maximum current carrying capacity, he shall before installing the cable notify the Engineer as to what the current capacity would be under these conditions and shall not proceed with the work until the Engineer has given his permission in writing or otherwise instructed the sub-contractor to alter the cable. Before any section of the work is taken over, the sub-contractor shall confirm to the engineer, in writing, the maximum continuous current carrying capacity of the cables.

h. When the cables are laid into trenches, they shall be drawn by cable pulling grips with rotating eyes from drums supported on stands, on to the rollers throughout their length. All rollers must be removed from the trench before the covering of sifted sand is laid over the cables. All cables shall be inspected by the Engineer before backfilling.

i. Where more than one horizontal layer of cables is laid, the level of the upper layer of cable shall be gauged from the level of the finished bottom of the trench and marked on the side of the trench at frequent intervals before the installation of the lower layers, to ensure that the correct vertical spacing is maintained.

j. Final trench back filling shall not proceed until all required test for cables are performed.

k. Cable pulling machine shall have a calibrated tension meter to ensure the correct cable pulling tension as recommended by the manufacturer.

3.3 CABLES DIRECT IN DUCTS

a. Where cables pass under roads or rail tracks and where shown as being in ducts in the Drawings, the cables shall be drawn into ducts. The removal of temporary plugs, rodding and cleaning of the ducts shall be the responsibility of the Contractor.

b. Particular attention shall be given to the sealing of ducts where any of such ducts enter cable trenches within the confines of the building.

c. Where cables are detailed to be drawn into ducts, cable pulling grips with rotating eyes shall be used and the cables shall be supported on rollers without sharp edges during drawing operation. All cable ducts shall first be cleaned and proved by drawing a mandrel of slightly less diameter than the duct immediately before pulling the cables.

d. Any lubricant used shall have no harmful effect on the cables. Where ducts are unused, they shall be sealed before backfilling by means of wooden plugs.

e. Where draw-in pits are inserted in the route, they will be of such size that no undue strain caused by bending is placed upon the cables. Minimum bending radii should be as specified. Cable rollers shall be used when drawing cables into a pit to ensure that no undue strain is placed upon the cables.

f. When the cable is taken off the drum and flaked, the bending radii shall be not less than those stated for installation.

g. After the cable is installed in the duct, a split wooded bus shall be drilled to suit the cable diameter and refitted and caulked with an approved asbestos compound followed by not less than 38 mm of bitumen compound soft cement.

3.4 CABLES IN COVERED CONCRETE TRENCHES

a. The construction of cable trenches and draw-pits and the provision of cable trench and draw-pit covers shall be included.

b. All cables shall be so arranged and fixed that any one cable may be removed without disturbance to the remainder.

c. Multicore cables shall be installed on cable hangers, ladder or tray work fixed to back-straps which in turn are fixed to the side of the trench.

d. All single core phase cables shall be installed in die-cast, non-ferrous, trefoil cleats of British Insulated Calendars Cables manufacture or similar and neutral cables in similar single way cleats of the same manufacture. Flat formation may be used in specified cases when approved cleats shall be used.

e. MICC and FP 200 type cables shall be installed on cable trays mounted and secured to back-straps fixed to the side of the trench. Such cables shall be saddled to this cable tray at intervals of not more than 500.

f. The crossing over of cables in the same trench shall be avoided as far as possible. All unnecessary bends shall be straightened after lying.

g. In very exception circumstances, and then only with the Engineers approval in writing, cables installed under this method shall be laid on the bottom of trenches and then in a neat and orderly manner.

h. The laying of cables will require the removal of trench covers from time to time, and the contractor shall include in his price for the removal and immediate replacement of covers after laying each cable. The trenches shall not any time therefore be left open to be fouled

and trench covers damaged. Whilst trenches are open the Contractor shall be responsible to ensure that covers are undamaged and trenches are clean before recovering; any damage to covers shall be made good by the Contractor at his own expense.

3.5 CABLES ON CABLE LADDERS

a. Where so indicated on the layout drawings a cable ladder system may be run. The ladders shall be of adequate width for disposing the cables with a width allowance of 25% for additional cables. Care shall be taken to ensure that the ladders do no foul overhead cranes, doors or other features.

b. The ladder shall be of such strength that, when loaded with all the cables for which it is designed, plus an additional 15kg/m, it shall not deflect from the horizontal by more than 3 mm.

c. The contractor shall supply. All medium duty mild steel ladders to BS 1449 part 1 1983, fixing bolts etc., for supporting the cable, including marking out and checking.

d. Cables shall be supported on steel cable ladders using approved cleats. All single core phase cables are to be installed in die-cast, non-ferrous, trefoil cleats of British Insulated Calendars Cables manufacture or similar and neutral cable in similar single way cleats of the same manufacture unless flat formation is used when approved single cleats may be used.

e. For cables of core area of and less than 25mm2 c.s.a. multi-cleats, on a common bolt or spindle, of British Insulated Calendars Cables manufacture, or approved or equivalent will be acceptable. Multiple cables shall be secured with PC cleats at spacing consistent with the size of cables used.

f. Every care shall be taken in cabling handling during erection to avoid the slightest damage to cables. When cables are clamped in the ladders, the contractor shall ensure that undue stress is not placed on any shading or armoring.

g. All supports and ladders shall be arranged as far as practicable for the easy removal of any single cable in a multi-cable run, without disturbing other cables and without threading cables through supports or racks.

h. Cutting away, fixing and grouting of rawlbolts or approved rawlbolts type fixings and making goods shall be done by the Contractor. Cables shall be run in a neat and orderly manner. The Contractor shall be responsible for the design and detailing of the steelwork for cable ladder and shall submit such design for approval before putting the work in hand. The contractor shall include the cost of this design work in his price for this method of installation.

3.6 CABLES ON TRAYS

a. Trays shall be adequately supported to prevent sagging by more than 3mm between fixed points; all supporting steelwork shall be fixed at not more than 1m centers unless otherwise specified or approved.

b. All cables shall be saddled to tray-work. MICC cabling shall be saddled at not more than 500 mm centers and all other cabling at not more than 1m centers.

c. All cables, other than pilot or control, when installed on trays shall not be more than one layer.

d. The saddling of MICC or FP 200 type cable to tray-work shall be by 12mm PVC coated copper strip unless otherwise specified or approved.

e. All cable tray shall be of the heavy duty hot dipped galvanized (with thickness not less than 1 mm width of the tray) to BS 2989 1982, return flange type unless approved otherwise for specific locations only.

f. The contractor shall submit detailed drawings for cable tray (H.T. & L.T.) and cable tray suspension system to EDD for their approval.

g. Cable tray mounted externally on roofs etc. shall be provided with heavy duty sunshields made of galvanized steel or aluminum. The sunshields shall be arranged to allow adequate ventilation of the cables or the tray.

h. All external fixings and brackets shall be galvanized steel, galvanized after fabrication.

i. All internal fixings shall be either proprietary galvanized channel or a galvanized fabricated channel or angle steel to the Engineer's approval.

3.7 CABLES FIXED TO CONCRETE AND BLOCK WORK

a. Where cables, other than MICC are run individually, they shall be supported by approved cleats fixed directly to the concrete or brick work. These cleats shall be spaced so as to avoid sagging of cables and in no case at more than 1m between centers.

b. When more than one row of cables follows a single route, cables cleats shall be fixed to approve back-straps.

c. MICC cables run individually shall be saddled with spacer bars at intervals of not more than 500 mm. Where five or more cables are required to be supported, the fixing saddles and

spacer bars shall be fabricated from 12mm copper strips.

d. Except where otherwise stated cables within buildings shall be supported on purpose made cable hangers. Where single runs or cables are to be installed along walls, the hangers shall be of the 'J' bracket type manufactured form mild steel and mounted on mild steel back-straps, which shall be fixed to the wall by means of a ragbolts.

e. Where multiple runs of cables are to be installed along walls, or in ducts, the hangers shall be of the 'claw' type mounted on slotted channel the full height of the ducts.

f. All cleats, clamps and hangers shall have rounded edges and a single lapping of bitumastic felt inserted between the cable armoring and the metalwork of any hanger or bracket. Spacing of fixing shall be in accordance with the relevant IEE regulations and, where a number of cables are run together, the spacing of the fixings shall be that required by the smallest cable in the run.

g. Bends in cables shall not exceed the limits as laid out in the IEE regulations.

h. Cables installed in open positions shall be cased to a height of 2 meters above platform or floor. Sheet steel of not less than 2mm thickness shall be used for this purpose.

3.8 CABLES FIXED TO STEELWORK

a. Structural steelwork shall not be drilled for cable fixing. Individual cables other than MICC cables run on steelwork shall be supported in approved cleats fixed to approve back straps clamped to the structural steelwork. These cleats shall be spaced so as to avoid sagging of cables and in no case at more than 1m between centers.

b. MICC and FP 200 type cable run individually shall be saddled at intervals of not more than 500mm and spacer bar saddles shall be used, mounted on back-straps clipped or welded to the steelwork. Where five or more cables are required to be supported, the fixing saddles and spacer bars shall be fabricated from 12mm copper strip.

3.9 CABLE TERMINATION

a. All jointing materials to be used shall conform to the relevant requirements of British Standards and the Contractor shall state the quality of the compounds he proposes to use, which shall be entirely suitable for the site conditions.

b. The contractor shall be responsible for 'ringing through' and testing all cables before finally making off end and connecting up. The correct phase rotation of motors etc., shall be the responsibility of the Contractor. Phase rotation tests shall be carried out by the Contractor and, if found necessary, the Contractor shall carry out any reversal of phase connections.

This work shall be included in the works.

c. During the maintenance period, the contractor shall be responsible for maintaining the filling medium at correct level in all terminal boxes or other apparatus to be filled by him, and shall inform the Engineer when action has been necessary.

d. All cables shall be color coded in accordance with the IEE Regulations current edition and amendments.

e. All sealing and jointing work shall be in accordance with the best current practice and of first class workmanship.

f. Where cable sheaths are used as earth continuity conductors, glands shall have the necessary contact surfaces or straps to provide a low resistance path under fault conditions.

g. All cables connections to plant shall be made with approved cable lugs, compression type lugs being used, together with tools supplied by the lug manufacture.

h. All cable ends shall be marked to identify the cable connection. Identification labels for all cables shall give the cable an approved reference number.

i. All cables shall have a label fixed to them below each cable joints, also where the cable passes through ducts and trenches at each exit from or entry to such ducts and trenches and where the cable enters a room or building. The label shall indicate the cable potential and destination as well as the cable number.

3.10 OTHER CONDITIONS

Home runs exceeding 25m in length to distribution boards shall be minimum 4mm2 unless otherwise stated.

a. The cross-sectional area of circuit protective conductors shall be in strict accordance with the requirement of the IEE Wiring Regulations.

b. Conductors shall be pulled into conduit in a careful and workmanlike manner without overstressing or exceeding the pulling limitations of the conductors.

c. Conductors shall be 'combed' as pulling proceeds. The neutral and circuit Protective Conductor or each circuit shall be pulled with the phase conductors.

d. Conductors of a circuit run in trunking shall be 'grouped' together with approved plastic binding clips. Tape shall not be used.

e. Clip cables neatly to tray with cable separation and support spacing as recommended by the manufacturer.

f. Where more than two power cables are run together, provide a cable tray. Secure cables with cleats, saddles or ties as appropriate to location and use spacers where more than one layer is required.

g. Install cables in accordance with the manufacturer's instructions, using manufacturer's approved terminating devices.

h. Terminate single conductor cables entering steel cabinets through a non-ferrous plate.
   i. Where cables pass through a floor or fire barrier provide cable transit or equivalent fire stop with openings properly sized for the cables.
   ii. Run surface cables similar to exposed conduit installations. Run cables concealed above ceilings in finished areas. Where exposed, run parallel to building lines and avoid proximity to water.

X ---------- END OF SECTION ---------- X

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works, Section 01 00 00.
b. Conform to the Common Work Results for Electrical, Section 26 05 00.
c. Follow the Consultant's Instructions and Manufacturer's Recommendations.

1.2 SCOPE OF WORK

The scope of work shall cover the supply, design, manufacture, testing in the factory, packing, insurance, delivery to site, unloading, installation, testing and commissioning of all components with all the necessary accessories in accordance with this technical specification.

2. PRODUCTS

a. The earthing system shall include, but not limited to, the following:
   i. Frames of main supply transformers, neutral earthing of transformers.
   ii. Main 220/400V low voltage switchboards and distribution boards.
   iii. Frames of all motors 40 hp and larger with separate ground wire to nearest MCC ground bus.
   iv. Motor control centers, starters and control panels.
   v. Building steel.
   vi. Emergency generators, elevators and escalators.
   vii. Air-conditioning systems.
   viii. Water pipes including sprinkler pipes.
   ix. Exposed Metallic Parts of the Building.

b. All equipment earth conductors outside the electrical rooms or closets, except bare conductors which are part of a cable assembly, shall have the insulation colored green/yellow and shall be installed in the same conduit as the circuit wiring.

c. Earth conductors shall be copper, not smaller than No. 10mm2, except as indicated.

d. Earth bar shall be 6mm x 50mm by length or as indicated on drawings.

e. Connections to earth rods shall be made by proprietary purpose made clamps of the same manufacture and provided with a concrete inspection pit with removable cover inscribed "Earth".

3. EXECUTION

3.1 INSTALLATION

a. The whole of the earthing and bonding shall be installed and tested in accordance with the requirements of the IEE Wiring Regulations, K-ELECTRIC requirement and this specification.

b. Attention is drawn to the use of circuit protective conductors in addition to metallic conduit/trunking.

c. All enclosures, equipment, exposed conductive parts, extraneous conductive parts, and metallic trunking, metallic conduits, metallic cable trays and other metalwork other than any live part, forming protection to or part of the electrical installation, Including apparatus and appliances, shall be effectively bonded to earth.

d. Protective conductors shall be provided in the form of copper tape to all vertical electrical rising busbars. The size of this tape shall be in accordance with the IEE Wiring Regulations.

e. All bonding and protective conductors, where fixed to bolted connections, shall be terminated on compression type lugs made with an automatic purpose-made machine.

f. Provide an earth bar 450mm long on 10mm spacers on the wall of each electrical room, and connect to the enclosure and ground buses of all equipment in the room.

g. Run a No. 120mm2 sheathed copper cables from the main 600V switchboard ground bus to the main water pipe and connect to the upstream side of the water meter.

h. Bond water main with proprietary purpose made bonding clamps. Scrape and sand the water main to remove all rust, paint or scale at the location where the connection is to be made.

i. Remove non-conductive coatings from threads or other contact surfaces to ensure good electrical continuity.

j. Provide a separate insulated ground conductor in every conduit, in every system, to all, devices and fixtures.

k. Protect all exposed earthing conductors from mechanical damage.

l. Soldered joints are not permitted.

3.2 TESTING AND COMMISSIONING

a. GENERAL

i. The complete installation shall be tested and inspected to ensure that it complies with the requirements of this Specification, the IEE Wiring Regulations, and British Standards. The tests shall be carried out in accordance with the IEE Wiring Regulations

ii. The inspection and tests shall be carried out in the same sequence as set out in the IEE Wiring Regulations and in such time as to allow any remedial work to be completed prior to Practical Completion. Tests shall also include any part of the existing installation related to the new work.

iii. Tests shall be carried out strictly in accordance with a programme to be agreed prior to commencement of such tests. Facilities shall be provided for witnessing of such tests.

iv. All instruments necessary for inspection and testing shall be supplied and shall be properly calibrated and operated by personnel skilled in their use.

v. Allowance shall be made for disconnection or similar operations to satisfy the requirements for testing, etc., and the reinstatement of the installation.

b. CERTIFICATES AND SCHEDULES

All values called for under the IEE Wiring Regulations shall be recorded and three copies of the Inspection Certificate described in the IEE Wiring Regulations shall be submitted. The installation shall not be considered as completed unless inspection Certificates have been submitted.

X ---------- END OF SECTION ---------- X

SECTION 26 05 33.16

BOXES FOR ELECTRICAL SYSTEMS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works, Section 01 00 00.
b. Conform to the Common Work Results for Electrical, Section 26 05 00.
c. Follow the Consultant's Instructions and Manufacturer's Recommendations.

1.2 SCOPE OF WORK

The scope of work shall cover the supply, design, manufacture, testing in the factory, packing, insurance, delivery to site, unloading, installation, testing and commissioning of all components with all the necessary accessories in accordance with this technical specification.

2. PRODUCTS

a. JUNCTION BOXES

i. Junction and pull boxes shall be sized to accommodate the conduits indicated and to facilitate pulling conductors required. Minimum depth shall be 50mm.
ii. Junction and pull boxes shall be steel with covers attached by screws.
iii. Junction boxes for signaling, communications, alarms and control wiring shall be provided with terminal strips. Terminal strips shall have screw type terminals and cable identification strip.
iv. Junction & Pull boxes shall be of 16 gauge sheet steel / PVC should be of hard plastic, sheet steel should be rustproof with two coats of zinc chromate. All boxes should have ample wiring space and boxes used outdoor shall be weatherproof.
v. Junction & Pull boxes shall be not less than four inches in diameter.

b. OUTLET BOXES

i. Outlet boxes shall be manufactured of galvanized sheet steel, for surface run conduit and UPVC where conduits are buried in concrete slabs.
ii. Use metal clad weatherproof boxes outdoors or in damp locations.
iii. Use metal clad boxes where surface mounted in unfinished areas.
iv. Ceiling boxes shall be 75mm circular or square, and 50mm deep complete with fittings where required to support fixtures.
v. Outlet boxes in walls ceilings or floors shall be of an approved type suitable for the

application.

vi. Provide gang boxes at locations where more than one device is to be mounted.

vii. Provide combination boxes with barriers for wiring of more than one voltage source.

viii. Provide panel mounted fixing frames where outlet boxes are installed in paneling.

ix. Boxes shall have only the holes necessary to accommodate the conduit at point of installation. Sectionalized boxes shall be used wherever possible to group adjacent devices under a single plate as detailed on the drawings.

x. Outlet boxes shall be of 16 gauge sheet steel, rustproof with two coats of zinc chromate and painted with enamel, complete with earthing terminal. All boxes should have ample wiring space and boxes used outdoor shall be weatherproof.

xi. Ceiling outlet boxes shall be not less than four inches in diameter to provide a seat for the fixture canopy.

xii. Outlet boxes for wall fixtures where conduit is concealed shall be deep type, four inch diameter and have covers with center opening thee inches in diameter

xiii. Switch and receptacle outlet boxes:

- Outlet boxes for switches and receptacles in finished walls shall be of suitable size for the device to be mounted and the partitions in which they are installed. The boxes shall have covers with rectangular openings of proper size and shape. Provide covers with raised openings on all outlets in masonry walls with plaster or tile finishes. Wall switch outlets shall be set close to the trim on lock side of door. Outlets shall be set flush with the wall.
- Outlet boxes for exposed switches and receptacles shall be of the "Condulet" type Crouse-Hinds or equal.

3. EXECUTION

3.1 INSTALLATION OF JUNCTION BOXES

a. Locate junction and pull boxes to be accessible at all times. Boxes may be installed in mechanical, electrical, storage or generator rooms or in hung ceiling space.

b. Provide access hatches for boxes installed in ceiling spaces unless ceiling tiles are of lay-in or snap-in type.

c. Locate junction and pull boxes so piping, ductwork or equipment will not restrict or block access. If such obstruction are installed after junction or pull box is installed, the obstruction shall be removed or junction or pull box relocated with no adjustment to the contract price.

d. Cables connected to terminals shall be identified by cable markers and at the terminal strip.

e. Terminal strips may be omitted where there are less than 5 connections in a junction box. All conductors shall be identified by wire markers.

f. Terminals and cable identification may be omitted for through cables which are not broken at a junction box.

g. Provide pull boxes in conduit runs where required to facilitate the pulling of cable.

3.2 INSTALLATION OF OUTLET BOXES

a. Provide outlet boxes for all lighting fixtures, receptacles or other devices in walls ceilings, or floors. Wire each fixture from an outlet box, with a maximum of four fixtures per box.

b. Support boxes independently of the conduit system and mechanical ducts.

c. Locate boxes in hung ceilings Spaces so as not interfere with the removal of ceiling tiles or equipment.

d. Openings for outlet boxes installed flush in concrete block shall be cut by the Masonry Division. Ensure that opening s are cut to fit boxes so that edges of openings are not visible after installation of cover plates. The use of mortar to patch oversize or ragged openings not be permitted.

e. Do not mount boxes between pairs of studs, on opposite sides of sound-rated partitions. Seal spaces between boxes and gypsum board with acoustical sealant.

f. Adjust floor boxes so that closure plates are flush with the surface of the floor tile, or the floor if carpeting is specified. Provide under floor duct fittings and outlets or single flush outlets with waterproof covers, as indicated on the drawings.

X ---------- END OF SECTION ---------- X

SECTION 26 05 36

CABLE TRAYS FOR ELECTRICAL SYSTEMS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works, Section 01 00 00.
b. Conform to the Common Work Results for Electrical, Section 26 05 00.
c. Follow the Consultant's Instructions and Manufacturer's Recommendations.

1.2 SCOPE OF WORK

a. Submit Shop Drawings as specified in Section 26 05 00.

2. PRODUCTS

a. GENERAL

i. SUBMITTALS
- Product data for each component
- Designate components and accessories, including clamps, brackets, fittings etc. to complete the system.
- Co-ordination drawings, showing accurately scaled Cable Ladder/trays layout and relationships between components and adjacent structural and mechanical elements.
- Maintenance data for cable Ladder and trays, for inclusion in 'Operation & Maintenance Manual' include detailed manufacturer's instruction on tightening connections.

ii. QUALITY ASSURANCE
- Listing and labeling: Provide products specified that are listed and labeled.
- Single Source responsibility: All Cable Ladder and trays components shall be the product of a single manufacturer.

iii. SEQUENCING & SCHEDULING
- Co-ordinate layout and installation of Cable Ladder with other installations.
- Revise locations and elevations from those indicated as required to suit field, conditions and as approved by the Engineer.

b. MATERIALS

i. The Cable ladder/tray system shall be complete with all necessary sizes of ladders/trays and the necessary accessories like Support Bracket, Profile Clamps, Joints, Couplings, Bends, End

covers, Fittings etc. required for the installation conforming to BS EN 61537.

ii. The Cable ladder and tray system, T-Junctions (4 way and 3 way) shall be premium pre Galvanized Steel (Imported as per ASTM A 653 CS (Commercial) or Metal Sheet MS as per drawings and Bills of Quantities. The thickness of the sheet steel shall be as per BS and IEC Standards. The reinforcement of the ladder shall be by the hexagonal profile of the ladder supporting the rungs. Cable Ladder\tray widths to be as indicated by manufacturer and allowing for 30% spare capacity for future additional cables.

iii. The Cable Ladders/trays should have a high resistance against Ultra Violet radiation of the sun.

iv. Where Cable ladders/trays pass through walls of a specific fire resistance, the electrical Contractor shall conform according to the Local Fire Regulation Norms.

v. The various accessories shall be of the same material as that of the Cable Ladder trays.

vi. Protect steel hardware against corrosion by galvanizing conforming to BS EN ISO 1461.

vii. Fabricate Cable Ladder/trays products with rounded edges and smooth surfaces.

c. ACCESSORIES

i. Fittings: Horizontal T-Junction, Horizontal 4-Way T-Junction, 90 degree horizontal bend 90 degree inside vertical bend and other fittings as indicated, same manufactured as the Cable Ladder/trays and shall be specifically designed for the type of Ladder/tray used.

ii. Cable Ladder/tray supports and connectors, composing of splice plates, threaded studs, trapeze with studs etc. as recommended, by Cable Ladder/tray manufacturer and approved by Consultant.

d. SOURCE QUALITY CONTROL

i. Perform design and production tests according to BS EN ISO 9001 Standards.

3. EXECUTION

3.1 INSTALLATION

a. Accessories including bends, intersections, tees, risers and reducing sections shall be purpose-made by the tray manufacturer. Only one manufacturer's tray and accessories shall be used.

b. Care shall be taken to avoid any electrolytic action between dissimilar metals.

c. Under no circumstances shall any copper sheathed cable or fitting be in direct contact with the galvanizing.

d. Off-sets and bends shall be sized to allow for the minimum permissible radius of the largest cable on the tray. Cables shall retain their relative positions on bends and sweeps.

e. Earth continuity shall be maintained at all joints with suitable earthling links.

f. Cable trays shall be cut along a line of plain metal and not through perforations. Burrs or sharp edges shall be removed prior to the installation of tray sections or accessories.

g. Bushing shall be provided through all holes cut in the body of the tray.

h. Cable tray shall be made good at all joints or holes by first treating the surfaces with a suitable rust proofing agent, then applying finishes comparable to the remainder of the surface.

i. A minimum space of 75mm shall be allowed between trays and structures to provide for securing cable and for general maintenance.

j. Cable tray shall be secured to galvanized steel or stainless steel support, fixed to the structure at not more than 1.2m to 3.0m intervals, depending on cable tray thickness.

k. Mid span joints shall be avoided. Joints shall be positioned as close to the support as practical. Fixing of supports shall utilize "Rawlbolts" or equal.

l. Alternatively, proprietary steel channel may be used, permitting easy adjustment and modification.

m. Proprietary clamps fixing on to the flanges of structural members may be used.

n. All metal work fixing bolt and the like shall be suitably primed and painted with two coats of zinc-enriched paint.

o. Cables shall be installed on trays in a single layer with a spacing between cables of 1 times the largest cable diameter in accordance with the IEE Wiring Regulations, using plastic coated, metal reinforced clips or saddles and by proprietary cleats of a pattern recommended by the cable manufacturer.

p. Not more than four cables shall be secured by a single clip or saddle. Binding tape fixings must not be used. On vertical tray installations load-bearing cleats or saddles shall be used and securely fixed to the tray.

q. Provide, cable tray expansion joints at all locations where the tray crosses a building expansion joint and at other locations recommended by the manufacturer.

r. Where cables in tray pass through a floor or fire barrier interrupt the tray and provide an Electro tray cable transit with openings sized for the cables.

s. Protect cables against mechanical damage for a minimum distance of 1800 mm. above finished floor level.

t. The Cable/Ladders trays shall be connected to each other in such a way that the electrical earth connectivity is continuously maintained.

u. Where cables enter and leave Cable Ladders/trays, the electrical Contractor shall ensure that no sharp edges are carrying the weight of the cables or that cables subjected to any vibration are in a position where they could be affected by sharp edges.

v. The Cable Ladders/trays may either be run horizontally and supported from the ceiling, or cantilever wall brackets or supported directly on top of cantilever brackets or mounted vertically as required. Fixing will be such that there will be no perceptible deflection on the ladder when all cables are in position. A safety factor of 2 shall be considered during design of the ladder such that, with a uniformly distributed load of 120 Kg/m, the ladder can take a point load of 100 Kg at a middle span without deformation.

w. Provide ventilated galvanized sun shield cover plates on all cable trays exposed to the sun.

X ---------- END OF SECTION ---------- X

SECTION 26 24 16
DISTRIBUTION PANELBOARDS

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works, Section 01 00 00.
b. Conform to the Common Work Results for Electrical, Section 26 05 00.
c. Follow the Consultant's Instructions and Manufacturer's Recommendations.

1.2 SCOPE OF WORK

The scope of work shall cover the supply, design, manufacture, testing in the factory, packing, insurance, delivery to site, unloading, installation, testing and commissioning of all components with all the necessary accessories in accordance with this technical specification.

1.3 SUBMITTALS

Submit shop drawings as specified in Section 26 05 00.

2. PRODUCTS

2.1 DISTRIBUTION BOARDS

a. Distribution boards shall be manufactured to comply with IEC 61439-1 and IEC 61439-3, Form-2B with degree of protection to IP 42 in conditioned areas and IP 55 in unconditioned areas, such as plant rooms, service rooms, car park, store area etc.

b. Refer to distribution board's schedules for rating and type of feeders required.

c. Type, mains, ampere capacity, branch circuit rating and total number of circuits shall be as shown on schedules.

d. Distribution boards shall:
   i. Have dead front sheet steel enclosure with flush doors, concealed hinges, flush lock and concealed trim bolts.
   ii. Be 2.0 mm zinc coated sheet steel corrosion resistant treated after all forming and welding have been completed and all holes have been punched. The finish coat shall be epoxy-powdered paint deposited by an electrically charged procedure, both inside and outside -light blue/grey color, RAL 7032 and subject to the engineer's approval.

iii. Be rated for operation on a 400-volt, 3 phase and neutral (TP/N), 4-wire system, with neutral solidly earthed.
iv. Have bus bar and connections of high conductivity tin plated copper mounted on heavy duty glass polyester supports. Bus joints and connections shall be bolted with high strength bolts and Belleville washers: Provide double sized neutral busbar where indicated on schedule. Neutral bus bar shall have one terminal per outgoing way.
v. Flush or surface mounted as shown on the drawings or as required for the area and shall have adjustable trim clamps.
vi. Be complete with a directory mounted on the inside of the door in a metal frame: with a clear plastic cover. After completion of the wiring, type the directory showing clearly the description of each circuit controlled from the panel.
vii. Be complete with integral MCCB incomer and earth leakage protection as detailed on the drawings.
viii. Be assembled under license to the supplier of the equipment.
ix. Have trim and doors finished with epoxy coated powder painted-light blue/grey color.
x. Have suitably size copper earth bars running full height of the board with one incoming terminal and one per outgoing way plus earth studs for additional connections.
xi. Have a maximum depth of 150mm or as permissible by wall depth as shown on drawings.
xii. Where more than one section is required, bolt sections together to form a rigid assembly complete with all necessary interconnections.
xiii. Fused switch panels shall have dead front sheet enclosures without doors.
xiv. Where more than one section required bolt sections together to form a rigid assembly.
xv. Name plate shall be engraved lamicoid, with white letters on a black background.
xvi. DB's in offices & rentable spaces shall be metal type by Hager, 'Voltra' series or equivalent.

2.2 MINIATURE CIRCUIT BREAKERS

a. Miniature circuit breakers shall:
   i. Comply with BS EN 60898-1 and BS EN 60898-2.
   ii. Be quick make quick break molded case type, with thermal magnetic trips. Two and three pole breakers shall have a common trip and single operating handle.
   iii. Have plug in connections to the bus bars.
   iv. Be ambient temperature corrected. Details of certificates shall be handed to the Engineer for approval.
   v. Be instantaneous trip type 'C' with a minimum short, circuit rating of 9 kA.

b. Residual current circuit breakers shall comply with BS EN 60898 or BS EN 61008-1

c. Main breakers, switches and contactors shall comply with the applicable Sections of this

specification.

d. Branch circuits indicated as “Spare" shall include a breaker of the rating indicated. Branch circuits indicated "Space" shall have a cover, and shall be ready to receive breaker of the rating indicated. "Spaces" in fused switch panels shall include a blank door or cover.

2.3 MANUFACTURER

a. Manufacturer of the equipment shall be independently certified to BS EN ISO 9001 Quality specification.

b.

c. Routine tests as specified in applicable standard specifications shall be carried out at manufacturer’s works.

3. EXECUTION

3.1 EQUIPMENT IDENTIFICATION

Provide equipment identification as per the Section 26 05 00.

3.2 INSTALLATION

a. Run conduits from each flush mounted distribution board and terminate each in a 200mm x 200mm x 150mm deep box in accessible area in ceiling space. Allow 50% spare conduits for future cabling.

b. Mount distribution board plumb, securely, true and square.

c. Do not use connecting conduits for support, close all unused openings.

d. Connect loads to circuits as indicated.

e. Provide padlocking facility for all breaker/switch units feeding elevator equipment.

X ---------- END OF SECTION ---------- X

SECTION 26 27 13
ELECTRICITY METERING

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works, Section 01 00 00.
b. Conform to the Common Work Results for Electrical, Section 26 05 00.

1.2 SUBMITTALS

Submit shop drawings as specified in Section 26 05 00.

2. PRODUCTS

2.1 ELECTRIC METER

a. Provide all EDD meters and current transformers as indicated on the drawings. EDD meters indicated within the switchboards shall be mounted in a separate enclosure with lockable doors. All meters shall be visible without opening the doors.

b. Meters shall have suitable hardware for the application EDD seal.

c. Meters shall be as approved and be calibrated to EDD requirements.

d. Meters shall be dual tariff and able to integrate with BMS.

e. Meters shall meet the requirements of Electric Supply Company (wherever applicable).

3. EXECUTION

a. Coordinate with the electric utility and make all necessary arrangements for metering.

b. Supply and install the required equipment and materials.

X ---------- END OF SECTION ----------X

SECTION 26 27 26
WIRING DEVICES

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works, Section 01 00 00.
b. Conform to the Common Work Results for Electrical, Section 26 05 00.

1.2 SUBMITTALS

Submit shop drawings as specified in Section 26 05 00.

2. PRODUCTS

2.1 GENERAL

a. Wiring devices for finished areas shall be flush mounted as follows:
   i. Wiring devices in all unfinished areas such as pump rooms electrical rooms and the like shall be surface mounted metal clad.
   ii. Wiring devices in all the weather proof areas marked 'W.P.' or in external areas shall be IP44 minimum rated, all sockets shall have Plastic covers.

   Note: All accessories shall be screw less fix.

2.2 SWITCHES

a. Light switches shall be of manufacture rating and type as specified.

b. Light switches shall-comply with BS EN 60669-1 and shall be grid type.

c. Switches shall be installed in boxes with adjustable lugs to ensure front plate is true and square. Flush boxes shall be flush with the finished wall surface and overlapping front plates shall be used. Boxes shall be suitable for the wiring system used.

d. Switches shall be 10 ampere rated.

e. Where switches are mounted in Class 4 installations where exposed to weather or continual dampness they shall be water-tight pattern with approved gaskets. Enclosure shall comply with BS EN 60529 with ingress protection to IP 54.

f. Ceiling type switches shall be to BS EN 60669-1insulated pattern finished white (unless otherwise specified) with single cord operation.

g. Switches shall be suitable for back and side wiring with 4.0mm2 or 2 x 2.5mm2 standard conductors.

h. Switches & faceplate shall be made of polycarbonate material

2.3 SOCKETS OUTLETS

a. Socket outlets shall comply with BS 1363-1 and BS 1363-2, switched, shuttered and mounted in ring or multiple assemblies and shall be of the type and rating as specified/indicated on the drawings.

b. Matching plugs shall be provided for each socket outlet installed.

c. Plugs tops shall be fitted with the correct rated fuse for the appliance to which it is connected.

d. Socket outlets shall be complete with boxes not less than 35mm deep and the box shall have a suitably mounted, brass, protective conductor terminal.

e. Socket outlets installed in flush installations shall have overlapping front plates.

f. In surface installations front plates shall be flush with the sides of the box and shall be metal clad unless otherwise specified.

g. Where socket outlets are installed on perimeter paneling, provide suitable metal frames for panel mounting.

h. The earth pin of the socket shall be connected to the box earth terminal with a green and yellow PVC-insulated protective conductor. Cover screws are not acceptable for earth continuity.

i. Indicating pattern socket outlets shall be used for appliances containing a heating element and the like.

j. In Class 4 protection areas, where socket outlets are installed in exterior or damp locations, outlets shall be watertight pattern with watertight caps and approved gaskets. Suitable plugs shall be provided for each outlet. Enclosure shall comply with BS EN 60529 and ingress protection to IP 44.

k. Socket outlet shall be suitable for back and side wiring with 1 x 6.0mm2 or 2 x 4.0mm2

standard conductors.

l. 240/110V socket outlets shall comprise of double wound transformer with midpoint of secondary winding earthed. The socket outlet shall be 16A rated, 3 pin for portable tools and hand lamps.

2.4 FUSED CONNECTION UNITS

a. Fused connection units shall be to BS5733, double-pole, insulated pattern, switched with neon Indicator as specified, with brushed satin, stainless steel face plates or face plates to match socket outlets.

b. Where used as a flexible outlet to an appliance, fused connection units shall be of the flexible outlet pattern with cable anchoring clamp. Fuses shall be provided with each connection unit.

2.5 COVER PLATES

a. Socket outlets and switch cover plate finishes to be as detailed in 2.1.

b. Socket outlets and switch cover plate in unfinished areas and above ceilings shall be metal clad.

c. Samples of all cover plates shall be provided to the Engineer for approval prior to ordering.

2.6 SHAVER OUTLETS

a. Shaver outlets shall be dual voltage 115/240 volts output with 220V 50 Hz input.

b. Shaver outlets shall be in accordance with BS EN 61558-2-4.

c. Shaver outlets shall be complete with a double wound isolating transformer rated at 20VA.

d. Shaver outlets shall be flush mounted and finishes shall match the accessories in the area Refer to 2.1.

2.7 INDUSTRIAL SOCKETS 20 AMPERE AND 30 AMPERE RATING

a. Industrial sockets shall comply BS EN 60309-2 and shall be switched.

b. Industrial sockets located internally shall have minimum ingress protection of IP44 and IP65 for external sockets.

c. All single phase sockets shall be 220-250 volts and all three phase sockets shall be 380-415 volts.

d. Sockets and plugs shall have polycarbonate housing.

e. Sockets shall be complete with surface back base and shall be angled at approximately 45°.

f. Sockets shall be complete with plugs.

3. EXECUTION

a. Install single throw switches with lever in "UP" position when switch is closed.

b. Install switches in gang type outlet boxes with ganged cover plate when more than one switch or device is shown.

c. Cover plates shall be installed after all painting has been completed.

d. Provide phase barriers where more than one phase enters lighting switch.

e. Samples of all accessories shall be provided for approval by the Engineer prior to ordering.

X ---------- END OF SECTION ---------- X

SECTION 26 50 00
LIGHTING

1. GENERAL

1.1 REFERENCE

a. Conform to the General Requirements and Conditions for MEP Works, Section 01 00 00.
b. Conform to the Common Work Results for Electrical, Section 26 05 00.

1.2 SCOPE OF WORK

The scope of work shall cover the supply, design, manufacture, testing in the factory, packing, insurance, delivery to site, unloading, installation, testing and commissioning of all components with all the necessary accessories in accordance with this technical specification.

1.3 SUBMITTALS

a. Submit shop drawings as specified in Section 26 01 00.

b. Submit schedules and samples of each fixture specified, to the Engineer for approval. If, applicable no additional fixtures shall be manufactured until samples has been duly approved.

c. Approved samples shall be retained on the Job site until project completion. Fixtures which do not match quality and workmanship standards of the sample will be rejected.

d. Provide photometric data with each fixture sample.

1.4 COORDINATION

a. Rectangular openings for recessed lighting fixtures in gypsum board ceilings will be framed by the gypsum board division. Supply dimensions for openings to the gypsum board division, and ensure that the openings are correctly located.

b. Supply rings for other recessed fixtures, and install in conjunction with the ceiling tile or gypsum board Section.

c. Coordinate with other Divisions to ensure the correct location and installation of the plaster frames and rings.

2. PRODUCTS

a. Lighting fixtures shall be in accordance with the Schedule of Fixture and as per the Approved List of Makes unless otherwise indicated.

b. Before placing orders for any recessed lighting fixtures check the room finishes to ensure that fixtures are coordinated with the ceiling and compatible with the ceiling support grid.

c. Fixtures shall be delivered completely assembled and in their original cartons. No fixtures shall be delivered to or stored within the building or on the site until dry and protected space is available.

d. Steel fixture bodies and components shall be painted after all forming, cutting and fabrication are complete. Pre-painted steel will not be accepted.

e. Luminaires shall be complete with integral high power factor correction control gear to give a power factor between 0.9 and unit 1.

f. Ensure correct control gear is provided where light fixture are to be dimmed.

g. Fluorescent Lamps to be triphosphor color temp 3500 K.

h. All control gear shall be high frequency.

i. Light fixtures will be manufactured in Europe and will bear certificates ensuring compliance with all European Norms.

j. All luminaries to have control gear from the Approved Brands.

3. EXECUTION

a. Install rows of lighting fixtures accurately, in line and level. Any fixtures which in the opinion of the Engineer are not installed properly in the opinion of the Engineer shall be taken down and reinstalled to the satisfaction of the Engineer at no change to the contract sum.

b. Install surface mounted fixtures light to the ceiling without showing a space or light leak between the frame and the ceiling, except where fixtures have an upward indirect light component.

c. Support suspended fixtures of mild steel threaded rod as recommended by the manufacturer with a minimum number of two supports per fixture.

d. Where fixtures are chain hung, the chain shall be No. 10T single jack chain, galvanized with 20kg working load limit. Run heat resistant cable down chains to fixtures and attach to chains with cable

clips.

e. Attach fixtures, boxes or supports to concrete slabs with minimum 6mm dia. Bolts and metal expansion anchors. Submit samples of anchors to Engineer for approval before installation.

f. Locate fixture hangers on the tile centers or intersections. Mount recessed incandescent, troffers and surface-mounted fixtures in or on full tiles.

g. Do not mount fixtures pipes, ducts or ceiling mounted equipment. In the event o unavoidably tight locations, provide hangers to clear the obstructions. Check layouts of other trades on the job and plan cooperatively. Hang fixtures in any room at one height unless indicated otherwise. Support fixtures independently of mechanical ducts.

h. Support all lighting fixtures independently of suspended ceiling.

i. Obtain the Engineer's approval before making any changes to fixtures layouts.

j. Install louvers after other construction work has been completed and are is made ready for occupancy. Handle louvers with clean gloves, never with bare hands. Replace or clean nay louvers, which are finger printed or otherwise marked to the Engineer's satisfaction.

k. Drilling of structural steel beams is no permitted. Fixing to steel work shall utilize proprietary steel clamps.

l. Connections to luminaires were ceiling tile is accessible shall be via a plug-in ceiling rose wired in heat resistant double insulated cable. Ceiling rose to be mounted within 1000mm of fight fixture.

m. Connections to luminaires where the ceiling is not accessible such as dry wall and the like, shall be via OHLS flexible conduit with no terminations above the ceiling.

n. Fluorescent fixtures shall be aligned parallel to the longitudinal axis of the area they serve.

X ---------- END OF SECTION ---------- X

SECTION – 8

LIST OF SPECIFIED MATERIAL

CADET COLLEGE SANGHAR
AT JAM NAWAZ ALI, VIA TANDO ADAM, SINDH

"Construction of following Buildings: (a). Construction of Lal Shahbaz Qalandar Boys Hostel, (b). Construction of Staff Family Quarters / Flats Category – IV (Officers Colony), (c). Construction of Lower Staff Family Quarters / Flats Category – V, (d). Construction of Lower Staff Family Quarters / Flats Category – VI"

LIST OF SPECIFIED MATERIAL.

S.NO.	MATERIAL	BRAND NAME	MANUFACTURER	AGENCY / DISTRIBUTOR	SOURCE
1	ORDINARY PORTALAND / SULPHATE RESISTANCE CEMENT	LUCKY BRAND/D.G KHAN/ FALCON			HYDERABAD
2	WHITE CEMENT	MAPLE LEAF OR ANWARZEB			HYDERABAD
3	CRUSHED STONE				ONGAR/ NORIABAD
4	SAND				BOLHARI/ NORIABAD
5	STEEL (DEFORMED)	AMRELLI/ RAZZAK/ FF STEEL/NAVEENA			HYDERABAD SINDH
6	FIRST CLASS BURNT BRICKS				
7	GLAZED TILES		MASTER / SHABBIR TILES OR APPROVED EQUIVALENT		HYDERABAD
8	PORCELAIN TILES		SHABBIR / MASTER / GRANITE/SONEX OR EQUIVALENT APPROVED		HYDERABAD
9	ALUMINIUM DOORS / WINDOWS		LUCKY / PAK CABLE		MANUFACTURER SUPPLY

LIST OF APPROVED ELECTRICAL & ELV MANUFACTURER

Samples of all equipment's shall have to be got approved prior to their procurement. The bidder has to sign and stamp all pages of Annexure-1. Any deviation from the BoQ / Specification shall be listed in a separate sheet to be labeled as Annexure-2 containing the details of the deviation including the deviating BoQ item number.

S.No	Manufacturer / Supplier	Country Of Origin
LOW VOLTAGE (LV) PRODUCTS		
LV Switchboards / Distribution Boards / PFI Panels		
a.	Baber Brothers	Pakistan
b.	Volamp	Pakistan
c.	Al-Rehman Switchgear	Pakistan
d.	PEL	Pakistan
Circuit Breakers		
a.	M.G. (Schneider Electric)	France / Italy
b.	Terasaki	Japan / Malaysia / Spain
c.	ABB	Germany / Italy
d.	Siemens	Germany
CT, PTs Relay & Instruments		
a.	Schneider Electric.	France
b.	Siemens	Germany
c.	Revalco	Italy
d.	ABB	Italy
PFI Plant		
a.	Nokian	Finland
b.	Schneider	France
c.	ABB	Italy
d.	Circutor	France
Load Break Switches, Changeover Switches		
a.	Socomec	France
b.	Kraus & Naimer	Austria
Push Buttons, Switches, Etc.		
a.	Schneider Electric	France / Italy
b.	Maruyasa	Japan/Malaysia/Indonesia
LV Cables & Wires		
a.	Pakistan Cables	Pakistan
b.	Fast Cables	Pakistan
c.	Allied Cables	Pakistan

S.No.	Manufacturer / Supplier	Country Of Origin
Cable Glands, Lugs, Terminals and Accessories		
a.	Cembre	UK
b.	Hubbell / Hawke	UK
PVC Conduits and Accessories		
a.	Galco	Pakistan
b.	Dadex	Pakistan
c.	Jeddah Polymer	Pakistan
d.	Civic	Pakistan
Cable Tray / Trunking		
a.	A to Zee	Pakistan
b.	Premier Engineering	Pakistan
c.	Ashraf Industries	Pakistan
Back Boxes		
a.	Hussain & Co.	Pakistan
b.	Hensel	Germany
c.	Jeddah Polymer	Pakistan
Switch & Socket Outlets / Floor Boxes		
a.	Clipsal (Schneider Electric)	Australia / Singapore
b.	M.K.	UK
c.	Legrand	France/UK
FAN & Accessories		
a.	Pak Fan	Pakistan
b.	GFC Fan	Pakistan
c.	Millat Fan	Pakistan
Lighting Fixtures		
a.	Philips	Netherland/China
b.	nVc	USA/China
c.	Pierlite	Australia/China
d.	Sunlight	China
Contactors		
a.	Telemechanique (Schneider Electric)	France / Italy
b.	National	Japan
c.	ABB	Germany
Earthing		
a.	Furse	UK
b.	Wallis	UK

LOW CURRENT PRODUCTS		
S.No.	**Manufacturer / Supplier**	**Country Of Origin**
Telephone Cable		
a.	Clipsal (Schneider Electric)	Australia / France
b.	3M	UK
c.	Panduit	UK
CCTV		
a.	DAHUA	China
b.	HIKVISION	China
c.	ACTI	Korea

SECTION – 9

BILL OF QUANTITIES

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CADET COLLEGE SANGHAR

CONSTRUCTION OF FOLLOWING BUILDINGS

GRAND SUMMARY

1	Construction of Lal Shahbaz Qalandar Boys Hostel.	
2	Construction of Staff Family Quarters / Flats Category IV (Officers Colony).	
3	Construction of Lower Family Quarters / Flats Category V.	
4	Construction of Lower Family Quarters / Flats Category VI.	
	Total: (1 + 2 + 3 + 4)	

CONTRACTOR

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL

SUMMARY OF COST

1	CIVIL WORK.	_____
2	PLUMBING WORK.	_____
3	ELECTRICAL WORK.	_____
	Total: (1 + 2 + 3)	_____

_____

CONTRACTOR

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL

SUMMARY OF CIVIL WORKS

A.	SCHEDULE ITEMS:	_____
B.	NON - SCHEDULE ITEMS:	_____
	Total: (A + B)	_____

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)
CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL
CADET COLLEGE SANGHAR
BILL OF QUANTITIES
CIVIL WORKS

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
	A - SCHEDULE ITEMS				
1	**JUNGLE CLEARENCE**				
	Jungle Clearence and removing within 100 feet				
(a)	Light Chapter # 18, Page-88, Item # 4(a)	12,971	Per Sft	0.4	5,188
2	**EXCAVATION**				
	Excavation in foundation of Building, Bridges and other Structures including dagbeling dressing, refilling around structure with excavated earth watering and ramming lead upto one chain (30 metre) and lift upto 5 ft. (1.5 metre)				
(b)	In ordinary soil Chapter # 1, Page-27, Item # 18(b)	95,531	Per Cft	11.88	1,134,908
3	**EARTH FILL**				
	Filling, watering and ramming earth under floor with new earth (excavated from outside) lift upto 5 ft and lead upto 10 miles including cost of earth. Chapter # 1, Page-27, Item # 22	67,022	Per Cft	47.02	3,151,374
4	**LEAN (1:4:8)**				
	Cement concrete plain including placing compacting, finishing and curing, complete (including screening and washing at stone aggregate without shuttering).				
(i)	Ratio. 1:4:8 Chapter # 4, Page-34, Item # 5(i)	4,399	Per Cft	348.83	1,534,503
5	**REINFORCEMENT STEEL**				
	Febrication of deformed steel reinforcement for cement concrete including cutting, bending, laying in position, making joints and festenings including cost of binding wire (also includes removal of rust from bars).				
(a)	Deformed Bar.				
(i)	Grade - 60 Chapter # 4, Page-36, Item # 8(a)(i)	2,441	Per Cwt	18934.02	46,217,582
6	**P.C.C. (1:3:6)**				
	Cement concrete plain including placing compacting, finishing and curing, complete (including screening and washing at stone aggregate without shuttering).				
(h)	Ratio: 1:3:6 Chapter # 4, Page-34, Item # 5(h)	2,422	Per Cft	388.67	941,359

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
7	**D.P.C**				
	Damp proof course with (cement sand and shingle concrete 1:2:4) including 2 coats of asphaltic mixture.				
(b)	2" thick Chapter # 4, Page-38, Item # 28(b)	1,660	Per Sft	126.97	210,770
8	**BRICK WORK**				
	Pacca brick work in ground floor in (including striking of joints).				
(I)(c)	Cement Sand Mortar (1:4) Chapter # 5, Page-40, Item # 5(I)(c)	21,568	Per Cft	397.85	8,580,829
	Add extra labour in Item # 5 for brick work in:				
	First Floor	5,215	Per Cft	17.23	89,854
	Second Floor	1,738	Per Cft	39.11	67,973
9	**FLOORING (1:2:4)**				
	Cement concrete plain including placing compacting, finishing and curing, complete (including screening and washing at stone aggregate without shuttering).				
(f)	Ratio: 1:2:4 Chapter # 5, Page-34, Item # 5(f)	2,187	Per Cft	443.54	970,022
10	**CERAMIC TILES (TOILET)**				
(a)	Laying floor of approved coloured glazed tiles 1/4" thick floor of approved colour & size jointing in white cement and laid over 1:2 cement sand mortar 3/4" thick including grouting with matching colour and finishing. Chapter # 8, Page-56, Item # 25	916	Per Sft	325.40	298,066
(b)	Laying floor of approved coloured glazed tiles 1/4" thick dado of approved colour & size jointing in white cement and laid over 1:2 cement sand mortar 3/4" thick including grouting with matching colour and finishing. Chapter # 8, Page-55, Item # 24	2,472	Per Sft	389.36	962,498
(c)	Laying Afghan Ziarat white flooring fine dressed on the surface without winding set in time mortar 1:2 including rubbing and polishing of the joints.				
(ix)	24"x24"x5/16" flooring Chapter # 8, Page-56, Item # 28(ix)	5,098	Per Sft	439.57	2,240,928
(d)	Providing & laying full body Porcelain Tile in flooring or facing of approved design. Set in gray cement mortar 1:2 of 3/4" thickness including washing and joints fill with white cement, slurry using matching colour pigment and complete as per specification. 24"x24"x5/16" flooring Chapter # 8, Page-56, Item # 28(vii)	11,662	Per Sft	439.57	5,126,265

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
11	**PLASTER (1/2")**				
	Cement plaster 1:4 upto 12' height.				
(b)	1/2" thick.	91,784	Per Sft	39.83	3,655,757
	Chapter # 9, Page-62, Item # 11(b)				
12	**PLASTER (3/8")**				
	Cement plaster 1:4 upto 12' height.				
(a)	3/8" thick.	91,784	Per Sft	37.78	3,467,600
	Chapter # 9, Page-62, Item # 11(a)				
13	**NEERU PLASTER**				
	Cement Neru plaster 1:2 Cement and Sand upto 20 ft. (6.10 metre)				
(b)	1/2" thick	330	Per Sft	44.62	14,725
	Chapter # 9, Page-61, Item # 5(b)				
14	**DISTEMPER**				
	Distempering				
(c)	New Surface (iii) Three Coats	21,897	Per Sft	17.23	377,285
	Chapter # 9, Page-63, Item # 24(c)				
15	**WEATHER SHIELD PAINT**				
	Preparing the surface and painting with weather coat including rubbing the surface with rubbing brick / sand paper, filling the voids with chalk / plaster of paris and then painting with weather coat of approved make.	27,398	Per Sft	39.38	1,078,933
	Chapter # 9, Page-64, Item # 38(A)				
	(b) 2nd and subsequent coat	27,398	Per Sft	23.60	646,593
	Chapter # 9, Page-64, Item # 38(B)				
16	**WINDOWS / DOOR PAINT**				
	Preparing surface and painting doors and windows any type. (including edges).				
	(i) Priming Coat.	2,750	Per Sft	11.30	31,075
	(ii) Each subsequent coat.	2,750	Per Sft	7.11	19,553
	Chapter # 11, Page-73, Item # 5(c) (i) (ii)				
17	**PLASTIC EMULSION PAINT**				
	Preparing the surface and painting with plastic emulsion paint of approved make including rubbing the surface with sand Paper, filling the voids with chalk / plaster of paris and then painting etc. complete.				
	(A) Three Coats	64,385	Per Sft	38.71	2,492,343
	Chapter # 9, Page-64, Item # 40(A)				
19	**DOOR SHUTTERS**				
	First class deodar wood wrough joinery in doors and windows etc. fixed in position including chowkhats hold fasts, higes iron tower bolts, chock cleats, handles and cord with hooks etc. Deodar pannelled or Pannelled and glazed or fully glazed.				
	(b) Deodar Wood.	1,375	Per Sft	1233.27	1,695,746
	Deduct for wooden frame from rate.				
	Chapter # 10, Page-68, Item # 25(b)				

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
20	**ARCHITRAVE / WOODEN BIDDING** Providing & fixing with sunk iron screws Wooden Architrave approved design / shape having wifth not less than 2-1/2" inchesas directed by Engineer Incharge. Chapter # 10, Page-71, Item # 60	2,968	Per Rft	136.4	404,835
21	**MORTICE LOCKS** Providing & fixing approved quality mortice lock. Chapter # 10, Page-68, Item # 21	92	Each	1039.05	95,593
22	**IRON GRILL** Providing & fixing iron steel grill using solid square bars of size 1/2"x1/2" placed at 4" I/c and frame of flat iron patti of 3/4"x3/4" I/c circle shape at 1-0 apart equivalent fitted with screws are pins i/c painting 3 coats with 1st coat of red oxide paint etc. Chapter # 17, Page-86, Item # 30	1,122	Per Sft	833.27	934,929
23	**WINDOW FRAME** Providing and fixing G.I frames / choukhats of size 7"x2" or 4-1/2"x3" for windows using 20 gauge G.I sheet I/c welded hinges and fixing at site with necessary hold fasts, filling with cement sand slurry of ratio 1:6 and repairing the jambs. The cost also i/c all carriage, tools and plants used in making and fixing. Chapter # 17, Page-86, Item # 28	1,302	Per Rft	908.25	1,182,542
24	**DOOR FRAME** Providing and fixing G.I frames / choukhats of size 7"x2" or 4-1/2"x3" for door using 20 gauge G.I sheet I/c welded hinges and fixing at site with necessary hold fasts, filling with cement sand slurry of ratio 1:6 and repairing the jambs. The cost also i/c all carriage, tools and plants used in making and fixing. Chapter # 17, Page-86, Item # 29	1,666	Per Rft	690.67	1,150,656

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
25	**GROOVE PLASTER**				
	Extra labour rate for making grooves of 1"x1/4" or 3/4"x1/2" plastered surface with true edges both vertically and horizontally with uniform depth and with groove base smoothly finished etc. complete as per instruction of Engineer Incharge.	2,740	Per Rft	31.19	85,461
	Chapter # 9, Page-64, Item # 34				
26	**ROOF SCREED / FLOOR**				
	Providing & laying 1" thick topping of cement concrete (1:2:4) including Surface finishing and dividing into panels.				
	(c) 2" thick	11,662	Per Sft	108.75	1,268,243
	(d) 3" thick	12,245	Per Sft	145	1,775,525
	Chapter # 8, Page-55, Item # 16(c) & (d)				
27	**DRIP COURSE**				
	Making drip course 2"x1/2" (50x12mm) under RCC Slab edges in outer opening, in cement sand mortar (1:2).	527	Per Rft	34.42	18,139
	Chapter # 7, Page-53, Item # 48				
28	**STAIR CASE**				
	Laying Super Botisinam Crème, Badal or Black Marble 12"x12" / 12"x24" fine dress on surface without winding set in line mortar 1:2 including rubbing and polishing on the joint.				
	(a) 3/4" thick marble	1,122	Per Sft	337.9	379,124
	Chapter # 8, Page-56, Item # 28(v)(a)				
29	**SKIRTING / MARBLE**				
	Providing & fixing 3/8" thick Marble Tiles of approved quality & coloued and shade size 8"x4" in dado skirting & facing removal tucking of existing plaster surface etc. over 1/2" thick base of cement mortar 1:3 setting of tile in slurry of white cement over mortar base i/c filling & joints & washing the tile with white cement slurry current finishing clearing & polishing etc. complete (New Work)	357	Per Sft	247.28	88,279
	Chapter # 8, Page-59, Item # 61				

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
30	**FLY PROOF DOOR & WINDOW SHUTTERS** First class deodar wood wrought joinery work in wire gauze doors and windows with 22 SWG galvanized wire gauze 12x12 mashes per squareinch (625 mm) including iron fittings complete.				
(a)	Deodar framing 1-3/4" (45 mm) with wire guage fixed in position. Chapter # 10, Page-67, Item # 14(a)	1,375	Per Sft	1559.16	2,143,845
31	**ALUMINIUM SHEET** Providing & fixing Aluminium sheet on doors pasted with glue as per requirement. Chapter # 10, Page-71, Item # 61	878	Per Sft	115.38	101,304
					94,640,204
	Add / Deduct ____ % above / below				
	TOTAL:				

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CIVIL WORKS

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
	B - NON - SCHEDULE ITEMS				
1	**R.C.C**				
	Providing and laying reinforced cement concrete using Hub River crushed stone aggregate 3/4 inch (19 mm) and down gauge having a minimum works cylindrical crushing strength of 3000 psi for foundation, plinth beam, roof beam, slab, wall and for 4000 PSI columns at 28 days of any shape including using SBR and water tight form work and its removal, compacting, leveling vibrating and curing etc. complete but excluding the cost of reinforcement. (Sulphate resisting cement will be used up to Plinth level)				
	(iii) 3000 PSI	24,856	Per Cft		
	(iv) 4000 PSI	2,726	Per Cft		
2	**SHUTTERING**				
	Erection of removal of centering for RCC or plain cement concrete works of Partal Wood.				
(b)	Vertical	4,010	Per Sft		
3	**STONE SOLING**				
	Providing and laying soling stones 4 inches to 6 inches under Footings, floors including packing with spawls and chips and consolidating compacting watering etc. complete.	8,038	Per Cft		
4	**ANTITERMITE**				
	Provide & apply Antitermite treatment using MIRAGE of Ali Abkar Enterpises or equaivelent approved quality in various stages e.g. under ground treatment at various stages and each floor including all wooden work. Plinth area will be measured once for all operations. (The Contractor will give 10 years Guarantee).	12,862	Per Sft		
5	**WATER SPOUTS**				
	Providing & fixing water spout.				
	UPVC 4" dia Pipe & 4.5' long	30	Each		

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CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL

SUMMARY OF PLUMBING WORKS

A.	SCHEDULE ITEMS:	_____
B.	NON - SCHEDULE ITEMS:	_____
	Total: (A + B)	_____

YOUNG ASSOCIATES
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NAME OF WORKS: **CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL**

CLIENTS: **CADET COLLEGE SANGHAR**

JOBS DESCRIPTION: **BILL OF QUANTITIES (WATER SUPPLY AND SANITARY INSTALLATION)**

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
	A - SCHEDULE ITEMS				
1	Providing and Fixing orisa type white or colour glazed earthen ware w.c. pan with cost of low level plastic flush tank of 3 gallons capacity of approved quality i/c making requisite number of holes in wall. Plinth and floor and making good in cement concrete 1:2:4				
	A. W.C pan orisa type 23" with plastic tank of low down 3 gallons C.I trap and C.I thumble (superior quality)	12 Nos.	10,440.50	Each	125,286
	(ii) with 4 inch dia earthen ware trap & plastic thumble.				
	Chapter # 01, Item # 3(a), Page-204				
2	Providing & Fixing 24" x 18" lavatory basin in white glazed earthen ware complete with i/c the cost of W.I or C.I Cantilever brackets 6 inch built into wall, painted white in two coat after a primary coat of red lead paint a pair of ½" dia chrome plate pillar traps 1½" dia rubber plug & chrome plated brass chain 1-1/4" dia malleable iron or cp brass traps malleable iron or brass union & making requisite number of holes in walls plinth & floor for pipe connection and making good in cement concrete 1:2: (standard pattern)	33 Nos	9,495.14	Each	313,340
	Chapter # 01, Item # 8, Page-205				
3	Add extra for labour for providing and fixing of eathern ware pedestal white or colored glazed (standard pattern).	33 Nos	3,276.00	Each	108,108
	Chapter # 01, Item # 9, Page-205				
4	Providing and fixing in position nyloon connections complete with ½" dia brass stop cock with pair of brass nuts and lining joints to nyloon connection.	95 Nos	760.50	Each	72,248
	Chapter # 01, Item # 22, Page-207				
5	Providing and fixing chrome plated brass towel rail complete with brackets fixing on wooden cleats with 1" long C.P. brass screws.				
	(iii) Towel Rail 30" Long	33	945.07	Each	31,187
	Chapter # 02, Item # 1(iii)(a), Page-208				

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
6	Supplying and fixing soap tray made of plastic of superior quality and design with fine finishing with C.P. screws etc. complete. Chapter # 02, Item # 5, Page-208	33 Nos	585.00	Each	19,305
7	Add extra labour for concealed pipe and fittings i/c making recess in the wall for pipe and making good in cement mortar etc. complete.				
	(i) ½" dia	200	159.30	P.Rft	31,860
	(ii) 3/4" dia	250	199.83	P.Rft	49,958
	(iii) 1" dia	30	272.35	P.Rft	8,171
	Chapter # 04, Item # 2(i)(ii)&(iii), Page-211				
8	Providing and fixing full way gun metal valves with wheels, threaded or flabged ends with rubber washing.(gate valve)				
	1-1/2" dia (standard pattern) Chapter # 06, Item # 4(B)(c), Page-215	4	1,614.60	Each	6,458
9	Supplying & fixing handle valve (china) (ii). 1" dia	1	1,907.10	Each	1,907
	Chapter # 06, Item # 5(c), Page-215				
10	Constructing manhole or inspection chamber for the required dia of circular sewer and 3'-6" (1067 mm) depth with walls of B.B in cement mortar 1:3 cement plastered 1:3 , ½" thick, inside of walls and 1" (25 mm) thick over benching and channel i/c fixing C.I. manhole cover with frame of clear opening 1½" x 1½" (457 x 457 mm) of 1.75 Cwt. (88.9 kg) embedded in plain C.C. 1:2:4 and fixing 1" (25 mm) dia M.S steps 6" (150 mm) wide projecting 4" (102 mm) from the face of wall at 12" (305 mm) C/C duly painted etc. complete as per specification and drawing No. D.P/I of Public Health Circle Southern Zone.				
	(a) 4" to 12" dia 2' x 2' x 3'-6" Chapter # 11, Item # 1(a), Page-148	17	55,584.18	Each	944,931
	Note: Deducted from the above cost at the rate of Rs. 4234 per foot depth, where depth of Manhole is less than 3'-6" or 1067mm)				
11	Supplying & Fixing swan type pillar cock of superior quality with single c.p head 1/2" dia.	33	1,029.60	Each	33,977

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
	With Crystal Head Chapter # 06, Item # 16(a)&(b), Page-217	33	1,848.60	Each	61,004
12	S/Fixing concealed tee cock of superior quality with c.p head 1/2" dia Chapter # 06, Item # 11(a), Page-216	27	1,614.60	Each	43,594
13	Suppying and fixing in position C.P Bib Cock 3/4" dia C.P bib cock, standard pattern Chapter # 06, Item # 2(c), Page-215	50	1,544.40	Each	77,220
14	Providing UPVC pipes specials and clamps etc. including fixing cutting and fittings complete with and including the cost of breaking through walls and roof making good etc. with pigment to match the colour of the building and testing with water to a pressure bead of 200 feet and handling.				
	UPVC Nikasi pipe 4" dia.	350	465.53	P.Rft	162,936
	UPVC Nikasi pipe 3" dia.	360	836.36	P.Rft	301,090
	UPVC Nikasi pipe 6" dia. Chapter # 04, Item # 2(iv)(v)&(vi), Page-211	640	950.38	P.Rft	608,243
16	(a). Supplying & fixing concealed stop cock of superior quality with C.P head ½ inch dia. Chapter # 06, Item # 12(a), Page-216	27	1,615	Each	43,594
17	Providing and fixing steel sinks stainless local bt make complete with cast iron or wrought iron LINA ALVH brackets 6 inches built into wall, 1-1/2" rubber plug and chrome plated brass chain 1-1/2" C.P. brass waste with 1-1/2" P.V.C waste pipe & making requisite number of holes in walls, plinth & floor for pipe connection & making good in cement concrete 1:2:4.				
	a)steel sink stainless sized 40"x20" local make (Standard Pattern) Chapter # 01, Item # 19(a), Page-206	3	12,555.27	Each	37,666
18	Supplying & Fixing sink mixture cock of superior quality with c.p head etc complete (Sonex or Master Chapter # 06, Item # 17, Page-217	3	2,550.60	Each	7,652
19	Supplying and fixing jet shower with rod of each superior quality single C.P head 1/2" dia. Chapter # 06, Item # 15(a), Page-217	24	3,486.60	Each	83,678
				TOTAL "A"	**3,173,411**
				Add / Deduct ____ % above / below	
				TOTAL:	

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NAME OF WORKS: **CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL**

CLIENTS: **CADET COLLEGE SANGHAR**

JOBS DESCRIPTION: **BILL OF QUANTITIES (WATER SUPPLY AND SANITARY INSTALLATION)**

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
	B - NON-SCHEDULE ITEMS				
1	Supplying and fixing UPVC Plydex (P.P.R) manufactured by Dadex eternit Ltd cold water internal and external water supply pipe or approved equivalent including all cutting, fitting, bends, tees, specials as required etcjointed with solvent / special adhesive laid in floor walls trench making holes and making them good with C.C 1:2:4 etc complete as per direction.				
	(i) UPVC Polydex (PPR) pipe 1/2" dia.	200		P. Rft.	
	(ii) UPVC Polydex (PPR) pipe 3/4" dia.	250		P. Rft.	
	(iii) UPVC Polydex (PPR) pipe 1" dia.	50		P. Rft.	
	(iv) UPVC Polydex (PPR) pipe 1-1/2" dia.	130		P. Rft.	
	(v) UPVC Polydex (PPR) pipe 1-1/4"	200		P. Rft.	
	(v) UPVC Polydex (PPR) pipe 2" dia.	200		P. Rft.	
2	Providing and Fixing a P.V.C trap with 4" dia inlet and 4" out let of the approved self clearing design with a P.V.C grating 6" x 6" with or without a vent arm including cost of making requisite number of holes in walls plinth and floor for pipe connection and making good cement concrete 1:2:4	14		Each	
3	Providing and fixing 6" x 2" or 6" x 3" floor trap of the approved self cleaning design, with a UPVC grating 6" x 6", with or without vent arm complete with and including making requiisite number of holes in walls, plinth and floor for pipe connections and making good in C.C. 1:2:4 etc.	29		Each	
4	Providing and fixing 6" x 4" P.V.C gully trap with 4" outlet complete 6" x 6" PVC cover with PVC frame.	7		Each	
5	Providing and fixing 24" x 24" beveled edge Mirror best quality Pak made fixed with 4 Nos clamp set and brass screw fixed to wood cleat	33		Each	

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
6	Providing & fixing a P.V.C clamps of the approved design to 4" dia pipe sockets including the cost of cutting and making good to wall or M.S bolts & nuts, 4" into wall including pipe distances extra painting to match the colour of the building.	78		Each	
7	Supply, fixing, testing and commissioning of clean out plug of 4" dia along with specials, fittings, bends, sleeves, masking plates, traps, vent cowl, chiseling, making hole, excavation, backfilling making good where as required to operate as per specifications, drawings and instructions of Consultant.	5		Each	
	Total of non-schedule items		**Total**		

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CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL

SUMMARY OF ELECTRICAL WORKS

A.	SCHEDULE ITEMS:	_____
B.	NON - SCHEDULE ITEMS:	_____
	Total: (A + B)	_____

EXECUTIVE SUMMARY OF COST OF ELECTRICAL & ALLIED WORKS		
SECTION	**DESCRIPTION**	**TOTAL**
		AMOUNT (PKR)
SECTION-A	WIRING & WIRING ACCESSORIES	
SECTION-B	LIGHTING FIXTURES	
	TOTAL COST FOR ELECTRICAL WORKS	

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL

BOQ OF ELECTRICAL & ALLIED WORKS						
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	COMPOSITE RATE	
					RATE PKR	AMOUNT PKR
		SECTION - A **WIRING / WIRING ACCESSORIES**				
		Providing, installation, testing & commissioning of following items including all material, tools, labor & accessories required for completion of work as per specifications, details & drawings. Complete in all respects. Megger Test Report of all wiring shall be submitted by contractor to consultant.				
		SMALL WIRING FOR LIGHTS				
	C	**WITH 3 WIRE PVC CONDUIT ON SURFACE**				
A1	C17	Providing & laying (Main or Sub Main) PVC insulated with size 3-7-3/.029 copper conductor in ¾" dia PVC conduit on surface. Average Length 100 Rft. (667.06 / FT)				
a		3-7-3/.029 PVC, Cu	5060	Per Ft	667.06	3,375,324
	N	**POINT WIRING SUB-HEAD II**				
A2	N-102	Wiring for light or fan point with 3/.029 PVC insulated wire in 20mm (3/4") PVC conduit recessed in the wall or column as required.	236	Per Point	6,573.50	1,551,346
A3	N-102	Wiring for light or fan point with 3/.029 PVC insulated wire in 20mm (3/4") PVC conduit recessed in the wall or column as required..	256	Per Point	6,573.50	1,682,816
		SMALL WIRING FOR POWER				
	C	**WITH 3 WIRE PVC CONDUIT ON SURFACE**				
A4	C17	Providing & laying (Main or Sub Main) PVC insulated with size 3-7-3/.029 copper conductor in ¾" dia PVC conduit on surface. Average Length 30 Rft. (667.06/ FT)				
a		3-7-3/.029 PVC, Cu	4840	Per Ft	667.06	3,228,570
	N	**POINT WIRING SUB-HEAD II**				

BOQ OF ELECTRICAL & ALLIED WORKS						
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	COMPOSITE RATE	
					RATE PKR	AMOUNT PKR
A5	N-103	Wiring for plug point with 3/.029 PVC insulated wire in 20mm (3/4") PVC conduit on surface as required				
a		3/.029 PVC, Cu	244	Per Point	3,816.06	931,119
		WIRING FOR WATER TRANSFER PUMP				
A6	C-18	Wiring for Water Transfer Pump Providing & laying (Main or Sub Main) PVC insulated with size 3-7/.036(4mm2) copper conductor in ¾" dia PVC conduit on surface. Average Length 100 Rft..	300	Per Ft	916.79	275,037
		WIRING FOR BOOSTER PUMP				
A7	C-18	Wiring for Booster Pump Providing & laying (Main or Sub Main) PVC insulated with size 3-7/.036(4mm2) copper conductor in ¾" dia PVC conduit on surface. Average Length 100 Rft..	300	Per Ft	916.79	275,037
		WIRING FOR COMBOX				
A8	C17	Wiring for Comrbox Providing & laying (Main or Sub Main) PVC insulated with size 3-7-3/.029 copper conductor in ¾" dia PVC conduit on surface. Average Length 30 Rft. (667.06/ FT)	200	Per Ft	667.06	133,412
		TOTAL AMOUNT - SEC - A (PKR) (CARRIED FORWARD TO SUMMARY)	.		-	**11,452,661**
		SECTION - B LIGHTING FIXTURES				
		Providing/ Supplying , Installation, testing and commissioning of the following lighting fixture including all accessories like electronic ballast, lamps, mounting arrangements etc. Complete in all respects. Mounting accessories shall be provided by contractor like screws, nuts, bolts, strings etc.				

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL

BOQ OF ELECTRICAL & ALLIED WORKS						
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	COMPOSITE RATE	
					RATE PKR	AMOUNT PKR
B1	195 ©	**CELING FAN** Providing & fixing A.C Electric Ceiling fan 56" (good quality) As approved by architect.	48	Nos.	14,869.21	713,722
		TOTAL AMOUNT - SEC - B (PKR) (CARRIED FORWARD TO SUMMARY)			-	**713,722**
		Add / Deduct ____ % above / below				
		TOTAL				

EXECUTIVE SUMMARY OF COST OF ELECTRICAL & ALLIED WORKS		
SECTION	**DESCRIPTION**	**TOTAL**
		AMOUNT (PKR)
SECTION-B	WIRING DEVICES / RECEPTACLES	
SECTION-C	LIGHTING FIXTURES	
SECTION-D	DISTRIBUTION BOARDS AND CABLES	
SECTION-E	CABLE RACEWAYS / CONTAINMENTS	
SECTION-F	COMMUNICATION SYSTEM	
SECTION-G	GROUNDING & BONDING	
	TOTAL COST FOR ELECTRICAL WORKS	

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
		SECTION - B **WIRING DEVICES / RECEPTACLES**								
		Providing, installation and commissioning of following wiring devices / light control switches / power receptacles as per BS Standards including 16 SWG MS Powder Coated back boxes, flush with wall as shown in drawings and details.								
		LIGHT CONTROLLED SWITCHES								
B1		One Gang one way 10A Switch	12	Nos.						
B2		Two Gang one way 10A Switch	32	Nos.						
B3		Three Gang one way 10A Switch	32	Nos.						
B4		Four Gang one way 10A Switch	16	Nos.						
		UTILITY POWER RECEPTACLES / SOCKET OUTLETS								
B6		13A, Simplex multi-pin switch Socket Unit	283	Nos.						
B7		15A, Round 3Pin Switch Socket Unit	2	Nos.						
		TOTAL AMOUNT - SEC - B (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - C **LIGHTING FIXTURES**								
		Providing/ Supplying , Installation, testing and commissioning of the following lighting fixture including all accessories like electronic ballast, lamps, mounting arrangements etc. Complete in all respects. Mounting accessories shall be provided by contractor like screws, nuts, bolts, strings etc.								
C1		**DOWN LIGHT** DOWN LIGHT FLUSH WITH 20W LED LIGHT. As approved by architect.	340	Nos.						
C2		**FLOOD LIGHT** FLOOD LIGHT WITH 50W LED LIGHT. As approved by architect.	4	Nos.						
C3		**EXHUAST FAN** EXHUAST FAN. As approved by architect.	14	Nos.						
		TOTAL AMOUNT - SEC - C (PKR) (CARRIED FORWARD TO SUMMARY)								

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
		SECTION - D **DISTRIBUTION BOARDS & CABLES**								
		Providing, Laying, Testing, Termination and Commissioning of following multi-core PVC insulated Copper / Aluminium Conductor Cables for main/sub-main power distribution system as shown in the layout plans in appropriate size of conduits. Work also includes necessary termination accessories like compression lugs, color coded sleeves, identification tags etc. Note : The quantities shown in the boq are estimated based on design drawings. Contractor has to take accurate measurements at site prior to procurement of material.								
D1		4C, 35 Sqmm Cu. SWA/PVC/PVC + ECC, 1x16 Sqmm Cu.PVC From Nearest Power Source to MDB	70	RM						
D2		4C, 16 Sqmm Cu. PVC/PVC + ECC, 1x16 Cu.Sqmm PVC From MDB To DB-G	20	RM						
D3		4C, 16 Sqmm Cu. PVC/PVC + ECC, 1x16 Cu.Sqmm PVC From MDB To DB-F	25	RM						
		Supply, Installation, testing and commissioning of following distribution panels in accordance with the attached single line diagrams and layout plans. The panels shall be made according to the technical specifications attached.								
D4		MDB+ATS	1	No.						
D5		DB-G	1	No.						
D6		DB-F	1	No.						
D7		TP Box 125A TP Adj. MCCB (ICU=25KA) With Weather Proof Housing	1	No.						
		TOTAL AMOUNT - SEC - D (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - E **CABLE RACEWAYS / CONTAINMENTS**								
E1		**Supply and installation** of following sizes of PVC conduits / pipes including all installation acessories like bends, sockets, flexible conduits, partially above false ceiling and partially embedded in ground e.t.c , the works also complete with excavation and back filling of 1'-6" deep for laying of main / sub-main cables . Compete in all respects as shown in the drawing.								
a		20 mm dia PVC conduit	500	RM						
b		25 mm dia PVC conduit	500	RM						

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
c		32 mm dia PVC conduit	500	RM						
d		50 mm dia PVC conduit	100	RM						
		TOTAL AMOUNT - SEC - E (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - F **COMMUNICATION SYSTEMS**								
		Supply , installation , testing and commissioning of following items for voice & data communication cabling system including all material , labor , tools , accessories etc. Complete in all respects. Item includes termination of all cables at respective outlets as shown in the drawings and instructed by client. Note : The quantities shown in the boq are estimated based on design drawings. Contractor has to take accurate measurements at site prior to procurement of material.								
		HORIZONTAL DATA CABLING								
F1		**Category 6 , UTP Cables**, for data communication system at local workstations in 25mm dia PVC conduits under floor as shown in the layout plan and schematic diagrams. Work includes all terminations, management and tagging at both ends.	450	RMtr.						
		COMMUNICATION BOX								
F2		**Communication Box**, Front door with glass cover, lock & key, and front blank panels for covering empty spaces, air flow ducts for effective cooling management inside the rack for switches. Item includes supply and installation of 6 way rack mounted standard PDU.	2	Nos.						
		Wi-Fi ROUTERS WITH ONU DEVICES								
F3		**Supply and installation of Wi-Fi Routers With ONU Devices** as shown in the drawings including all accessories.	8	Nos.						
F4		**TV WIRING & OUTLET**								
a		TV Splitter (Tap) Unit with enclosure suitable for 1 incomings and 4 outgoing cables including all termination accessories.	1	No.						
b		Wall Mounted 150x150x75 mm TV Pull box made with 16SWG sheet steel for Antina system.	2	Nos.						
c		RG-7 Cable for TV	200	Rmtr.						
		TOTAL AMOUNT - SEC - F (PKR) (CARRIED FORWARD TO SUMMARY)								

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
		SECTION - G **GROUNDING & BONDING**								
		Providing , installation , testing and commissioning of following items for earthing & bonding system of complete data center including all material, boring, labor, tools, transportation, accessories etc. Complete in all respects including detailed test reports. Estimated earth stations are taken at this stage. Contractor has to check the soil resistivity at site and propose required stations to achieve earth resistance not more than one ohms.								
		EARTH STATIONS								
G1		**Providing fixing and connecting** of earthing set which consist of one copper rod of size 20mm dia 3 meters long buried at 20 meter below the ground level buried at least 3 meter away from the nearest foundation the earth lead shall be of 2 Nos.70mm2 stranded copper conductor drawn in 50mm dia G.I pipe from the earthing rod to the panels transformer earth pit including Boring / digging as required and refilling the earth pits with necessary lime powder wooden cool as requires and approved electrical inspector IEE regulation and confirming to the Specification including make of earth pit with cast iron manhole cover 150mm x 150m	1	Nos.						
		EARTH TEST POINTS / CONNECTING POINTS								
G2		**Earth Test Point including Test Link** , 150 mm x 75 mm x 5 mm electroplated Copper bar , as shown in drawings. Bar shall be provided with holes suitable for installation of required earth leads. The test bar shall be enclosed in powder coated metal enclosure as approved by the client.	1	Nos.						
		EARTH LEADS / CONDUCTORS								
G3		**Single Core PVC insulated**, 16 Sqmm Stranded Copper Conductor, green in color from earth pit to test point and from test point to connecting point / Panels in 32mm size of UPVC Conduit.	35	RM.						
		TOTAL AMOUNT - SEC - G (PKR) (CARRIED FORWARD TO SUMMARY)								

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

SUMMARY OF COST

1	CIVIL WORK.	_____
2	PLUMBING WORK.	_____
3	ELECTRICAL WORK.	_____
	Total: (1 + 2 + 3)	_____

_____

CONTRACTOR

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

SUMMARY OF CIVIL WORKS

A.	SCHEDULE ITEMS:	_____
B.	NON - SCHEDULE ITEMS:	_____
	Total: (A + B)	_____

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)
CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)
CADET COLLEGE SANGHAR
BILL OF QUANTITIES
CIVIL WORKS

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
	A - SCHEDULE ITEMS				
1	**JUNGLE CLEARENCE**				
	Jungle Clearence and removing within 100 feet				
(a)	Light Chapter # 18, Page-88, Item # 4(a)	45,600	Per Sft	0.4	18,240
2	**EXCAVATION**				
	Excavation in foundation of Building, Bridges and other Structures including dagbeling dressing, refilling around structure with excavated earth watering and ramming lead upto one chain (30 metre) and lift upto 5 ft. (1.5 metre)				
(b)	In ordinary soil Chapter # 1, Page-27, Item # 18(b)	33,963	Per Cft	11.88	403,480
3	**EARTH FILL**				
	Filling, watering and ramming earth under floor with new earth (excavated from outside) lift upto 5 ft and lead upto 10 miles including cost of earth. Chapter # 1, Page-27, Item # 22	30,796	Per Cft	47.02	1,448,028
4	**LEAN (1:4:8)**				
	Cement concrete plain including placing compacting, finishing and curing, complete (including screening and washing at stone aggregate without shuttering).				
(i)	Ratio. 1:4:8 Chapter # 4, Page-34, Item # 5(i)	4,013	Per Cft	348.83	1,399,855
5	**REINFORCEMENT STEEL**				
	Febrication of deformed steel reinforcement for cement concrete including cutting, bending, laying in position, making joints and festenings including cost of binding wire (also includes removal of rust from bars).				
(a)	Deformed Bar.				
(i)	Grade - 60 Chapter # 4, Page-36, Item # 8(a)(i)	250	Per Cwt	18934.02	4,733,505
6	**P.C.C. (1:3:6)**				
	Cement concrete plain including placing compacting, finishing and curing, complete (including screening and washing at stone aggregate without shuttering).				
(h)	Ratio: 1:3:6 Chapter # 4, Page-34, Item # 5(h)	9,684	Per Cft	388.67	3,763,880

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
7	**D.P.C**				
	Damp proof course with (cement sand and shingle concrete 1:2:4) including 2 coats of asphaltic mixture.				
(b)	2" thick Chapter # 4, Page-38, Item # 28(b)	502	Per Sft	126.97	63,739
8	**BRICK WORK**				
	Pacca brick work in ground floor in (including striking of joints).				
(I)(c)	Cement Sand Mortar (1:4) Chapter # 5, Page-40, Item # 5(I)(c)	11,955	Per Cft	397.85	4,756,297
	Add extra labour in Item # 5 for brick work in:				
	First Floor	5,978	Per Cft	17.23	102,992
	Second Floor	1,793	Per Cft	39.11	70,134
9	**FLOORING (1:2:4)**				
	Cement concrete plain including placing compacting, finishing and curing, complete (including screening and washing at stone aggregate without shuttering).				
(f)	Ratio: 1:2:4 Chapter # 5, Page-34, Item # 5(f)	1,421	Per Cft	443.54	630,208
10	**CERAMIC TILES (TOILET)**				
(a)	Laying floor of approved coloured glazed tiles 1/4" thick floor of approved colour & size jointing in white cement and laid over 1:2 cement sand mortar 3/4" thick including grouting with matching colour and finishing. Chapter # 8, Page-56, Item # 25	739	Per Sft	325.40	240,536
(b)	Laying floor of approved coloured glazed tiles 1/4" thick dado of approved colour & size jointing in white cement and laid over 1:2 cement sand mortar 3/4" thick including grouting with matching colour and finishing. Chapter # 8, Page-55, Item # 24	1,080	Per Sft	389.36	420,509
(c)	Laying Afghan Ziarat white flooring fine dressed on the surface without winding set in time mortar 1:2 including rubbing and polishing of the joints.				
(ix)	24"x24"x5/16" flooring Chapter # 8, Page-56, Item # 28(ix)	966	Per Sft	439.57	424,625
(d)	Providing & laying full body Porcelain Tile in flooring or facing of approved design. Set in gray cement mortar 1:2 of 3/4" thickness including washing and joints fill with white cement, slurry using matching colour pigment and complete as per specification. 24"x24"x5/16" flooring Chapter # 8, Page-56, Item # 28(vii)	4,547	Per Sft	439.57	1,998,835

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
11	**PLASTER (1/2")**				
	Cement plaster 1:4 upto 12' height.				
(b)	1/2" thick.	53,958	Per Sft	39.83	2,149,147
	Chapter # 9, Page-62, Item # 11(b)				
12	**PLASTER (3/8")**				
	Cement plaster 1:4 upto 12' height.				
(a)	3/8" thick.	53,958	Per Sft	37.78	2,038,533
	Chapter # 9, Page-62, Item # 11(a)				
13	**NEERU PLASTER**				
	Cement Neru plaster 1:2 Cement and Sand upto 20 ft. (6.10 metre)				
(b)	1/2" thick	483	Per Sft	44.62	21,551
	Chapter # 9, Page-61, Item # 5(b)				
14	**DISTEMPER**				
	Distempering				
(c)	New Surface (iii) Three Coats	9,165	Per Sft	17.23	157,913
	Chapter # 9, Page-63, Item # 24(c)				
15	**WEATHER SHIELD PAINT**				
	Preparing the surface and painting with weather coat including rubbing the surface with rubbing brick / sand paper, filling the voids with chalk / plaster of paris and then painting with weather coat of approved make.	8,295	Per Sft	39.38	326,657
	Chapter # 9, Page-64, Item # 38(A)				
	(b) 2nd and subsequent coat	8,295	Per Sft	23.60	195,762
	Chapter # 9, Page-64, Item # 38(B)				
16	**WINDOWS / DOOR PAINT**				
	Preparing surface and painting doors and windows any type. (including edges).				
	(i) Priming Coat.	4,804	Per Sft	11.30	54,285
	(ii) Each subsequent coat.	4,804	Per Sft	7.11	34,156
	Chapter # 11, Page-73, Item # 5(c) (i) (ii)				
17	**PLASTIC EMULSION PAINT**				
	Preparing the surface and painting with plastic emulsion paint of approved make including rubbing the surface with sand Paper, filling the voids with chalk / plaster of paris and then painting etc. complete.				
	(A) Three Coats	36,498	Per Sft	38.71	1,412,838
	Chapter # 9, Page-64, Item # 40(A)				
19	**DOOR SHUTTERS**				
	First class deodar wood wrough joinery in doors and windows etc. fixed in position including chowkhats hold fasts, higes iron tower bolts, chock cleats, handles and cord with hooks etc. Deodar pannelled or Pannelled and glazed or fully glazed.				
	(b) Deodar Wood.	2,402	Per Sft	1233.27	2,962,315
	Deduct for wooden frame from rate.				
	Chapter # 10, Page-68, Item # 25(b)				

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
20	**ARCHITRAVE / WOODEN BIDDING** Providing & fixing with sunk iron screws Wooden Architrave approved design / shape having wifth not less than 2-1/2" inchesas directed by Engineer Incharge. Chapter # 10, Page-71, Item # 60	1,968	Per Rft	136.4	268,435
21	**MORTICE LOCKS** Providing & fixing approved quality mortice lock. Chapter # 10, Page-68, Item # 21	60	Each	1039.05	62,343
22	**IRON GRILL** Providing & fixing iron steel grill using solid square bars of size 1/2"x1/2" placed at 4" I/c and frame of flat iron patti of 3/4"x3/4" I/c circle shape at 1-0 apart equivalent fitted with screws are pins i/c painting 3 coats with 1st coat of red oxide paint etc. Chapter # 17, Page-86, Item # 30	1,250	Per Sft	833.27	1,041,588
23	**WINDOW FRAME** Providing and fixing G.I frames / choukhats of size 7"x2" or 4-1/2"x3" for windows using 20 gauge G.I sheet I/c welded hinges and fixing at site with necessary hold fasts, filling with cement sand slurry of ratio 1:6 and repairing the jambs. The cost also i/c all carriage, tools and plants used in making and fixing. Chapter # 17, Page-86, Item # 28	1,250	Per Rft	908.25	1,135,313
24	**DOOR FRAME** Providing and fixing G.I frames / choukhats of size 7"x2" or 4-1/2"x3" for door using 20 gauge G.I sheet I/c welded hinges and fixing at site with necessary hold fasts, filling with cement sand slurry of ratio 1:6 and repairing the jambs. The cost also i/c all carriage, tools and plants used in making and fixing. Chapter # 17, Page-86, Item # 29	2,402	Per Rft	690.67	1,658,989
25	**GROOVE PLASTER** Extra labour rate for making grooves of 1"x1/4" or 3/4"x1/2" plastered surface with true edges both vertically and horizontally with uniform depth and with groove base smoothly finished etc. complete as per instruction of Engineer Incharge. Chapter # 9, Page-64, Item # 34	830	Per Rft	31.19	25,888

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
26	**ROOF SCREED / FLOOR** Providing & laying 1" thick topping of cement concrete (1:2:4) including Surface finishing and dividing into panels.				
	(c) 2" thick	9,095	Per Sft	108.75	989,027
	(d) 3" thick	10,004	Per Sft	145	1,450,573
	Chapter # 8, Page-55, Item # 16(c) & (d)				
27	**DRIP COURSE** Making drip course 2"x1/2" (50x12mm) under RCC Slab edges in outer opening, in cement sand mortar (1:2).	1,131	Per Rft	34.42	38,912
	Chapter # 7, Page-53, Item # 48				
28	**STAIR CASE** Laying Super Botisinam Crème, Badal or Black Marble 12"x12" / 12"x24" fine dress on surface without winding set in line mortar 1:2 including rubbing and polishing on the joint.				
	(a) 3/4" thick marble	1,007	Per Sft	337.9	340,265
	Chapter # 8, Page-56, Item # 28(v)(a)				
29	**SKIRTING / MARBLE** Providing & fixing 3/8" thick Marble Tiles of approved quality & coloued and shade size 8"x4" in dado skirting & facing removal tucking of existing plaster surface etc. over 1/2" thick base of cement mortar 1:3 setting of tile in slurry of white cement over mortar base i/c filling & joints & washing the tile with white cement slurry current finishing clearing & polishing etc. complete (New Work)	732	Per Sft	247.28	181,009
	Chapter # 8, Page-59, Item # 61				
30	**FLY PROOF DOOR & WINDOW SHUTTERS** First class deodar wood wrought joinery work in wire gauze doors and windows with 22 SWG galvanized wire gauze 12x12 mashes per squareinch (625 mm) including iron fittings complete.				
(a)	Deodar framing 1-3/4" (45 mm) with wire guage fixed in position.	2,402	Per Sft	1559.16	3,745,102
	Chapter # 10, Page-67, Item # 14(a)				
31	**ALUMINIUM SHEET** Providing & fixing Aluminium sheet on doors pasted with glue as per requirement.	600	Per Sft	115.38	69,228
	Chapter # 10, Page-71, Item # 61				
					40,834,691
	Add / Deduct ____ % above / below				
				TOTAL:	

YOUNG ASSOCIATES
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CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)
CADET COLLEGE SANGHAR
BILL OF QUANTITIES
CIVIL WORKS

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
	B - NON - SCHEDULE ITEMS				
1	**R.C.C**				
	Providing and laying reinforced cement concrete using Hub River crushed stone aggregate 3/4 inch (19 mm) and down gauge having a minimum works cylindrical crushing strength of 3000 psi for foundation, plinth beam, roof beam, slab, wall and for 4000 PSI columns at 28 days of any shape including using SBR and water tight form work and its removal, compacting, leveling vibrating and curing etc. complete but excluding the cost of reinforcement. (Sulphate resisting cement will be used up to Plinth level)				
	(iii) 3000 PSI	14,818	Per Cft		
	(iv) 4000 PSI	1,821	Per Cft		
2	**SHUTTERING**				
	Erection of removal of centering for RCC or plain cement concrete works of Partal Wood.				
(b)	Vertical	2,160	Per Sft		
3	**STONE SOLING**				
	Providing and laying soling stones 4 inches to 6 inches under Footings, floors including packing with spawls and chips and consolidating compacting watering etc. complete.	6,332	Per Cft		
4	**ANTITERMITE**				
	Provide & apply Antitermite treatment using MIRAGE of Ali Abkar Enterpises or equaivelent approved quality in various stages e.g. under ground treatment at various stages and each floor including all wooden work. Plinth area will be measured once for all operations. (The Contractor will give 10 years Guarantee).	5,227	Per Sft		
5	**WATER SPOUTS**				
	Providing & fixing water spout.				
	UPVC 4" dia Pipe & 4.5' long	15	Each		

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

SUMMARY OF PLUMBING WORKS

A.	SCHEDULE ITEMS:	_____
B.	NON - SCHEDULE ITEMS:	_____
	Total: (A + B)	_____

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

NAME OF WORKS: CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

CLIENTS: CADET COLLEGE SANGHAR

JOBS DESCRIPTION: BILL OF QUANTITIES (WATER SUPPLY AND SANITARY INSTALLATION)

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
	A - SCHEDULE ITEMS				
1	Providing and Fixing orisa type white or colour glazed earthen ware w.c. pan with cost of low level plastic flush tank of 3 gallons capacity of approved quality i/c making requisite number of holes in wall. Plinth and floor and making good in cement concrete 1:2:4				
	A. W.C pan orisa type 23" with plastic tank of low down 3 gallons C.I trap and C.I thumble (superior quality)	14 Nos.	10,440.50	Each	146,167
	(ii) with 4 inch dia earthen ware trap & plastic thumble.				
	Chapter # 01, Item # 3(a), Page-204				
2	Providing & Fixing 24" x 18" lavatory basin in white glazed earthen ware complete with i/c the cost of W.I or C.I Cantilever brackets 6 inch built into wall, painted white in two coat after a primary coat of red lead paint a pair of ½" dia chrome plate pillar traps 1½" dia rubber plug & chrome plated brass chain 1-1/4" dia malleable iron or cp brass traps malleable iron or brass union & making requisite number of holes in walls plinth & floor for pipe connection and making good in cement concrete 1:2: (standard pattern)	6 Nos	9,495.14	Each	56,971
	Chapter # 01, Item # 8, Page-205				
3	Add extra for labour for providing and fixing of eathern ware pedestal white or colored glazed (standard pattern).	6 Nos	3,276.00	Each	19,656
	Chapter # 01, Item # 9, Page-205				
4	Providing and fixing in position nyloon connections complete with ½" dia brass stop cock with pair of brass nuts and lining joints to nyloon connection.	30 Nos	760.50	Each	22,815
	Chapter # 01, Item # 22, Page-207				
5	Providing and fixing chrome plated brass towel rail complete with brackets fixing on wooden cleats with 1" long C.P. brass screws.				
	(iii) Towel Rail 30" Long	2	945.07	Each	1,890
	Chapter # 02, Item # 1(iii)(a), Page-208				

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
6	Supplying and fixing soap tray made of plastic of superior quality and design with fine finishing with C.P. screws etc. complete. Chapter # 02, Item # 5, Page-208	4 Nos	585.00	Each	2,340
7	Add extra labour for concealed pipe and fittings i/c making recess in the wall for pipe and making good in cement mortar etc. complete.				
	(i) ½" dia	250	159.30	P.Rft	39,825
	(ii) 3/4" dia	120	199.83	P.Rft	23,980
	(iii) 1" dia	155	272.35	P.Rft	42,214
	Chapter # 04, Item # 2(i)(ii)&(iii), Page-211				
8	Providing and fixing full way gun metal valves with wheels, threaded or flabged ends with rubber washing.(gate valve)				
	1-1/2" dia (standard pattern) Chapter # 06, Item # 4(B)(c), Page-215	3	1,614.60	Each	4,844
9	Supplying & fixing handle valve (china) (ii). 1" dia	2	1,907.10	Each	3,814
	Chapter # 06, Item # 5(c), Page-215				
10	Constructing manhole or inspection chamber for the required dia of circular sewer and 3'-6" (1067 mm) depth with walls of B.B in cement mortar 1:3 cement plastered 1:3 , ½" thick, inside of walls and 1" (25 mm) thick over benching and channel i/c fixing C.I. manhole cover with frame of clear opening 1½" x 1½" (457 x 457 mm) of 1.75 Cwt. (88.9 kg) embedded in plain C.C. 1:2:4 and fixing 1" (25 mm) dia M.S steps 6" (150 mm) wide projecting 4" (102 mm) from the face of wall at 12" (305 mm) C/C duly painted etc. complete as per specification and drawing No. D.P/I of Public Health Circle Southern Zone.				
	(a) 4" to 12" dia 2' x 2' x 3'-6" Chapter # 11, Item # 1(a), Page-148	12	55,584.18	Each	667,010
	Note: Deducted from the above cost at the rate of Rs. 4234 per foot depth, where depth of Manhole is less than 3'-6" or 1067mm)				
11	Supplying & Fixing swan type pillar cock of superior quality with single c.p head 1/2" dia.	2	1,029.60	Each	2,059

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
	With Crystal Head Chapter # 06, Item # 16(a)&(b), Page-217	2	1,848.60	Each	3,697
12	S/Fixing concealed tee cock of superior quality with c.p head 1/2" dia Chapter # 06, Item # 11(a), Page-216	32	1,614.60	Each	51,667
13	Suppying and fixing in position C.P Bib Cock 3/4" dia C.P bib cock, standard pattern Chapter # 06, Item # 2(c), Page-215	18	1,544.40	Each	27,799
14	Providing UPVC pipes specials and clamps etc. including fixing cutting and fittings complete with and including the cost of breaking through walls and roof making good etc. with pigment to match the colour of the building and testing with water to a pressure bead of 200 feet and handling.				
	UPVC Nikasi pipe 4" dia.	100	465.53	P.Rft	46,553
	UPVC Nikasi pipe 3" dia.	260	836.36	P.Rft	217,454
	UPVC Nikasi pipe 6" dia. Chapter # 04, Item # 2(iv)(v)&(vi), Page-211	140	950.38	P.Rft	133,053
16	(a). Supplying & fixing concealed stop cock of superior quality with C.P head ½ inch dia. Chapter # 06, Item # 12(a), Page-216	36	1,615	Each	58,126
17	Providing and fixing steel sinks stainless local bt make complete with cast iron or wrought iron LINA ALVH brackets 6 inches built into wall, 1-1/2" rubber plug and chrome plated brass chain 1-1/2" C.P. brass waste with 1-1/2" P.V.C waste pipe & making requisite number of holes in walls, plinth & floor for pipe connection & making good in cement concrete 1:2:4.				
	a)steel sink stainless sized 40"x20" local make (Standard Pattern) Chapter # 01, Item # 19(a), Page-206	1	12,555.27	Each	12,555
18	Supplying & Fixing sink mixture cock of superior quality with c.p head etc complete (Sonex or Master Chapter # 06, Item # 17, Page-217	1	2,550.60	Each	2,551
19	Supplying and fixing jet shower with rod of each superior quality single C.P head 1/2" dia. Chapter # 06, Item # 15(a), Page-217	-	3,486.60	Each	-
				TOTAL "A"	**1,587,040**
				Add / Deduct ____ % above / below	
				TOTAL:	

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

NAME OF WORKS: CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

CLIENTS: CADET COLLEGE SANGHAR

JOBS DESCRIPTION: BILL OF QUANTITIES (WATER SUPPLY AND SANITARY INSTALLATION)

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
	B - NON-SCHEDULE ITEMS				
1	Supplying and fixing UPVC Plydex (P.P.R) manufactured by Dadex eternit Ltd cold water internal and external water supply pipe or approved equivalent including all cutting, fitting, bends, tees, specials as required etcjointed with solvent / special adhesive laid in floor walls trench making holes and making them good with C.C 1:2:4 etc complete as per direction.				
	(i) UPVC Polydex (PPR) pipe 1/2" dia.	250		P. Rft.	
	(ii) UPVC Polydex (PPR) pipe 3/4" dia.	120		P. Rft.	
	(iii) UPVC Polydex (PPR) pipe 1" dia.	155		P. Rft.	
	(iv) UPVC Polydex (PPR) pipe 1-1/2" dia.	220		P. Rft.	
	(v) UPVC Polydex (PPR) pipe 1-1/4"	155		P. Rft.	
2	Providing and Fixing a P.V.C trap with 4" dia inlet and 4" out let of the approved self clearing design with a P.V.C grating 6" x 6" with or without a vent arm including cost of making requisite number of holes in walls plinth and floor for pipe connection and making good cement concrete 1:2:4	20		Each	
3	Providing and fixing 6" x 2" or 6" x 3" floor trap of the approved self cleaning design, with a UPVC grating 6" x 6", with or without vent arm complete with and including making requiisite number of holes in walls, plinth and floor for pipe connections and making good in C.C. 1:2:4 etc.	20		Each	
4	Providing and fixing 6" x 4" P.V.C gully trap with 4" outlet complete 6" x 6" PVC cover with PVC frame.	2		Each	
5	Providing and fixing 24" x 24" beveled edge Mirror best quality Pak made fixed with 4 Nos clamp set and brass screw fixed to wood cleat	6		Each	

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
6	Providing & fixing a P.V.C clamps of the approved design to 4' dia pipe sockets including the cost of cutting and making good to wall or M.S bolts & nuts, 4" into wall including pipe distances extra painting to match the colour of the building.	200		Each	
7	Supply, fixing, testing and commissioning of clean out plug of 4 " dia along with specials, fittings, bends, sleeves, masking plates, traps, vent cowl, chiseling, making hole, excavation, backfilling making good where as required to operate as per specifications, drawings and instructions of Consultant.	8		Each	
	Total of non-schedule items		**Total**		

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

SUMMARY OF ELECTRICAL WORKS

A.	SCHEDULE ITEMS:	_____
B.	NON - SCHEDULE ITEMS:	_____
	Total: (A + B)	_____

EXECUTIVE SUMMARY OF COST OF ELECTRICAL & ALLIED WORKS		
SECTION	**DESCRIPTION**	**TOTAL AMOUNT (PKR)**
SECTION-A	WIRING & WIRING ACCESSORIES	
SECTION-B	LIGHTING FIXTURES	
SECTION-C	DISTRIBUTION BOARDS AND CABLES	
	TOTAL COST FOR ELECTRICAL WORKS	

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

BOQ OF ELECTRICAL & ALLIED WORKS						
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	COMPOSITE RATE	
					RATE PKR	AMOUNT PKR
		SECTION - A **WIRING / WIRING ACCESSORIES**				
		Providing, installation, testing & commissioning of following items including all material, tools, labor & accessories required for completion of work as per specifications, details & drawings. Complete in all respects. Megger Test Report of all wiring shall be submitted by contractor to consultant.				
		SMALL WIRING FOR LIGHTS				
	C	**WITH 3 WIRE PVC CONDUIT ON SURFACE**				
A1	C17	Providing & laying (Main or Sub Main) PVC insulated with size 3-7-3/.029 copper conductor in ¾" dia PVC conduit on surface. Average Length 30 Rft. (667.06 / FT)				
a		3-7-3/.029 PVC, Cu	1800	Per Ft	667.06	1,200,708
	N	**POINT WIRING SUB-HEAD II**				
A2	N-102	Wiring for light or fan point with 3/.029 PVC insulated wire in 20mm (3/4") PVC conduit recessed in the wall or column as required.	146	Per Point	6,573.50	959,731
A3	N-102	Wiring for light or fan point with 3/.029 PVC insulated wire in 20mm (3/4") PVC conduit recessed in the wall or column as required..	98	Per Point	6,573.50	644,203
		SMALL WIRING FOR POWER				
	C	**WITH 3 WIRE PVC CONDUIT ON SURFACE**				
A4	C17	Providing & laying (Main or Sub Main) PVC insulated with size 3-7-3/.029 copper conductor in ¾" dia PVC conduit on surface. Average Length 30 Rft. (667.06/ FT)				
a		3-7-3/.029 PVC, Cu	1800	Per Ft	667.06	1,200,708
	N	**POINT WIRING SUB-HEAD II**				

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

BOQ OF ELECTRICAL & ALLIED WORKS						
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	COMPOSITE RATE	
					RATE PKR	AMOUNT PKR
A5	N-103	Wiring for plug point with 3/.029 PVC insulated wire in 20mm (3/4") PVC conduit on surface as required				
a		3/.029 PVC, Cu	90	Per Point	3,816.06	343,445
		WIRING FOR AC UNITS				
A6	C-18	Wiring for 1.0 Ton A/C Units Providing & laying (Main or Sub Main) PVC insulated with size 3-7/.036(4mm2) copper conductor in ¾" dia PVC conduit on surface. ***Average Length 40 Rft..***	1500	Per Ft	916.79	1,375,185
		WIRING FOR WATER TRANSFER PUMP				
A7	C-18	Wiring for Water Transfer Pump Providing & laying (Main or Sub Main) PVC insulated with size 3-7/.036(4mm2) copper conductor in ¾" dia PVC conduit on surface. Average Length 100 Rft..	100	Per Ft	916.79	91,679
		WIRING FOR BOOSTER PUMP				
A8	C-18	Wiring for Booster Pump Providing & laying (Main or Sub Main) PVC insulated with size 3-7/.036(4mm2) copper conductor in ¾" dia PVC conduit on surface. Average Length 100 Rft..	100	Per Ft	916.79	91,679
		WIRING FOR COMBOX				
A9	C17	Wiring for Comrbox Providing & laying (Main or Sub Main) PVC insulated with size 3-7-3/.029 copper conductor in ¾" dia PVC conduit on surface. Average Length 30 Rft. (667.06/ FT)	350	Per Ft	667.06	233,471
		TOTAL AMOUNT - SEC - A (PKR) (CARRIED FORWARD TO SUMMARY)	.		-	**6,140,809**
		SECTION - B LIGHTING FIXTURES				

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

BOQ OF ELECTRICAL & ALLIED WORKS						
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	COMPOSITE RATE	
					RATE PKR	AMOUNT PKR
		Providing/ Supplying , Installation, testing and commissioning of the following lighting fixture including all accessories like electronic ballast, lamps, mounting arrangements etc. Complete in all respects. Mounting accessories shall be provided by contractor like screws, nuts, bolts, strings etc.				
B1	195 ©	**CELING FAN** Providing & fixing A.C Electric Ceiling fan 56" (good quality) As approved by architect.	32	Nos.	14,869.21	475,815
		TOTAL AMOUNT - SEC - B (PKR) (CARRIED FORWARD TO SUMMARY)			-	**475,815**
		SECTION - C **DISTRIBUTION BOARDS & CABLES**				
		Providing, Laying, Testing, Termination and Commissioning of following multi-core PVC insulated Copper / Aluminium Conductor Cables for main/sub-main power distribution system as shown in the layout plans in appropriate size of conduits. Work also includes necessary termination accessories like compression lugs, color coded sleeves, identification tags etc. Note : The quantities shown in the boq are estimated based on design drawings. Contractor has to take accurate measurements at site prior to procurement of material.				
C1	O-80	4C, 35 Sqmm Cu. SWA/PVC/PVC + ECC, 1x16 Sqmm Cu.PVC From Nearest Power Source to MDB	98.4	Per Ft.	1,937.18	190,619
		TOTAL AMOUNT - SEC - C (PKR) (CARRIED FORWARD TO SUMMARY)			-	**190,619**
					Add / Deduct ____ % above / below	
					TOTAL:	

EXECUTIVE SUMMARY OF COST OF ELECTRICAL & ALLIED WORKS		
SECTION	**DESCRIPTION**	**TOTAL**
		AMOUNT (PKR)
SECTION-B	WIRING DEVICES / RECEPTACLES	
SECTION-C	LIGHTING FIXTURES	
SECTION-D	DISTRIBUTION BOARDS AND CABLES	
SECTION-E	CABLE RACEWAYS / CONTAINMENTS	
SECTION-F	COMMUNICATION SYSTEM	
SECTION-G	GROUNDING & BONDING	
	TOTAL COST FOR ELECTRICAL WORKS	

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
		SECTION - B **WIRING DEVICES / RECEPTACLES**								
		Providing, installation and commissioning of following wiring devices / light control switches / power receptacles as per BS Standards including 16 SWG MS Powder Coated back boxes, flush with wall as shown in drawings and details.								
		LIGHT CONTROLLED SWITCHES								
B1		One Gang one way 10A Switch	33	Nos.						
B2		Two Gang one way 10A Switch	41	Nos.						
B3		Three Gang one way 10A Switch	16	Nos.						
B4		Four Gang one way 10A Switch	8	Nos.						
B5		Dimmer	32	Nos.						
		UTILITY POWER RECEPTACLES / SOCKET OUTLETS								
B6		13A, Simplex multi-pin switch Socket Unit	88	Nos.						
B7		15A, Round 3Pin Switch Socket Unit	18	Nos.						
B8		20A, DP Switch Socket Unit	24	Nos.						
B9		Door Bell With all allied accessories	8	Nos.						
		TOTAL AMOUNT - SEC - B (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - C **LIGHTING FIXTURES**								
		Providing/ Supplying , Installation, testing and commissioning of the following lighting fixture including all accessories like electronic ballast, lamps, mounting arrangements etc. Complete in all respects. Mounting accessories shall be provided by contractor like screws, nuts, bolts, strings etc.								
C1		**DOWN LIGHT** DOWN LIGHT FLUSH WITH 20W LED LIGHT. As approved by architect.	156	Nos.						
C2		**DOWN LIGHT** DOWN LIGHT SURFACE WITH 20W LED LIGHT. As approved by architect.	40	Nos.						
C3		**DECORATIVE LED WALL LIGHT** DECORATIVE LED WALL LIGHT WITH 18W. As approved by architect.	50	Nos.						
C4		**BULKHEAD WALL LIGHT** BULKHEAD WALL WITH 10W LED LIGHT. As approved by architect.	16	Nos.						

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
C5		**BATTEN LIGHT** BATTEN LIGHT WITH 40W LED LIGHT. As approved by architect.	16	Nos.						
C6		**EXHUAST FAN** EXHUAST FAN. As approved by architect.	24	Nos.						
		TOTAL AMOUNT - SEC - C (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - D **DISTRIBUTION BOARDS & CABLES**								
		Providing, Laying, Testing, Termination and Commissioning of following multi-core PVC insulated Copper / Aluminium Conductor Cables for main/sub-main power distribution system as shown in the layout plans in appropriate size of conduits. Work also includes necessary termination accessories like compression lugs, color coded sleeves, identification tags etc. Note : The quantities shown in the boq are estimated based on design drawings. Contractor has to take accurate measurements at site prior to procurement of material.								
D1		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-G1	20	RM						
D2		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-G2	20	RM						
D3		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-G3	20	RM						
D4		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-G4	20	RM						
D5		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-F1	25	RM						
D6		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-F2	25	RM						
D7		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-F3	25	RM						
D8		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-F4	25	RM						
		Supply, Installation, testing and commissioning of following distribution panels in accordance with the attached single line diagrams and layout plans. The panels shall be made according to the technical specifications attached.								
D9		MDB	1	No.						
D10		DB-G1	1	No.						
D11		DB-G2	1	No.						

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
D12		DB-G3	1	No.						
D13		DB-G4	1	No.						
D14		DB-F1	1	No.						
D15		DB-F2	1	No.						
D16		DB-F3	1	No.						
D17		DB-F4	1	No.						
D18		TP Box 125A TP Adj. MCCB (ICU=25KA) With Weather Proof Housing	1	No.						
		TOTAL AMOUNT - SEC - D (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - E **CABLE RACEWAYS / CONTAINMENTS**								
E1		**Supply and installation** of following sizes of PVC conduits / pipes including all installation acessories like bends, sockets, flexible conduits, partially above false ceiling and partially embedded in ground e.t.c , the works also complete with excavation and back filling of 1'-6" deep for laying of main / sub-main cables . Compete in all respects as shown in the drawing.								
a		20 mm dia PVC conduit	400	RM						
b		25 mm dia PVC conduit	400	RM						
c		32 mm dia PVC conduit	125	RM						
d		50 mm dia PVC conduit	75	RM						
		TOTAL AMOUNT - SEC - E (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - F **COMMUNICATION SYSTEMS**								
		Supply , installation , testing and commissioning of following items for voice & data communication cabling system including all material , labor , tools , accessories etc. Complete in all respects. Item includes termination of all cables at respective outlets as shown in the drawings and instructed by client. Note : The quantities shown in the boq are estimated based on design drawings. Contractor has to take accurate measurements at site prior to procurement of material.								
		HORIZONTAL DATA CABLING								
F1		**Category 6 , UTP Cables**, for data communication system at local workstations in 25mm dia PVC conduits under floor as shown in the layout plan and schematic diagrams. Work includes all terminations, management and tagging at both ends.	150	RMtr.						
		BACKBONE CABLING VOICE & DATA COMMUNICATION								
F2		**10 pair, 0.6 mm Telephone Cable from PTCL** as shown in the drawings and schematic diagram in 32mm dia pvc conduit including all accessories. Complete with termination and tagging at both ends.	210	RMtr.						

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
F3		Telephone Outlet .	8	Nos.						
		COMMUNICATION BOX								
F4		**Communication Box**, Front door with glass cover, lock & key, and front blank panels for covering empty spaces, air flow ducts for effective cooling management inside the rack for switches. Item includes supply and installation of 6 way rack mounted standard PDU.	8	Nos.						
		TELEPHONE JUNCTION BOX								
F5		**Telephone Junction Boxes (TJB)** for termination of incoming PTCL Cables having 10 pair tag block including surge protector, powder coated enclosure including interncal jumper wires and tagging.	8	No.						
		Wi-Fi ROUTERS WITH ONU DEVICES								
F6		**Supply and installation of Wi-Fi Routers With ONU Devices** as shown in the drawings including all accessories.	8	Nos.						
F7		**TV WIRING & OUTLET**								
a		TV Splitter (Tap) Unit with enclosure suitable for 1 incomings and 4 outgoing cables including all termination accessories.	8	Nos.						
b		Wall Mounted 150x150x75 mm TV Pull box made with 16SWG sheet steel for Antina system.	8	Nos.						
c		RG-7 Cable for TV	300	Rmtr.						
		TOTAL AMOUNT - SEC - F (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - G GROUNDING & BONDING								
		Providing , installation , testing and commissioning of following items for earthing & bonding system of complete data center including all material, boring, labor, tools, transportation, accessories etc. Complete in all respects including detailed test reports. Estimated earth stations are taken at this stage. Contractor has to check the soil resistivity at site and propose required stations to achieve earth resistance not more than one ohms.								
		EARTH STATIONS								
G1		**Providing fixing and connecting** of earthing set which consist of one copper rod of size 20mm dia 3 meters long buried at 20 meter below the ground level buried at least 3 meter away from the nearest foundation the earth lead shall be of 2 Nos.70mm2 stranded copper conductor drawn in 50mm dia G.I pipe from the earthing rod to the panels transformer earth pit including Boring / digging as required and refilling the earth pits with necessary lime powder wooden cool as requires and approved electrical inspector IEE regulation and confirming to the Specification including make of earth pit with cast iron manhole cover 150mm x 150m	1	Nos.						
		EARTH TEST POINTS / CONNECTING POINTS								

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF STAFF FAMILY QUARTERS / FLATS CATEGORY - IV (OFFICERS COLONY)

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
G2		**Earth Test Point including Test Link** , 150 mm x 75 mm x 5 mm electroplated Copper bar , as shown in drawings. Bar shall be provided with holes suitable for installation of required earth leads. The test bar shall be enclosed in powder coated metal enclosure as approved by the client.	1	Nos.						
		EARTH LEADS / CONDUCTORS								
G3		**Single Core PVC insulated**, 16 Sqmm Stranded Copper Conductor, green in color from earth pit to test point and from test point to connecting point / Panels in 32mm size of UPVC Conduit.	100	RM.						
		TOTAL AMOUNT - SEC - G (PKR) (CARRIED FORWARD TO SUMMARY)								

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V

SUMMARY OF COST

1	CIVIL WORK.	_____
2	PLUMBING WORK.	_____
3	ELECTRICAL WORK.	_____
	Total: (1 + 2 + 3)	_____

_____

CONTRACTOR

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V

SUMMARY OF CIVIL WORKS

A.	SCHEDULE ITEMS:	_____
B.	NON - SCHEDULE ITEMS:	_____
	Total: (A + B)	_____

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V
CADET COLLEGE SANGHAR
BILL OF QUANTITIES
CIVIL WORKS

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
	A - SCHEDULE ITEMS				
1	**JUNGLE CLEARENCE**				
	Jungle Clearence and removing within 100 feet				
(a)	Light Chapter # 18, Page-88, Item # 4(a)	12,932	Per Sft	0.4	5,173
2	**EXCAVATION**				
	Excavation in foundation of Building, Bridges and other Structures including dagbeling dressing, refilling around structure with excavated earth watering and ramming lead upto one chain (30 metre) and lift upto 5 ft. (1.5 metre)				
(b)	In ordinary soil Chapter # 1, Page-27, Item # 18(b)	47,040	Per Cft	11.88	558,835
3	**EARTH FILL**				
	Filling, watering and ramming earth under floor with new earth (excavated from outside) lift upto 5 ft and lead upto 10 miles including cost of earth. Chapter # 1, Page-27, Item # 22	43,624	Per Cft	47.02	2,051,200
4	**LEAN (1:4:8)**				
	Cement concrete plain including placing compacting, finishing and curing, complete (including screening and washing at stone aggregate without shuttering).				
(i)	Ratio. 1:4:8 Chapter # 4, Page-34, Item # 5(i)	3,220	Per Cft	348.83	1,123,233
5	**REINFORCEMENT STEEL**				
	Febrication of deformed steel reinforcement for cement concrete including cutting, bending, laying in position, making joints and festenings including cost of binding wire (also includes removal of rust from bars).				
(a)	Deformed Bar.				
(i)	Grade - 60 Chapter # 4, Page-36, Item # 8(a)(i)	2,082	Per Cwt	18934.02	39,419,499
6	**P.C.C. (1:3:6)**				
	Cement concrete plain including placing compacting, finishing and curing, complete (including screening and washing at stone aggregate without shuttering).				
(h)	Ratio: 1:3:6 Chapter # 4, Page-34, Item # 5(h)	2,376	Per Cft	388.67	923,480

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
7	**D.P.C**				
	Damp proof course with (cement sand and shingle concrete 1:2:4) including 2 coats of asphaltic mixture.				
(b)	2" thick Chapter # 4, Page-38, Item # 28(b)	848	Per Sft	126.97	107,643
8	**BRICK WORK**				
	Pacca brick work in ground floor in (including striking of joints).				
(I)(c)	Cement Sand Mortar (1:4) Chapter # 5, Page-40, Item # 5(I)(c)	10,130	Per Cft	397.85	4,030,061
	Add extra labour in Item # 5 for brick work in:				
	First Floor	4,051	Per Cft	17.23	69,802
	Second Floor	2,026	Per Cft	39.11	79,221
9	**FLOORING (1:2:4)**				
	Cement concrete plain including placing compacting, finishing and curing, complete (including screening and washing at stone aggregate without shuttering).				
(f)	Ratio: 1:2:4 Chapter # 5, Page-34, Item # 5(f)	3,746	Per Cft	443.54	1,661,678
10	**CERAMIC TILES (TOILET)**				
(a)	Laying floor of approved coloured glazed tiles 1/4" thick floor of approved colour & size jointing in white cement and laid over 1:2 cement sand mortar 3/4" thick including grouting with matching colour and finishing. Chapter # 8, Page-56, Item # 25	840	Per Sft	325.40	273,336
(b)	Laying floor of approved coloured glazed tiles 1/4" thick dado of approved colour & size jointing in white cement and laid over 1:2 cement sand mortar 3/4" thick including grouting with matching colour and finishing. Chapter # 8, Page-55, Item # 24	4,032	Per Sft	389.36	1,569,900
(c)	Laying Afghan Ziarat white flooring fine dressed on the surface without winding set in time mortar 1:2 including rubbing and polishing of the joints.				
(ix)	24"x24"x5/16" flooring Chapter # 8, Page-56, Item # 28(ix)	1,601	Per Sft	439.57	703,861
(d)	Providing & laying full body Porcelain Tile in flooring or facing of approved design. Set in gray cement mortar 1:2 of 3/4" thickness including washing and joints fill with white cement, slurry using matching colour pigment and complete as per specification. 24"x24"x5/16" flooring Chapter # 8, Page-56, Item # 28(vii)	2,650	Per Sft	439.57	1,164,861

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
11	**PLASTER (1/2")**				
	Cement plaster 1:4 upto 12' height.				
(b)	1/2" thick.	55,110	Per Sft	39.83	2,195,015
	Chapter # 9, Page-62, Item # 11(b)				
12	**PLASTER (3/8")**				
	Cement plaster 1:4 upto 12' height.				
(a)	3/8" thick.	55,110	Per Sft	37.78	2,082,041
	Chapter # 9, Page-62, Item # 11(a)				
13	**NEERU PLASTER**				
	Cement Neru plaster 1:2 Cement and Sand upto 20 ft. (6.10 metre)				
(b)	1/2" thick	363	Per Sft	44.62	16,197
	Chapter # 9, Page-61, Item # 5(b)				
14	**DISTEMPER**				
	Distempering				
(c)	New Surface (iii) Three Coats	9,646	Per Sft	17.23	166,201
	Chapter # 9, Page-63, Item # 24(c)				
15	**WEATHER SHIELD PAINT**				
	Preparing the surface and painting with weather coat including rubbing the surface with rubbing brick / sand paper, filling the voids with chalk / plaster of paris and then painting with weather coat of approved make.	8,472	Per Sft	39.38	333,627
	Chapter # 9, Page-64, Item # 38(A)				
	(b) 2nd and subsequent coat	8,472	Per Sft	23.60	199,939
	Chapter # 9, Page-64, Item # 38(B)				
16	**WINDOWS / DOOR PAINT**				
	Preparing surface and painting doors and windows any type. (including edges).				
	(i) Priming Coat.	8,471	Per Sft	11.30	95,722
	(ii) Each subsequent coat.	8,471	Per Sft	7.11	60,229
	Chapter # 11, Page-73, Item # 5(c) (i) (ii)				
17	**PLASTIC EMULSION PAINT**				
	Preparing the surface and painting with plastic emulsion paint of approved make including rubbing the surface with sand Paper, filling the voids with chalk / plaster of paris and then painting etc. complete.				
	(A) Three Coats	55,110	Per Sft	38.71	2,133,293
	Chapter # 9, Page-64, Item # 40(A)				
19	**DOOR SHUTTERS**				
	First class deodar wood wrough joinery in doors and windows etc. fixed in position including chowkhats hold fasts, higes iron tower bolts, chock cleats, handles and cord with hooks etc. Deodar pannelled or Pannelled and glazed or fully glazed.				
	(b) Deodar Wood.	4,236	Per Sft	1233.27	5,223,515
	Deduct for wooden frame from rate.				
	Chapter # 10, Page-68, Item # 25(b)				

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
20	**ARCHITRAVE / WOODEN BIDDING** Providing & fixing with sunk iron screws Wooden Architrave approved design / shape having wifth not less than 2-1/2" inchesas directed by Engineer Incharge. Chapter # 10, Page-71, Item # 60	7,740	Per Rft	136.4	1,055,736
21	**MORTICE LOCKS** Providing & fixing approved quality mortice lock. Chapter # 10, Page-68, Item # 21	71	Each	1039.05	73,773
22	**IRON GRILL** Providing & fixing iron steel grill using solid square bars of size 1/2"x1/2" placed at 4" I/c and frame of flat iron patti of 3/4"x3/4" I/c circle shape at 1-0 apart equivalent fitted with screws are pins i/c painting 3 coats with 1st coat of red oxide paint etc. Chapter # 17, Page-86, Item # 30	2,085	Per Sft	833.27	1,737,368
23	**WINDOW FRAME** Providing and fixing G.I frames / choukhats of size 7"x2" or 4-1/2"x3" for windows using 20 gauge G.I sheet I/c welded hinges and fixing at site with necessary hold fasts, filling with cement sand slurry of ratio 1:6 and repairing the jambs. The cost also i/c all carriage, tools and plants used in making and fixing. Chapter # 17, Page-86, Item # 28	2,085	Per Rft	908.25	1,893,701
24	**DOOR FRAME** Providing and fixing G.I frames / choukhats of size 7"x2" or 4-1/2"x3" for door using 20 gauge G.I sheet I/c welded hinges and fixing at site with necessary hold fasts, filling with cement sand slurry of ratio 1:6 and repairing the jambs. The cost also i/c all carriage, tools and plants used in making and fixing. Chapter # 17, Page-86, Item # 29	1,785	Per Rft	690.67	1,232,846

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
25	**GROOVE PLASTER**				
	Extra labour rate for making grooves of 1"x1/4" or 3/4"x1/2" plastered surface with true edges both vertically and horizontally with uniform depth and with groove base smoothly finished etc. complete as per instruction of Engineer Incharge.	2,096	Per Rft	31.19	65,374
	Chapter # 9, Page-64, Item # 34				
26	**ROOF SCREED / FLOOR**				
	Providing & laying 1" thick topping of cement concrete (1:2:4) including Surface finishing and dividing into panels.				
	(c) 2" thick	2,915	Per Sft	108.75	317,006
	(d) 3" thick	5,248	Per Sft	145	760,935
	Chapter # 8, Page-55, Item # 16(c) & (d)				
27	**DRIP COURSE**				
	Making drip course 2"x1/2" (50x12mm) under RCC Slab edges in outer opening, in cement sand mortar (1:2).	3,511	Per Rft	34.42	120,849
	Chapter # 7, Page-53, Item # 48				
28	**STAIR CASE**				
	Laying Super Botisinam Crème, Badal or Black Marble 12"x12" / 12"x24" fine dress on surface without winding set in line mortar 1:2 including rubbing and polishing on the joint.				
	(a) 3/4" thick marble	1,007	Per Sft	337.9	340,096
	Chapter # 8, Page-56, Item # 28(v)(a)				
29	**SKIRTING / MARBLE**				
	Providing & fixing 3/8" thick Marble Tiles of approved quality & coloued and shade size 8"x4" in dado skirting & facing removal tucking of existing plaster surface etc. over 1/2" thick base of cement mortar 1:3 setting of tile in slurry of white cement over mortar base i/c filling & joints & washing the tile with white cement slurry current finishing clearing & polishing etc. complete (New Work)	732	Per Sft	247.28	180,885
	Chapter # 8, Page-59, Item # 61				

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
30	**FLY PROOF DOOR & WINDOW SHUTTERS** First class deodar wood wrought joinery work in wire gauze doors and windows with 22 SWG galvanized wire gauze 12x12 mashes per squareinch (625 mm) including iron fittings complete.				
(a)	Deodar framing 1-3/4" (45 mm) with wire guage fixed in position. Chapter # 10, Page-67, Item # 14(a)	16,513	Per Sft	1559.16	25,745,630
31	**ALUMINIUM SHEET** Providing & fixing Aluminium sheet on doors pasted with glue as per requirement. Chapter # 10, Page-71, Item # 61	525	Per Sft	115.38	60,575
					99,832,336
	Add / Deduct ____ % above / below				
				TOTAL:	

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V
CADET COLLEGE SANGHAR
BILL OF QUANTITIES
CIVIL WORKS

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
	B - NON - SCHEDULE ITEMS				
1	**R.C.C** Providing and laying reinforced cement concrete using Hub River crushed stone aggregate 3/4 inch (19 mm) and down gauge having a minimum works cylindrical crushing strength of 3000 psi for foundation, plinth beam, roof beam, slab, wall and for 4000 PSI columns at 28 days of any shape including using SBR and water tight form work and its removal, compacting, leveling vibrating and curing etc. complete but excluding the cost of reinforcement. (Sulphate resisting cement will be used up to Plinth level)				
	(iii) 3000 PSI	21,469	Per Cft		
	(iv) 4000 PSI	2,056	Per Cft		
2	**SHUTTERING** Erection of removal of centering for RCC or plain cement concrete works of Partal Wood.				
(b)	Vertical	2,063	Per Sft		
3	**STONE SOLING** Providing and laying soling stones 4 inches to 6 inches under Footings, floors including packing with spawls and chips and consolidating compacting watering etc. complete.	6,331	Per Cft		
4	**ANTITERMITE** Provide & apply Antitermite treatment using MIRAGE of Ali Abkar Enterpises or equaivelent approved quality in various stages e.g. under ground treatment at various stages and each floor including all wooden work. Plinth area will be measured once for all operations. (The Contractor will give 10 years Guarantee).	5,300	Per Sft		
5	**WATER SPOUTS** Providing & fixing water spout. UPVC 4" dia Pipe & 4.5' long	25	Each		

YOUNG ASSOCIATES
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CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V

SUMMARY OF PLUMBING WORKS

A.	SCHEDULE ITEMS:	_____
B.	NON - SCHEDULE ITEMS:	_____
	Total: (A + B)	_____

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

NAME OF WORKS: CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V

CLIENTS: CADET COLLEGE SANGHAR

JOBS DESCRIPTION: BILL OF QUANTITIES (WATER SUPPLY AND SANITARY INSTALLATION)

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
	A - SCHEDULE ITEMS				
1	Providing and Fixing orisa type white or colour glazed earthen ware w.c. pan with cost of low level plastic flush tank of 3 gallons capacity of approved quality i/c making requisite number of holes in wall. Plinth and floor and making good in cement concrete 1:2:4				
	A. W.C pan orisa type 23" with plastic tank of low down 3 gallons C.I trap and C.I thumble (superior quality)	28 Nos.	10,440.50	Each	292,334
	(ii) with 4 inch dia earthen ware trap & plastic thumble.				
	Chapter # 01, Item # 3(a), Page-204				
2	Providing & Fixing 24" x 18" lavatory basin in white glazed earthen ware complete with i/c the cost of W.I or C.I Cantilever brackets 6 inch built into wall, painted white in two coat after a primary coat of red lead paint a pair of ½" dia chrome plate pillar traps 1½" dia rubber plug & chrome plated brass chain 1-1/4" dia malleable iron or cp brass traps malleable iron or brass union & making requisite number of holes in walls plinth & floor for pipe connection and making good in cement concrete 1:2: (standard pattern)	30 Nos	9,495.14	Each	284,854
	Chapter # 01, Item # 8, Page-205				
3	Add extra for labour for providing and fixing of eathern ware pedestal white or colored glazed (standard pattern).	30 Nos	3,276.00	Each	98,280
	Chapter # 01, Item # 9, Page-205				
4	Providing and fixing in position nyloon connections complete with ½" dia brass stop cock with pair of brass nuts and lining joints to nyloon connection.	80 Nos	760.50	Each	60,840
	Chapter # 01, Item # 22, Page-207				
5	Providing and fixing chrome plated brass towel rail complete with brackets fixing on wooden cleats with 1" long C.P. brass screws.				
	(iii) Towel Rail 30" Long	30	945.07	Each	28,352
	Chapter # 02, Item # 1(iii)(a), Page-208				

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
6	Supplying and fixing soap tray made of plastic of superior quality and design with fine finishing with C.P. screws etc. complete. Chapter # 02, Item # 5, Page-208	30 Nos	585.00	Each	17,550
7	Add extra labour for concealed pipe and fittings i/c making recess in the wall for pipe and making good in cement mortar etc. complete.				
	(i) ½" dia	450	159.30	P.Rft	71,685
	(ii) 3/4" dia	120	199.83	P.Rft	23,980
	(iii) 1" dia	155	272.35	P.Rft	42,214
	Chapter # 04, Item # 2(i)(ii)&(iii), Page-211				
8	Providing and fixing full way gun metal valves with wheels, threaded or flabged ends with rubber washing.(gate valve)				
	1-1/2" dia (standard pattern) Chapter # 06, Item # 4(B)(c), Page-215	5	1,614.60	Each	8,073
9	Supplying & fixing handle valve (china) (ii). 1" dia	4	1,907.10	Each	7,628
	Chapter # 06, Item # 5(c), Page-215				
10	Constructing manhole or inspection chamber for the required dia of circular sewer and 3'-6" (1067 mm) depth with walls of B.B in cement mortar 1:3 cement plastered 1:3 , ½" thick, inside of walls and 1" (25 mm) thick over benching and channel i/c fixing C.I. manhole cover with frame of clear opening 1½" x 1½" (457 x 457 mm) of 1.75 Cwt. (88.9 kg) embedded in plain C.C. 1:2:4 and fixing 1" (25 mm) dia M.S steps 6" (150 mm) wide projecting 4" (102 mm) from the face of wall at 12" (305 mm) C/C duly painted etc. complete as per specification and drawing No. D.P/I of Public Health Circle Southern Zone.				
	(a) 4" to 12" dia 2' x 2' x 3'-6" Chapter # 11, Item # 1(a), Page-148	50	55,584.18	Each	2,779,209
	Note: Deducted from the above cost at the rate of Rs. 4234 per foot depth, where depth of Manhole is less than 3'-6" or 1067mm)				
11	Supplying & Fixing swan type pillar cock of superior quality with single c.p head 1/2" dia.	30	1,029.60	Each	30,888

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
	With Crystal Head Chapter # 06, Item # 16(a)&(b), Page-217	30	1,848.60	Each	55,458
12	S/Fixing concealed tee cock of superior quality with c.p head 1/2" dia Chapter # 06, Item # 11(a), Page-216	70	1,614.60	Each	113,022
13	Suppying and fixing in position C.P Bib Cock 3/4" dia C.P bib cock, standard pattern Chapter # 06, Item # 2(c), Page-215	60	1,544.40	Each	92,664
14	Providing UPVC pipes specials and clamps etc. including fixing cutting and fittings complete with and including the cost of breaking through walls and roof making good etc. with pigment to match the colour of the building and testing with water to a pressure bead of 200 feet and handling.				
	UPVC Nikasi pipe 4" dia.	1020	465.53	P.Rft	474,841
	UPVC Nikasi pipe 3" dia.	1160	836.36	P.Rft	970,178
	UPVC Nikasi pipe 6" dia. Chapter # 04, Item # 2(iv)(v)&(vi), Page-211	480	950.38	P.Rft	456,182
16	(a). Supplying & fixing concealed stop cock of superior quality with C.P head ½ inch dia. Chapter # 06, Item # 12(a), Page-216	70	1,615	Each	113,022
17	Providing and fixing steel sinks stainless local bt make complete with cast iron or wrought iron LINA ALVH brackets 6 inches built into wall, 1-1/2" rubber plug and chrome plated brass chain 1-1/2" C.P. brass waste with 1-1/2" P.V.C waste pipe & making requisite number of holes in walls, plinth & floor for pipe connection & making good in cement concrete 1:2:4.				
	a)steel sink stainless sized 40"x20" local make (Standard Pattern) Chapter # 01, Item # 19(a), Page-206	15	12,555.27	Each	188,329
18	Supplying & Fixing sink mixture cock of superior quality with c.p head etc complete (Sonex or Master Chapter # 06, Item # 17, Page-217	15	2,550.60	Each	38,259
19	Supplying and fixing jet shower with rod of each superior quality single C.P head 1/2" dia. Chapter # 06, Item # 15(a), Page-217	30	3,486.60	Each	104,598
				TOTAL "A"	**6,352,440**
				Add / Deduct ____ % above / below	
				TOTAL:	

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

NAME OF WORKS: **CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V**

CLIENTS: **CADET COLLEGE SANGHAR**

JOBS DESCRIPTION: **BILL OF QUANTITIES (WATER SUPPLY AND SANITARY INSTALLATION)**

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
	B - NON-SCHEDULE ITEMS				
1	Supplying and fixing UPVC Plydex (P.P.R) manufactured by Dadex eternit Ltd cold water internal and external water supply pipe or approved equivalent including all cutting, fitting, bends, tees, specials as required etcjointed with solvent / special adhesive laid in floor walls trench making holes and making them good with C.C 1:2:4 etc complete as per direction.				
	(i) UPVC Polydex (PPR) pipe 1/2" dia.	528			
	(ii) UPVC Polydex (PPR) pipe 3/4" dia.	120			
	(iii) UPVC Polydex (PPR) pipe 1" dia.	155			
	(iv) UPVC Polydex (PPR) pipe 1-1/2" dia.	520			
	(v) UPVC Polydex (PPR) pipe 1-1/4"	155			
	(v) UPVC Polydex (PPR) pipe 2" dia.	105			
2	Providing and Fixing a P.V.C trap with 4" dia inlet and 4" out let of the approved self clearing design with a P.V.C grating 6" x 6" with or without a vent arm including cost of making requisite number of holes in walls plinth and floor for pipe connection and making good cement concrete 1:2:4	42			
3	Providing and fixing 6" x 2" or 6" x 3" floor trap of the approved self cleaning design, with a UPVC grating 6" x 6", with or without vent arm complete with and including making requiisite number of holes in walls, plinth and floor for pipe connections and making good in C.C. 1:2:4 etc.	60			
4	Providing and fixing 6" x 4" P.V.C gully trap with 4" outlet complete 6" x 6" PVC cover with PVC frame.	15			
5	Providing and fixing 24" x 24" beveled edge Mirror best quality Pak made fixed with 4 Nos clamp set and brass screw fixed to wood cleat	42			

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
6	Providing & fixing a P.V.C clamps of the approved design to 4' dia pipe sockets including the cost of cutting and making good to wall or M.S bolts & nuts, 4" into wall including pipe distances extra painting to match the colour of the building.	500			
7	Supply, fixing, testing and commissioning of clean out plug of 4 " dia along with specials, fittings, bends, sleeves, masking plates, traps, vent cowl, chiseling, making hole, excavation, backfilling making good where as required to operate as per specifications, drawings and instructions of Consultant.	30			
	Total of non-schedule items		**Total**		

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V

SUMMARY OF ELECTRICAL WORKS

A.	SCHEDULE ITEMS:	_____
B.	NON - SCHEDULE ITEMS:	_____
	Total: (A + B)	_____

EXECUTIVE SUMMARY OF COST OF ELECTRICAL & ALLIED WORKS		
SECTION	**DESCRIPTION**	**TOTAL AMOUNT (PKR)**
SECTION-A	WIRING & WIRING ACCESSORIES	
SECTION-B	LIGHTING FIXTURES	
SECTION-C	DISTRIBUTION BOARDS AND CABLES	
	TOTAL COST FOR ELECTRICAL WORKS	

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V

BOQ OF ELECTRICAL & ALLIED WORKS						
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	COMPOSITE RATE	
					RATE PKR	AMOUNT PKR
		SECTION - A **WIRING / WIRING ACCESSORIES**				
		Providing, installation, testing & commissioning of following items including all material, tools, labor & accessories required for completion of work as per specifications, details & drawings. Complete in all respects. Megger Test Report of all wiring shall be submitted by contractor to consultant.				
		SMALL WIRING FOR LIGHTS				
	C	**WITH 3 WIRE PVC CONDUIT ON SURFACE**				
A1	C17	Providing & laying (Main or Sub Main) PVC insulated with size 3-7-3/.029 copper conductor in ¾" dia PVC conduit on surface. Average Length 30 Rft. (667.06 / FT)				
a		3-7-3/.029 PVC, Cu	2100	Per Ft	667.06	1,400,826
	N	**POINT WIRING SUB-HEAD II**				
A2	N-102	Wiring for light or fan point with 3/.029 PVC insulated wire in 20mm (3/4") PVC conduit recessed in the wall or column as required.	281	Per Point	6,573.50	1,847,154
A3	N-102	Wiring for light or fan point with 3/.029 PVC insulated wire in 20mm (3/4") PVC conduit recessed in the wall or column as required..	248	Per Point	6,573.50	1,630,228
		SMALL WIRING FOR POWER				
	C	**WITH 3 WIRE PVC CONDUIT ON SURFACE**				
A4	C17	Providing & laying (Main or Sub Main) PVC insulated with size 3-7-3/.029 copper conductor in ¾" dia PVC conduit on surface. Average Length 30 Rft. (667.06/ FT)				
a		3-7-3/.029 PVC, Cu	2100	Per Ft	667.06	1,400,826
	N	**POINT WIRING SUB-HEAD II**				

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V

BOQ OF ELECTRICAL & ALLIED WORKS						
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	COMPOSITE RATE	
					RATE PKR	AMOUNT PKR
A5	N-103	Wiring for plug point with 3/.029 PVC insulated wire in 20mm (3/4") PVC conduit on surface as required				
a		3/.029 PVC, Cu	38	Per Point	3,816.06	145,010
		WIRING FOR AC UNITS				
A6	C-18	Wiring for 1.0 Ton A/C Units Providing & laying (Main or Sub Main) PVC insulated with size 3-7/.036(4mm2) copper conductor in ¾" dia PVC conduit on surface. ***Average Length 40 Rft..***	1440	Per Ft	916.79	1,320,178
		WIRING FOR WATER TRANSFER PUMP				
A7	C-18	Wiring for Water Transfer Pump Providing & laying (Main or Sub Main) PVC insulated with size 3-7/.036(4mm2) copper conductor in ¾" dia PVC conduit on surface. Average Length 100 Rft..	276	Per Ft	916.79	253,034
		WIRING FOR BOOSTER PUMP				
A8	C-18	Wiring for Booster Pump Providing & laying (Main or Sub Main) PVC insulated with size 3-7/.036(4mm2) copper conductor in ¾" dia PVC conduit on surface. Average Length 100 Rft..	276	Per Ft	916.79	253,034
		WIRING FOR COMBOX				
A9	C17	Wiring for Comrbox Providing & laying (Main or Sub Main) PVC insulated with size 3-7-3/.029 copper conductor in ¾" dia PVC conduit on surface. Average Length 30 Rft. (667.06/ FT)	360	Per Ft	667.06	240,142
		TOTAL AMOUNT - SEC - A (PKR) (CARRIED FORWARD TO SUMMARY)			-	**8,490,431**
		SECTION - B LIGHTING FIXTURES				

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V

BOQ OF ELECTRICAL & ALLIED WORKS						
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	COMPOSITE RATE	
					RATE PKR	AMOUNT PKR
		Providing/ Supplying , Installation, testing and commissioning of the following lighting fixture including all accessories like electronic ballast, lamps, mounting arrangements etc. Complete in all respects. Mounting accessories shall be provided by contractor like screws, nuts, bolts, strings etc.				
B1	195-C	**CELING FAN** Providing & fixing A.C Electric Ceiling fan 56" (good quality) As approved by architect.	39	Nos.	14,869.21	579,899
		TOTAL AMOUNT - SEC - B (PKR) (CARRIED FORWARD TO SUMMARY)			-	**579,899**
		SECTION - C **DISTRIBUTION BOARDS & CABLES**				
		Providing, Laying, Testing, Termination and Commissioning of following multi-core PVC insulated Copper / Aluminium Conductor Cables for main/sub-main power distribution system as shown in the layout plans in appropriate size of conduits. Work also includes necessary termination accessories like compression lugs, color coded sleeves, identification tags etc. Note : The quantities shown in the boq are estimated based on design drawings. Contractor has to take accurate measurements at site prior to procurement of material.				
C1	O-80	4C, 35 Sqmm Cu. SWA/PVC/PVC + ECC, 1x16 Sqmm Cu.PVC From Nearest Power Source to MDB	59	Per Ft.	1,937.18	114,294
		TOTAL AMOUNT - SEC - C (PKR) (CARRIED FORWARD TO SUMMARY)			-	**114,294**
		Add / Deduct ____ % above / below				
		TOTAL:				

EXECUTIVE SUMMARY OF COST OF ELECTRICAL & ALLIED WORKS		
SECTION	**DESCRIPTION**	**TOTAL**
		AMOUNT (PKR)
SECTION-B	WIRING DEVICES / RECEPTACLES	
SECTION-C	LIGHTING FIXTURES	
SECTION-D	DISTRIBUTION BOARDS AND CABLES	
SECTION-E	CABLE RACEWAYS / CONTAINMENTS	
SECTION-F	COMMUNICATION SYSTEM	
SECTION-G	GROUNDING & BONDING	
	TOTAL COST FOR ELECTRICAL WORKS	

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V

BOQ OF ELECTRICAL & ALLIED WORKS											
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
		SECTION - B **WIRING DEVICES / RECEPTACLES**								
		Providing, installation and commissioning of following wiring devices / light control switches / power receptacles as per BS Standards including 16 SWG MS Powder Coated back boxes, flush with wall as shown in drawings and details.								
		LIGHT CONTROLLED SWITCHES								
B1		One Gang one way 10A Switch	15	Nos.						
B2		Two Gang one way 10A Switch	34	Nos.						
B3		Three Gang one way 10A Switch	22	Nos.						
B4		Four Gang one way 10A Switch	32	Nos.						
B5		Dimmer	39	Nos.						
		UTILITY POWER RECEPTACLES / SOCKET OUTLETS								
B6		13A, Simplex multi-pin switch Socket Unit	240	Nos.						
B7		15A, Round 3Pin Switch Socket Unit	26	Nos.						
B8		20A, DP Switch Socket Unit	39	Nos.						
B9		Door Bell With all allied accessories	8	Nos.						
		TOTAL AMOUNT - SEC - B (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - C **LIGHTING FIXTURES**								
		Providing/ Supplying , Installation, testing and commissioning of the following lighting fixture including all accessories like electronic ballast, lamps, mounting arrangements etc. Complete in all respects. Mounting accessories shall be provided by contractor like screws, nuts, bolts, strings etc.								
C1		**DOWN LIGHT** DOWN LIGHT FLUSH WITH 20W LED LIGHT. As approved by architect.	272	Nos.						
C2		**DOWN LIGHT** DOWN LIGHT SURFACE WITH 20W LED LIGHT. As approved by architect.	32	Nos.						

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
C3		**DECORATIVE LED WALL LIGHT** DECORATIVE LED WALL LIGHT WITH 18W. As approved by architect.	88	Nos.						
C4		**BULKHEAD WALL LIGHT** BULKHEAD WALL WITH 10W LED LIGHT. As approved by architect.	32	Nos.						
C5		**WALL BRACKET FAN** WAL BRACKET FAN As approved by architect.	8	Nos.						
C6		**EXHUAST FAN** EXHUAST FAN. As approved by architect.	32	Nos.						
		TOTAL AMOUNT - SEC - C (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - D **DISTRIBUTION BOARDS & CABLES**								
		Providing, Laying, Testing, Termination and Commissioning of following multi-core PVC insulated Copper / Aluminium Conductor Cables for main/sub-main power distribution system as shown in the layout plans in appropriate size of conduits. Work also includes necessary termination accessories like compression lugs, color coded sleeves, identification tags etc. Note : The quantities shown in the boq are estimated based on design drawings. Contractor has to take accurate measurements at site prior to procurement of material.								
D1		4C, 35 Sqmm Cu. SWA/PVC/PVC + ECC, 1x16 Sqmm Cu.PVC From Nearest Power Source to MDB	60	RM						
D2		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-G1	40	RM						
D3		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-G2	40	RM						
D4		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-F1	50	RM						
D5		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-F2	50	RM						

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V

BOQ OF ELECTRICAL & ALLIED WORKS											
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
		Supply, Installation, testing and commissioning of following distribution panels in accordance with the attached single line diagrams and layout plans. The panels shall be made according to the technical specifications attached.								
D6		MDB	2	No.						
D7		DB-G1	2	No.						
D8		DB-G2	2	No.						
D9		DB-F1	2	No.						
D10		DB-F2	2	No.						
D15		TP Box 125A TP Adj. MCCB (ICU=25KA) With Weather Proof Housing	2	No.						
		TOTAL AMOUNT - SEC - D (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - E **CABLE RACEWAYS / CONTAINMENTS**								
E1		**Supply and installation** of following sizes of PVC conduits / pipes including all installation acessories like bends, sockets, flexible conduits, partially above false ceiling and partially embedded in ground e.t.c , the works also complete with excavation and back filling of 1'-6" deep for laying of main / sub-main cables . Compete in all respects as shown in the drawing.								
a		20 mm dia PVC conduit	600	RM						
b		25 mm dia PVC conduit	600	RM						
c		32 mm dia PVC conduit	170	RM						
d		50 mm dia PVC conduit	100	RM						
		TOTAL AMOUNT - SEC - E (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - F **COMMUNICATION SYSTEMS**								
		Supply , installation , testing and commissioning of following items for voice & data communication cabling system including all material , labor , tools , accessories etc. Complete in all respects. Item includes termination of all cables at respective outlets as shown in the drawings and instructed by client. Note : The quantities shown in the boq are estimated based on design drawings. Contractor has to take accurate measurements at site prior to procurement of material.								

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
		HORIZONTAL DATA CABLING								
F1		**Category 6 , UTP Cables**, for data communication system at local workstations in 25mm dia PVC conduits under floor as shown in the layout plan and schematic diagrams. Work includes all terminations, management and tagging at both ends.	200	RMtr.						
		BACKBONE CABLING VOICE & DATA COMMUNICATION								
F2		**10 pair, 0.6 mm Telephone Cable from PTCL** as shown in the drawings and schematic diagram in 32mm dia pvc conduit including all accessories. Complete with termination and tagging at both ends.	312	RMtr.						
F3		Telephone Outlet .	16	Nos.						
		COMMUNICATION BOX								
F4		**Communication Box**, Front door with glass cover, lock & key, and front blank panels for covering empty spaces, air flow ducts for effective cooling management inside the rack for switches. Item includes supply and installation of 6 way rack mounted standard PDU.	8	Nos.						
		TELEPHONE JUNCTION BOX								
F5		**Telephone Junction Boxes (TJB)** for termination of incoming PTCL Cables having 10 pair tag block including surge protector, powder coated enclosure including interncal jumper wires and tagging.	8	No.						
		Wi-Fi ROUTERS WITH ONU DEVICES								
F6		**Supply and installation of Wi-Fi Routers With ONU Devices** as shown in the drawings including all accessories.	8	Nos.						
F7		**TV WIRING & OUTLET**								
a		TV Splitter (Tap) Unit with enclosure suitable for 1 incomings and 4 outgoing cables including all termination accessories.	8	Nos.						
b		Wall Mounted 150x150x75 mm TV Pull box made with 16SWG sheet steel for Antina system.	32	Nos.						
c		RG-7 Cable for TV	600	Rmtr.						
		TOTAL AMOUNT - SEC - F (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - G GROUNDING & BONDING								

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - V

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
		Providing , installation , testing and commissioning of following items for earthing & bonding system of complete data center including all material, boring, labor, tools, transportation, accessories etc. Complete in all respects including detailed test reports. Estimated earth stations are taken at this stage. Contractor has to check the soil resistivity at site and propose required stations to achieve earth resistance not more than one ohms.								
		EARTH STATIONS								
G1		**Providing fixing and connecting** of earthing set which consist of one copper rod of size 20mm dia 3 meters long buried at 20 meter below the ground level buried at least 3 meter away from the nearest foundation the earth lead shall be of 2 Nos.70mm2 stranded copper conductor drawn in 50mm dia G.I pipe from the earthing rod to the panels transformer earth pit including Boring / digging as required and refilling the earth pits with necessary lime powder wooden cool as requires and approved electrical inspector IEE regulation and confirming to the Specification including make of earth pit with cast iron manhole cover 150mm x 150m	2	Nos.						
		EARTH TEST POINTS / CONNECTING POINTS								
G2		**Earth Test Point including Test Link** , 150 mm x 75 mm x 5 mm electroplated Copper bar , as shown in drawings. Bar shall be provided with holes suitable for installation of required earth leads. The test bar shall be enclosed in powder coated metal enclosure as approved by the client.	2	Nos.						
		EARTH LEADS / CONDUCTORS								
G3		**Single Core PVC insulated**, 16 Sqmm Stranded Copper Conductor, green in color from earth pit to test point and from test point to connecting point / Panels in 32mm size of UPVC Conduit.	200	RM.						
		TOTAL AMOUNT - SEC - G (PKR) (CARRIED FORWARD TO SUMMARY)								

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI

SUMMARY OF ESTIMATED COST

1	CIVIL WORK.	_____
2	PLUMBING WORK.	_____
3	ELECTRICAL WORK.	_____
	Total: (1 + 2 + 3)	_____

_____

CONTRACTOR

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI

SUMMARY OF CIVIL WORKS

A.	SCHEDULE ITEMS:	_____
B.	NON - SCHEDULE ITEMS:	_____
	Total: (A + B)	_____

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI
CADET COLLEGE SANGHAR
BILL OF QUANTITIES
CIVIL WORKS

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
	A - SCHEDULE ITEMS				
1	**JUNGLE CLEARENCE**				
	Jungle Clearence and removing within 100 feet				
(a)	Light Chapter # 18, Page-88, Item # 4(a)	12,932	Per Sft	0.4	5,173
2	**EXCAVATION**				
	Excavation in foundation of Building, Bridges and other Structures including dagbeling dressing, refilling around structure with excavated earth watering and ramming lead upto one chain (30 metre) and lift upto 5 ft. (1.5 metre)				
(b)	In ordinary soil Chapter # 1, Page-27, Item # 18(b)	47,040	Per Cft	11.88	558,835
3	**EARTH FILL**				
	Filling, watering and ramming earth under floor with new earth (excavated from outside) lift upto 5 ft and lead upto 10 miles including cost of earth. Chapter # 1, Page-27, Item # 22	43,624	Per Cft	47.02	2,051,200
4	**LEAN (1:4:8)**				
	Cement concrete plain including placing compacting, finishing and curing, complete (including screening and washing at stone aggregate without shuttering).				
(i)	Ratio. 1:4:8 Chapter # 4, Page-34, Item # 5(i)	3,220	Per Cft	348.83	1,123,233
5	**REINFORCEMENT STEEL**				
	Febrication of deformed steel reinforcement for cement concrete including cutting, bending, laying in position, making joints and festenings including cost of binding wire (also includes removal of rust from bars).				
(a) (i)	Deformed Bar. Grade - 60 Chapter # 4, Page-36, Item # 8(a)(i)	300	Per Cwt	18934.02	5,680,206
6	**P.C.C. (1:3:6)**				
	Cement concrete plain including placing compacting, finishing and curing, complete (including screening and washing at stone aggregate without shuttering).				
(h)	Ratio: 1:3:6 Chapter # 4, Page-34, Item # 5(h)	2,376	Per Cft	388.67	923,480

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
7	**D.P.C**				
	Damp proof course with (cement sand and shingle concrete 1:2:4) including 2 coats of asphaltic mixture.				
(b)	2" thick Chapter # 4, Page-38, Item # 28(b)	848	Per Sft	126.97	107,643
8	**BRICK WORK**				
	Pacca brick work in ground floor in (including striking of joints).				
(I)(c)	Cement Sand Mortar (1:4) Chapter # 5, Page-40, Item # 5(I)(c)	8,130	Per Cft	397.85	3,234,521
	Add extra labour in Item # 5 for brick work in:				
	First Floor	3,051	Per Cft	17.23	52,569
	Second Floor	1,026	Per Cft	39.11	40,127
9	**FLOORING (1:2:4)**				
	Cement concrete plain including placing compacting, finishing and curing, complete (including screening and washing at stone aggregate without shuttering).				
(f)	Ratio: 1:2:4 Chapter # 5, Page-34, Item # 5(f)	3,746	Per Cft	443.54	1,661,678
10	**CERAMIC TILES (TOILET)**				
(a)	Laying floor of approved coloured glazed tiles 1/4" thick floor of approved colour & size jointing in white cement and laid over 1:2 cement sand mortar 3/4" thick including grouting with matching colour and finishing. Chapter # 8, Page-56, Item # 25	840	Per Sft	325.40	273,336
(b)	Laying floor of approved coloured glazed tiles 1/4" thick dado of approved colour & size jointing in white cement and laid over 1:2 cement sand mortar 3/4" thick including grouting with matching colour and finishing. Chapter # 8, Page-55, Item # 24	4,032	Per Sft	389.36	1,569,900
(c)	Laying Afghan Ziarat white flooring fine dressed on the surface without winding set in time mortar 1:2 including rubbing and polishing of the joints.				
(ix)	24"x24"x5/16" flooring Chapter # 8, Page-56, Item # 28(ix)	1,601	Per Sft	439.57	703,861
(d)	Providing & laying full body Porcelain Tile in flooring or facing of approved design. Set in gray cement mortar 1:2 of 3/4" thickness including washing and joints fill with white cement, slurry using matching colour pigment and complete as per specification. 24"x24"x5/16" flooring Chapter # 8, Page-56, Item # 28(vii)	2,650	Per Sft	439.57	1,164,861

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
11	**PLASTER (1/2")**				
	Cement plaster 1:4 upto 12' height.				
(b)	1/2" thick.	55,110	Per Sft	39.83	2,195,015
	Chapter # 9, Page-62, Item # 11(b)				
12	**PLASTER (3/8")**				
	Cement plaster 1:4 upto 12' height.				
(a)	3/8" thick.	55,110	Per Sft	37.78	2,082,041
	Chapter # 9, Page-62, Item # 11(a)				
13	**NEERU PLASTER**				
	Cement Neru plaster 1:2 Cement and Sand upto 20 ft. (6.10 metre)				
(b)	1/2" thick	363	Per Sft	44.62	16,197
	Chapter # 9, Page-61, Item # 5(b)				
14	**DISTEMPER**				
	Distempering				
(c)	New Surface (iii) Three Coats	9,646	Per Sft	17.23	166,201
	Chapter # 9, Page-63, Item # 24(c)				
15	**WEATHER SHIELD PAINT**				
	Preparing the surface and painting with weather coat including rubbing the surface with rubbing brick / sand paper, filling the voids with chalk / plaster of paris and then painting with weather coat of approved make.	8,472	Per Sft	39.38	333,627
	Chapter # 9, Page-64, Item # 38(A)				
	(b) 2nd and subsequent coat	8,472	Per Sft	23.60	199,939
	Chapter # 9, Page-64, Item # 38(B)				
16	**WINDOWS / DOOR PAINT**				
	Preparing surface and painting doors and windows any type. (including edges).				
	(i) Priming Coat.	8,471	Per Sft	11.30	95,722
	(ii) Each subsequent coat.	8,471	Per Sft	7.11	60,229
	Chapter # 11, Page-73, Item # 5(c) (i) (ii)				
17	**PLASTIC EMULSION PAINT**				
	Preparing the surface and painting with plastic emulsion paint of approved make including rubbing the surface with sand Paper, filling the voids with chalk / plaster of paris and then painting etc. complete.				
	(A) Three Coats	55,110	Per Sft	38.71	2,133,293
	Chapter # 9, Page-64, Item # 40(A)				
19	**DOOR SHUTTERS**				
	First class deodar wood wrough joinery in doors and windows etc. fixed in position including chowkhats hold fasts, higes iron tower bolts, chock cleats, handles and cord with hooks etc. Deodar pannelled or Pannelled and glazed or fully glazed.				
	(b) Deodar Wood.	4,236	Per Sft	1233.27	5,223,515
	Deduct for wooden frame from rate.				
	Chapter # 10, Page-68, Item # 25(b)				

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
20	**ARCHITRAVE / WOODEN BIDDING** Providing & fixing with sunk iron screws Wooden Architrave approved design / shape having wifth not less than 2-1/2" inchesas directed by Engineer Incharge. Chapter # 10, Page-71, Item # 60	7,740	Per Rft	136.4	1,055,736
21	**MORTICE LOCKS** Providing & fixing approved quality mortice lock. Chapter # 10, Page-68, Item # 21	71	Each	1039.05	73,773
22	**IRON GRILL** Providing & fixing iron steel grill using solid square bars of size 1/2"x1/2" placed at 4" I/c and frame of flat iron patti of 3/4"x3/4" I/c circle shape at 1-0 apart equivalent fitted with screws are pins i/c painting 3 coats with 1st coat of red oxide paint etc. Chapter # 17, Page-86, Item # 30	2,085	Per Sft	833.27	1,737,368
23	**WINDOW FRAME** Providing and fixing G.I frames / choukhats of size 7"x2" or 4-1/2"x3" for windows using 20 gauge G.I sheet I/c welded hinges and fixing at site with necessary hold fasts, filling with cement sand slurry of ratio 1:6 and repairing the jambs. The cost also i/c all carriage, tools and plants used in making and fixing. Chapter # 17, Page-86, Item # 28	2,085	Per Rft	908.25	1,893,701
24	**DOOR FRAME** Providing and fixing G.I frames / choukhats of size 7"x2" or 4-1/2"x3" for door using 20 gauge G.I sheet I/c welded hinges and fixing at site with necessary hold fasts, filling with cement sand slurry of ratio 1:6 and repairing the jambs. The cost also i/c all carriage, tools and plants used in making and fixing. Chapter # 17, Page-86, Item # 29	1,785	Per Rft	690.67	1,232,846

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
25	**GROOVE PLASTER**				
	Extra labour rate for making grooves of 1"x1/4" or 3/4"x1/2" plastered surface with true edges both vertically and horizontally with uniform depth and with groove base smoothly finished etc. complete as per instruction of Engineer Incharge.	2,096	Per Rft	31.19	65,374
	Chapter # 9, Page-64, Item # 34				
26	**ROOF SCREED / FLOOR**				
	Providing & laying 1" thick topping of cement concrete (1:2:4) including Surface finishing and dividing into panels.				
	(c) 2" thick	2,915	Per Sft	108.75	317,006
	(d) 3" thick	5,248	Per Sft	145	760,935
	Chapter # 8, Page-55, Item # 16(c) & (d)				
27	**DRIP COURSE**				
	Making drip course 2"x1/2" (50x12mm) under RCC Slab edges in outer opening, in cement sand mortar (1:2).	3,511	Per Rft	34.42	120,849
	Chapter # 7, Page-53, Item # 48				
28	**STAIR CASE**				
	Laying Super Botisinam Crème, Badal or Black Marble 12"x12" / 12"x24" fine dress on surface without winding set in line mortar 1:2 including rubbing and polishing on the joint.				
	(a) 3/4" thick marble	1,007	Per Sft	337.9	340,096
	Chapter # 8, Page-56, Item # 28(v)(a)				
29	**SKIRTING / MARBLE**				
	Providing & fixing 3/8" thick Marble Tiles of approved quality & coloued and shade size 8"x4" in dado skirting & facing removal tucking of existing plaster surface etc. over 1/2" thick base of cement mortar 1:3 setting of tile in slurry of white cement over mortar base i/c filling & joints & washing the tile with white cement slurry current finishing clearing & polishing etc. complete (New Work).	732	Per Sft	247.28	180,885
	Chapter # 8, Page-59, Item # 61				

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
30	**FLY PROOF DOOR & WINDOW SHUTTERS** First class deodar wood wrought joinery work in wire gauze doors and windows with 22 SWG galvanized wire gauze 12x12 mashes per squareinch (625 mm) including iron fittings complete.				
(a)	Deodar framing 1-3/4" (45 mm) with wire guage fixed in position. Chapter # 10, Page-67, Item # 14(a)	16,513	Per Sft	1559.16	25,745,630
31	**ALUMINIUM SHEET** Providing & fixing Aluminium sheet on doors pasted with glue as per requirement. Chapter # 10, Page-71, Item # 61	525	Per Sft	115.38	60,575
					65,241,174
	Add / Deduct ____ % above / below				
				TOTAL:	

YOUNG ASSOCIATES
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CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI
CADET COLLEGE SANGHAR
BILL OF QUANTITIES
CIVIL WORKS

S.#	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
	B - NON - SCHEDULE ITEMS				
1	**R.C.C** Providing and laying reinforced cement concrete using Hub River crushed stone aggregate 3/4 inch (19 mm) and down gauge having a minimum works cylindrical crushing strength of 3000 psi for foundation, plinth beam, roof beam, slab, wall and for 4000 PSI columns at 28 days of any shape including using SBR and water tight form work and its removal, compacting, leveling vibrating and curing etc. complete but excluding the cost of reinforcement. (Sulphate resisting cement will be used up to Plinth level)				
	(iii) 3000 PSI	21,469	Per Cft		
	(iv) 4000 PSI	2,056	Per Cft		
2	**SHUTTERING** Erection of removal of centering for RCC or plain cement concrete works of Partal Wood.				
(b)	Vertical	2,063	Per Sft		
3	**STONE SOLING** Providing and laying soling stones 4 inches to 6 inches under Footings, floors including packing with spawls and chips and consolidating compacting watering etc. complete.	6,331	Per Cft		
4	**ANTITERMITE** Provide & apply Antitermite treatment using MIRAGE of Ali Abkar Enterpises or equaivelent approved quality in various stages e.g. under ground treatment at various stages and each floor including all wooden work. Plinth area will be measured once for all operations. (The Contractor will give 10 years Guarantee).	5,300	Per Sft		
5	**WATER SPOUTS** Providing & fixing water spout. UPVC 4" dia Pipe & 4.5' long	25	Each		

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI

SUMMARY OF PLUMBING WORKS

A.	SCHEDULE ITEMS:	_____
B.	NON - SCHEDULE ITEMS:	_____
	Total: (A + B)	_____

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

NAME OF WORKS: CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI

CLIENTS: CADET COLLEGE SANGHAR

JOBS DESCRIPTION: BILL OF QUANTITIES (WATER SUPPLY AND SANITARY INSTALLATION)

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
	A - SCHEDULE ITEMS				
1	Providing and Fixing orisa type white or colour glazed earthen ware w.c. pan with cost of low level plastic flush tank of 3 gallons capacity of approved quality i/c making requisite number of holes in wall. Plinth and floor and making good in cement concrete 1:2:4				
	A. W.C pan orisa type 23" with plastic tank of low down 3 gallons C.I trap and C.I thumble (superior quality)	28 Nos.	10,440.50	Each	292,334
	(ii) with 4 inch dia earthen ware trap & plastic thumble.				
	Chapter # 01, Item # 3(a), Page-204				
2	Providing & Fixing 24" x 18" lavatory basin in white glazed earthen ware complete with i/c the cost of W.I or C.I Cantilever brackets 6 inch built into wall, painted white in two coat after a primary coat of red lead paint a pair of ½" dia chrome plate pillar traps 1½" dia rubber plug & chrome plated brass chain 1-1/4" dia malleable iron or cp brass traps malleable iron or brass union & making requisite number of holes in walls plinth & floor for pipe connection and making good in cement concrete 1:2: (standard pattern)	30 Nos	9,495.14	Each	284,854
	Chapter # 01, Item # 8, Page-205				
3	Add extra for labour for providing and fixing of eathern ware pedestal white or colored glazed (standard pattern).	30 Nos	3,276.00	Each	98,280
	Chapter # 01, Item # 9, Page-205				
4	Providing and fixing in position nyloon connections complete with ½" dia brass stop cock with pair of brass nuts and lining joints to nyloon connection.	80 Nos	760.50	Each	60,840
	Chapter # 01, Item # 22, Page-207				
5	Providing and fixing chrome plated brass towel rail complete with brackets fixing on wooden cleats with 1" long C.P. brass screws.				
	(iii) Towel Rail 30" Long	30	945.07	Each	28,352
	Chapter # 02, Item # 1(iii)(a), Page-208				

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
6	Supplying and fixing soap tray made of plastic of superior quality and design with fine finishing with C.P. screws etc. complete. Chapter # 02, Item # 5, Page-208	30 Nos	585.00	Each	17,550
7	Add extra labour for concealed pipe and fittings i/c making recess in the wall for pipe and making good in cement mortar etc. complete.				
	(i) ½" dia	450	159.30	P.Rft	71,685
	(ii) 3/4" dia	120	199.83	P.Rft	23,980
	(iii) 1" dia	155	272.35	P.Rft	42,214
	Chapter # 04, Item # 2(i)(ii)&(iii), Page-211				
8	Providing and fixing full way gun metal valves with wheels, threaded or flabged ends with rubber washing.(gate valve)				
	1-1/2" dia (standard pattern) Chapter # 06, Item # 4(B)(c), Page-215	5	1,614.60	Each	8,073
9	Supplying & fixing handle valve (china) (ii). 1" dia	4	1,907.10	Each	7,628
	Chapter # 06, Item # 5(c), Page-215				
10	Constructing manhole or inspection chamber for the required dia of circular sewer and 3'-6" (1067 mm) depth with walls of B.B in cement mortar 1:3 cement plastered 1:3 , ½" thick, inside of walls and 1" (25 mm) thick over benching and channel i/c fixing C.I. manhole cover with frame of clear opening 1½" x 1½" (457 x 457 mm) of 1.75 Cwt. (88.9 kg) embedded in plain C.C. 1:2:4 and fixing 1" (25 mm) dia M.S steps 6" (150 mm) wide projecting 4" (102 mm) from the face of wall at 12" (305 mm) C/C duly painted etc. complete as per specification and drawing No. D.P/I of Public Health Circle Southern Zone.				
	(a) 4" to 12" dia 2' x 2' x 3'-6" Chapter # 11, Item # 1(a), Page-148	50	55,584.18	Each	2,779,209
	Note: Deducted from the above cost at the rate of Rs. 4234 per foot depth, where depth of Manhole is less than 3'-6" or 1067mm)				
11	Supplying & Fixing swan type pillar cock of superior quality with single c.p head 1/2" dia.	30	1,029.60	Each	30,888

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
	With Crystal Head Chapter # 06, Item # 16(a)&(b), Page-217	30	1,848.60	Each	55,458
12	S/Fixing concealed tee cock of superior quality with c.p head 1/2" dia Chapter # 06, Item # 11(a), Page-216	70	1,614.60	Each	113,022
13	Suppying and fixing in position C.P Bib Cock 3/4" dia C.P bib cock, standard pattern Chapter # 06, Item # 2(c), Page-215	60	1,544.40	Each	92,664
14	Providing UPVC pipes specials and clamps etc. including fixing cutting and fittings complete with and including the cost of breaking through walls and roof making good etc. with pigment to match the colour of the building and testing with water to a pressure bead of 200 feet and handling.				
	UPVC Nikasi pipe 4" dia.	1020	465.53	P.Rft	474,841
	UPVC Nikasi pipe 3" dia.	1160	836.36	P.Rft	970,178
	UPVC Nikasi pipe 6" dia. Chapter # 04, Item # 2(iv)(v)&(vi), Page-211	480	950.38	P.Rft	456,182
16	(a). Supplying & fixing concealed stop cock of superior quality with C.P head ½ inch dia. Chapter # 06, Item # 12(a), Page-216	70	1,615	Each	113,022
17	Providing and fixing steel sinks stainless local bt make complete with cast iron or wrought iron LINA ALVH brackets 6 inches built into wall, 1-1/2" rubber plug and chrome plated brass chain 1-1/2" C.P. brass waste with 1-1/2" P.V.C waste pipe & making requisite number of holes in walls, plinth & floor for pipe connection & making good in cement concrete 1:2:4.				
	a)steel sink stainless sized 40"x20" local make (Standard Pattern) Chapter # 01, Item # 19(a), Page-206	15	12,555.27	Each	188,329
18	Supplying & Fixing sink mixture cock of superior quality with c.p head etc complete (Sonex or Master Chapter # 06, Item # 17, Page-217	15	2,550.60	Each	38,259
19	Supplying and fixing jet shower with rod of each superior quality single C.P head 1/2" dia. Chapter # 06, Item # 15(a), Page-217	30	3,486.60	Each	104,598
				TOTAL "A"	**6,352,440**
				Add / Deduct ____ % above / below	
				TOTAL:	

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

NAME OF WORKS: **CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI**

CLIENTS: **CADET COLLEGE SANGHAR**

JOBS DESCRIPTION: **BILL OF QUANTITIES (WATER SUPPLY AND SANITARY INSTALLATION)**

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
	B - NON-SCHEDULE ITEMS				
1	Supplying and fixing UPVC Plydex (P.P.R) manufactured by Dadex eternit Ltd cold water internal and external water supply pipe or approved equivalent including all cutting, fitting, bends, tees, specials as required etcjointed with solvent / special adhesive laid in floor walls trench making holes and making them good with C.C 1:2:4 etc complete as per direction.				
	(i) UPVC Polydex (PPR) pipe 1/2" dia.	528			
	(ii) UPVC Polydex (PPR) pipe 3/4" dia.	120			
	(iii) UPVC Polydex (PPR) pipe 1" dia.	155			
	(iv) UPVC Polydex (PPR) pipe 1-1/2" dia.	520			
	(v) UPVC Polydex (PPR) pipe 1-1/4"	155			
	(v) UPVC Polydex (PPR) pipe 2" dia.	105			
2	Providing and Fixing a P.V.C trap with 4" dia inlet and 4" out let of the approved self clearing design with a P.V.C grating 6" x 6" with or without a vent arm including cost of making requisite number of holes in walls plinth and floor for pipe connection and making good cement concrete 1:2:4	42			
3	Providing and fixing 6" x 2" or 6" x 3" floor trap of the approved self cleaning design, with a UPVC grating 6" x 6", with or without vent arm complete with and including making requiisite number of holes in walls, plinth and floor for pipe connections and making good in C.C. 1:2:4 etc.	60			
4	Providing and fixing 6" x 4" P.V.C gully trap with 4" outlet complete 6" x 6" PVC cover with PVC frame.	15			
5	Providing and fixing 24" x 24" beveled edge Mirror best quality Pak made fixed with 4 Nos clamp set and brass screw fixed to wood cleat	42			

S.No	Description	Quantity	Rate (Rs)	Unit	Amount (Rs.)
6	Providing & fixing a P.V.C clamps of the approved design to 4' dia pipe sockets including the cost of cutting and making good to wall or M.S bolts & nuts, 4" into wall including pipe distances extra painting to match the colour of the building.	500			
7	Supply, fixing, testing and commissioning of clean out plug of 4 " dia along with specials, fittings, bends, sleeves, masking plates, traps, vent cowl, chiseling, making hole, excavation, backfilling making good where as required to operate as per specifications, drawings and instructions of Consultant.	30			
	Total of non-schedule items		**Total**		

YOUNG ASSOCIATES
(CONSULTING ENGINEERS AND ARCHITECTS)

CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI

SUMMARY OF ELECTRICAL WORKS

A.	SCHEDULE ITEMS:	_____
B.	NON - SCHEDULE ITEMS:	_____
	Total: (A + B)	_____

EXECUTIVE SUMMARY OF COST OF ELECTRICAL & ALLIED WORKS		
SECTION	**DESCRIPTION**	**TOTAL AMOUNT (PKR)**
SECTION-A	WIRING & WIRING ACCESSORIES	
SECTION-B	LIGHTING FIXTURES	
SECTION-C	DISTRIBUTION BOARDS AND CABLES	
	TOTAL COST FOR ELECTRICAL WORKS	

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI

BOQ OF ELECTRICAL & ALLIED WORKS						
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	COMPOSITE RATE	
					RATE PKR	AMOUNT PKR
		SECTION - A **WIRING / WIRING ACCESSORIES**				
		Providing, installation, testing & commissioning of following items including all material, tools, labor & accessories required for completion of work as per specifications, details & drawings. Complete in all respects. Megger Test Report of all wiring shall be submitted by contractor to consultant.				
		SMALL WIRING FOR LIGHTS				
	C	**WITH 3 WIRE PVC CONDUIT ON SURFACE**				
A1	C17	Providing & laying (Main or Sub Main) PVC insulated with size 3-7-3/.029 copper conductor in ¾" dia PVC conduit on surface. Average Length 30 Rft. (667.06 / FT)				
a		3-7-3/.029 PVC, Cu	2100	Per Ft	667.06	1,400,826
	N	**POINT WIRING SUB-HEAD II**				
A2	N-102	Wiring for light or fan point with 3/.029 PVC insulated wire in 20mm (3/4") PVC conduit recessed in the wall or column as required.	281	Per Point	6,573.50	1,847,154
A3	N-102	Wiring for light or fan point with 3/.029 PVC insulated wire in 20mm (3/4") PVC conduit recessed in the wall or column as required..	248	Per Point	6,573.50	1,630,228
		SMALL WIRING FOR POWER				
	C	**WITH 3 WIRE PVC CONDUIT ON SURFACE**				

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI

BOQ OF ELECTRICAL & ALLIED WORKS						
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	COMPOSITE RATE	
					RATE PKR	AMOUNT PKR
A4	C17	Providing & laying (Main or Sub Main) PVC insulated with size 3-7-3/.029 copper conductor in ¾" dia PVC conduit on surface. Average Length 30 Rft. (667.06/ FT)				
a		3-7-3/.029 PVC, Cu	2100	Per Ft	667.06	1,400,826
	N	**POINT WIRING SUB-HEAD II**				
A5	N-103	Wiring for plug point with 3/.029 PVC insulated wire in 20mm (3/4") PVC conduit on surface as required				
a		3/.029 PVC, Cu	38	Per Point	3,816.06	145,010
		WIRING FOR AC UNITS				
A6	C-18	Wiring for 1.0 Ton A/C Units Providing & laying (Main or Sub Main) PVC insulated with size 3-7/.036(4mm2) copper conductor in ¾" dia PVC conduit on surface. ***Average Length 40 Rft..***	1440	Per Ft	916.79	1,320,178
		WIRING FOR WATER TRANSFER PUMP				
A7	C-18	Wiring for Water Transfer Pump Providing & laying (Main or Sub Main) PVC insulated with size 3-7/.036(4mm2) copper conductor in ¾" dia PVC conduit on surface. Average Length 100 Rft..	276	Per Ft	916.79	253,034
		WIRING FOR BOOSTER PUMP				
A8	C-18	Wiring for Booster Pump Providing & laying (Main or Sub Main) PVC insulated with size 3-7/.036(4mm2) copper conductor in ¾" dia PVC conduit on surface. Average Length 100 Rft..	276	Per Ft	916.79	253,034

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI

BOQ OF ELECTRICAL & ALLIED WORKS						
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	COMPOSITE RATE	
					RATE PKR	AMOUNT PKR
		WIRING FOR COMBOX				
A9	C17	Wiring for Comrbox Providing & laying (Main or Sub Main) PVC insulated with size 3-7-3/.029 copper conductor in ¾" dia PVC conduit on surface. Average Length 30 Rft. (667.06/ FT)	360	Per Ft	667.06	240,142
		TOTAL AMOUNT - SEC - A (PKR) (CARRIED FORWARD TO SUMMARY)			-	**8,490,431**
		SECTION - B LIGHTING FIXTURES				
		Providing/ Supplying , Installation, testing and commissioning of the following lighting fixture including all accessories like electronic ballast, lamps, mounting arrangements etc. Complete in all respects. Mounting accessories shall be provided by contractor like screws, nuts, bolts, strings etc.				
B1	195-C	**CELING FAN** Providing & fixing A.C Electric Ceiling fan 56" (good quality) As approved by architect.	39	Nos.	14,869.21	579,899
		TOTAL AMOUNT - SEC - B (PKR) (CARRIED FORWARD TO SUMMARY)			-	**579,899**
		SECTION - C DISTRIBUTION BOARDS & CABLES				

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI

BOQ OF ELECTRICAL & ALLIED WORKS						
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	COMPOSITE RATE	
					RATE PKR	AMOUNT PKR
		Providing, Laying, Testing, Termination and Commissioning of following multi-core PVC insulated Copper / Aluminium Conductor Cables for main/sub-main power distribution system as shown in the layout plans in appropriate size of conduits. Work also includes necessary termination accessories like compression lugs, color coded sleeves, identification tags etc. Note : The quantities shown in the boq are estimated based on design drawings. Contractor has to take accurate measurements at site prior to procurement of material.				
C1	O-80	4C, 35 Sqmm Cu. SWA/PVC/PVC + ECC, 1x16 Sqmm Cu.PVC From Nearest Power Source to MDB	59	Per Ft.	1,937.18	114,294
		TOTAL AMOUNT - SEC - C (PKR) (CARRIED FORWARD TO SUMMARY)			-	**114,294**
					Add / Deduct ____ % above / below	
					TOTAL:	

EXECUTIVE SUMMARY OF COST OF ELECTRICAL & ALLIED WORKS		
SECTION	**DESCRIPTION**	**TOTAL**
		AMOUNT (PKR)
SECTION-B	WIRING DEVICES / RECEPTACLES	
SECTION-C	LIGHTING FIXTURES	
SECTION-D	DISTRIBUTION BOARDS AND CABLES	
SECTION-E	CABLE RACEWAYS / CONTAINMENTS	
SECTION-F	COMMUNICATION SYSTEM	
SECTION-G	GROUNDING & BONDING	
	TOTAL COST FOR ELECTRICAL WORKS	

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
		SECTION - B **WIRING DEVICES / RECEPTACLES**								
		Providing, installation and commissioning of following wiring devices / light control switches / power receptacles as per BS Standards including 16 SWG MS Powder Coated back boxes, flush with wall as shown in drawings and details.								
		LIGHT CONTROLLED SWITCHES								
B1		One Gang one way 10A Switch	15	Nos.						
B2		Two Gang one way 10A Switch	34	Nos.						
B3		Three Gang one way 10A Switch	22	Nos.						
B4		Four Gang one way 10A Switch	32	Nos.						
B5		Dimmer	39	Nos.						
		UTILITY POWER RECEPTACLES / SOCKET OUTLETS								
B6		13A, Simplex multi-pin switch Socket Unit	240	Nos.						
B7		15A, Round 3Pin Switch Socket Unit	26	Nos.						
B8		20A, DP Switch Socket Unit	39	Nos.						
B9		Door Bell With all allied accessories	8	Nos.						
		TOTAL AMOUNT - SEC - B (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - C **LIGHTING FIXTURES**								
		Providing/ Supplying , Installation, testing and commissioning of the following lighting fixture including all accessories like electronic ballast, lamps, mounting arrangements etc. Complete in all respects. Mounting accessories shall be provided by contractor like screws, nuts, bolts, strings etc.								
C1		**DOWN LIGHT** DOWN LIGHT FLUSH WITH 20W LED LIGHT. As approved by architect.	272	Nos.						
C2		**DOWN LIGHT** DOWN LIGHT SURFACE WITH 20W LED LIGHT. As approved by architect.	32	Nos.						
C3		**DECORATIVE LED WALL LIGHT** DECORATIVE LED WALL LIGHT WITH 18W. As approved by architect.	88	Nos.						
C4		**BULKHEAD WALL LIGHT** BULKHEAD WALL WITH 10W LED LIGHT. As approved by architect.	32	Nos.						

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
C5		**WALL BRACKET FAN** WAL BRACKET FAN As approved by architect.	8	Nos.						
C6		**EXHUAST FAN** EXHUAST FAN. As approved by architect.	32	Nos.						
		TOTAL AMOUNT - SEC - C (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - D **DISTRIBUTION BOARDS & CABLES**								
		Providing, Laying, Testing, Termination and Commissioning of following multi-core PVC insulated Copper / Aluminium Conductor Cables for main/sub-main power distribution system as shown in the layout plans in appropriate size of conduits. Work also includes necessary termination accessories like compression lugs, color coded sleeves, identification tags etc. Note : The quantities shown in the boq are estimated based on design drawings. Contractor has to take accurate measurements at site prior to procurement of material.								
D1		4C, 35 Sqmm Cu. SWA/PVC/PVC + ECC, 1x16 Sqmm Cu.PVC From Nearest Power Source to MDB	60	RM						
D2		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-G1	40	RM						
D3		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-G2	40	RM						
D4		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-F1	50	RM						
D5		4C, 10 Sqmm Cu. PVC/PVC + ECC, 1x10 Cu.Sqmm PVC From MDB To DB-F2	50	RM						
		Supply, Installation, testing and commissioning of following distribution panels in accordance with the attached single line diagrams and layout plans. The panels shall be made according to the technical specifications attached.								
D6		MDB	2	No.						
D7		DB-G1	2	No.						
D8		DB-G2	2	No.						
D9		DB-F1	2	No.						
D10		DB-F2	2	No.						
D15		TP Box 125A TP Adj. MCCB (ICU=25KA) With Weather Proof Housing	2	No.						
		TOTAL AMOUNT - SEC - D (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - E **CABLE RACEWAYS / CONTAINMENTS**								

BOQ OF ELECTRICAL ALLIED WORKS FOR
CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
E1		**Supply and installation** of following sizes of PVC conduits / pipes including all installation acessories like bends, sockets, flexible conduits, partially above false ceiling and partially embedded in ground e.t.c , the works also complete with excavation and back filling of 1'-6" deep for laying of main / sub-main cables . Compete in all respects as shown in the drawing.								
a		20 mm dia PVC conduit	600	RM						
b		25 mm dia PVC conduit	600	RM						
c		32 mm dia PVC conduit	170	RM						
d		50 mm dia PVC conduit	100	RM						
		TOTAL AMOUNT - SEC - E (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - F **COMMUNICATION SYSTEMS**								
		Supply , installation , testing and commissioning of following items for voice & data communication cabling system including all material , labor , tools , accessories etc. Complete in all respects. Item includes termination of all cables at respective outlets as shown in the drawings and instructed by client. Note : The quantities shown in the boq are estimated based on design drawings. Contractor has to take accurate measurements at site prior to procurement of material.								
		HORIZONTAL DATA CABLING								
F1		**Category 6 , UTP Cables**, for data communication system at local workstations in 25mm dia PVC conduits under floor as shown in the layout plan and schematic diagrams. Work includes all terminations, management and tagging at both ends.	200	RMtr.						
		BACKBONE CABLING VOICE & DATA COMMUNICATION								
F2		**10 pair, 0.6 mm Telephone Cable from PTCL** as shown in the drawings and schematic diagram in 32mm dia pvc conduit including all accessories. Complete with termination and tagging at both ends.	312	RMtr.						
F3		Telephone Outlet .	16	Nos.						
		COMMUNICATION BOX								
F4		**Communication Box**, Front door with glass cover, lock & key, and front blank panels for covering empty spaces, air flow ducts for effective cooling management inside the rack for switches. Item includes supply and installation of 6 way rack mounted standard PDU.	8	Nos.						
		TELEPHONE JUNCTION BOX								

BOQ OF ELECTRICAL ALLIED WORKS FOR CONSTRUCTION OF LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY - VI

BOQ OF ELECTRICAL & ALLIED WORKS										
ITEM #	CSR No.	DESCRIPTION	QTY.	UNIT	MATERIAL		LABOUR		COMPOSITE	TOTAL
					RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR	RATE PKR	AMOUNT PKR
F5		**Telephone Junction Boxes (TJB)** for termination of incoming PTCL Cables having 10 pair tag block including surge protector, powder coated enclosure including internal jumper wires and tagging.	8	No.						
		Wi-Fi ROUTERS WITH ONU DEVICES								
F6		**Supply and installation of Wi-Fi Routers With ONU Devices** as shown in the drawings including all accessories.	8	Nos.						
F7		**TV WIRING & OUTLET**								
a		TV Splitter (Tap) Unit with enclosure suitable for 1 incomings and 4 outgoing cables including all termination accessories.	8	Nos.						
b		Wall Mounted 150x150x75 mm TV Pull box made with 16SWG sheet steel for Antina system.	32	Nos.						
c		RG-7 Cable for TV	600	Rmtr.						
		TOTAL AMOUNT - SEC - F (PKR) (CARRIED FORWARD TO SUMMARY)								
		SECTION - G **GROUNDING & BONDING**								
		Providing , installation , testing and commissioning of following items for earthing & bonding system of complete data center including all material, boring, labor, tools, transportation, accessories etc. Complete in all respects including detailed test reports. Estimated earth stations are taken at this stage. Contractor has to check the soil resistivity at site and propose required stations to achieve earth resistance not more than one ohms.								
		EARTH STATIONS								
G1		**Providing fixing and connecting** of earthing set which consist of one copper rod of size 20mm dia 3 meters long buried at 20 meter below the ground level buried at least 3 meter away from the nearest foundation the earth lead shall be of 2 Nos.70mm2 stranded copper conductor drawn in 50mm dia G.I pipe from the earthing rod to the panels transformer earth pit including Boring / digging as required and refilling the earth pits with necessary lime powder wooden cool as requires and approved electrical inspector IEE regulation and confirming to the Specification including make of earth pit with cast iron manhole cover 150mm x 150m	2	Nos.						
		EARTH TEST POINTS / CONNECTING POINTS								
G2		**Earth Test Point including Test Link** , 150 mm x 75 mm x 5 mm electroplated Copper bar , as shown in drawings. Bar shall be provided with holes suitable for installation of required earth leads. The test bar shall be enclosed in powder coated metal enclosure as approved by the client.	2	Nos.						
		EARTH LEADS / CONDUCTORS								
G3		**Single Core PVC insulated**, 16 Sqmm Stranded Copper Conductor, green in color from earth pit to test point and from test point to connecting point / Panels in 32mm size of UPVC Conduit.	200	RM.						
		TOTAL AMOUNT - SEC - G (PKR) (CARRIED FORWARD TO SUMMARY)								

SECTION – 10

FORM OF TENDER

FORM OF TENDER

CADET COLLEGE SANGHAR
AT JAM NAWAZ ALI, VIA TANDO ADAM, SINDH

TO
THE PRINCIPAL / PROJECT DIRECTOR
CADET COLLEGE SANGHAR
AT JAM NAWAZ ALI, VIA TANDO ADAM,
PH: 235-548001-4

Dear Sir,

1. Having examined the instructions to Tenderers, Conditions of Contract, Special Stipulations, Appendices, Specifications, Bill of Quantities and Drawings for the construction, completion and maintenance of the above named works, we, the undersigned Tenderer, offer to construct, complete and maintain the whole of the said works in accordance with the said Conditions of Contract, Special Stipulations, Appendices, Specifications, Bill of Quantities and Drawings for the Tender Price of Pakistan Rupees _____
_____

2. Should a Notice of Award accepting this Tender be issued to us, we undertake;

   a) To abide by and fulfill all the terms and provisions of the Conditions of Contract contained in the documents mentioned above.

   b) To commence the works within 07 (Seven) days of receipt of the OWNER's written order to commence, and to complete and deliver all the works comprised in the contract on or before the expiry of 18 (Eighteen) calendar months, after receipt of the said order to commence.

   c) To sign within 14 (fourteen) days following the issue of the said Notice of Award, an Agreement in the form set out in this Tender with such alterations and additions thereto as you may require to adopt such Agreement to the circumstances of this tender, and for this purpose, to attend or to cause one or more representatives duly authorized by us under appropriate power(s) of attorney to attend you office.

3. We agree that this Tender shall remain valid for a period of 90 (ninety) days from the date set for opening the Tenders and it shall remain binding upon us and may be accepted by you at any time before the expiration of the said period.

4. We further agree to pay all costs towards the execution of the formal agreement including the cost of stamps.

5. We understand that unless and until a formal Agreement is prepared and executed, this Tender together with the Tender Documents and Letter of Award accepting this Tender, shall constitute a binding contract between us.

6. We also understand that you are not bound to accept the lowest or any Tender you may receive.

7. As a guarantee for the performance of the undertakings and obligations of this Tender, we submit herewith Earnest Money of equivalents to 2% of total tender cost of Rs. _____ (Rupees _____) in the form of a Pay Order / Demand Draft No. _____ dated _____ of the _____Bank Ltd, Branch _____ being a Scheduled Bank, made in you favour and made payable to you, without any reference to us, and valid for 90 (ninety) days from the date established for opening of Tenders.

8. We certify that we clearly understand the terms and conditions of agreement as explained in the Tender Documents.

WITNESSES

1. _____

   _____

2. _____

   _____

Name and Address
Of Tenderer _____

Title of Person
Signing the Tender _____

Seal _____

SECTION – 11

TENDER DRAWING

CADET COLLEGE SANGHAR

CONSTRUCTION OF
LAL SHAHBAZ QALANDAR BOYS HOSTEL

ARCHITECTURAL, STRUCTURAL, PLUMBING & ELECRICAL

TENDER DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 th Commercial Street, Phase II (Extension)Defence Housing Authority, Karachi-75500
Tel :021-35396444, 021-35312244, FAX : 021-35883106
E-mail: info @ young associates .com.pk

CADET COLLEGE SANGHAR

CONSTRUCTION OF
LAL SHAHBAZ QALANDAR BOYS HOSTEL

ARCHITECTURAL DRAWINGS

TENDER DRAWINGS

PREPARED BY:

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9-C 24 th Commercial Street, Phase II (Extension)Defence Housing Authority, Karachi-75500
Tel :021-35396444, 021-35312244, FAX : 021-35883106
E-mail: info @ young associates .com.pk

LIST OF ARCHITECTURAL DRAWINGS

S.NO.	DWG. NO.	DESCRIPTION
1	303/10 AR-00	LIST OF ARCHITECTURAL DRAWINGS
2	303/10 AR-101	GOOGLE IMAGE
3	303/10 AR-102	GROUND FLOOR PLAN
4	303/10 AR-103	FIRST FLOOR PLAN
5	303/10 AR-104	ROOF PLAN
6	303/10 AR-105	ELEVATION NO. 01, 02, 03 & 04
7	303/10 AR-106	SECTION AT A-A
8	303/10 AR-107	SECTION AT B-B

3rd Revision : ---------- Date : ---------

2nd Revision : ---------- Date : ---------

1st Revision : ---------- Date : ---------

ISSUED FOR TENDER DRAWING Date : 09-12-2025

CLIENT: CADET COLLEGE SANGAR

JOB TITLE : CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL

DESCRIPTION : LIST OF ARCHITECTURAL DRAWINGS

YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
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FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO : 303/10

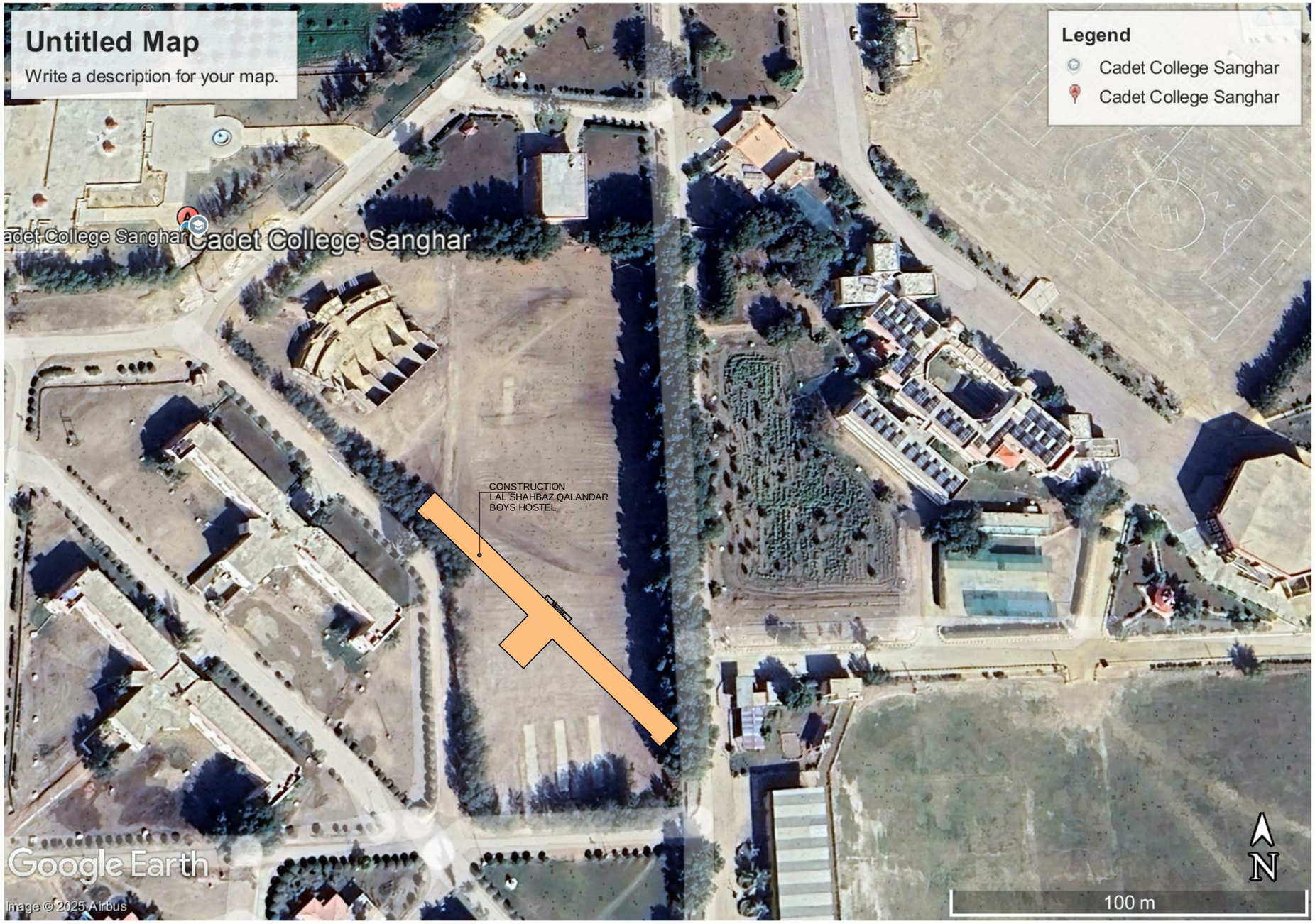
DRG. NO. : 303/10 AR-00

DRAWN BY : AAMIR

CHECKED BY : MUNEER

SCALE : 1"=25'-0"

DATE : 22-11-2025

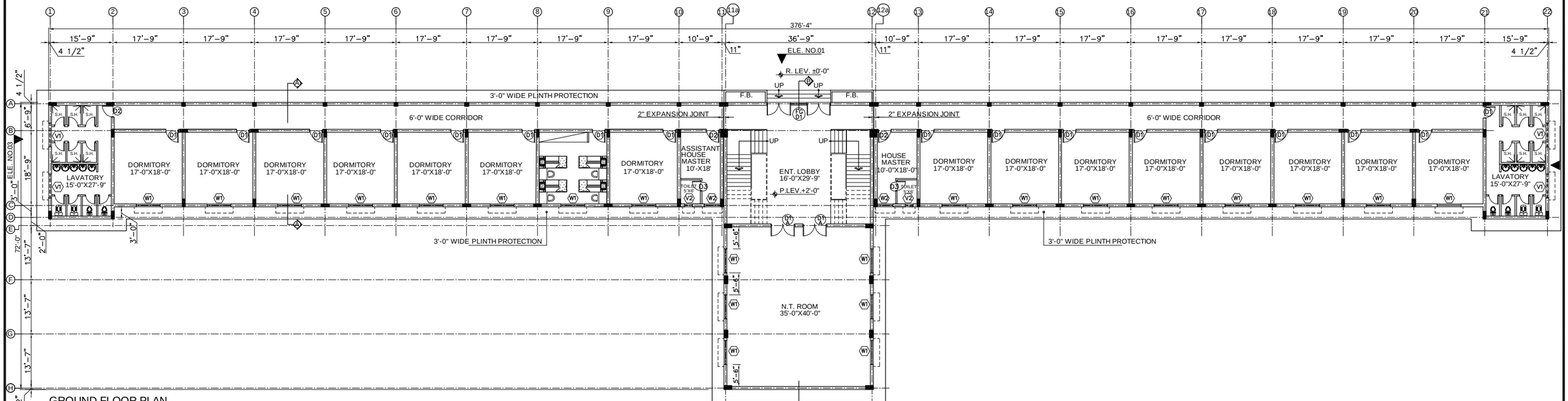


3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

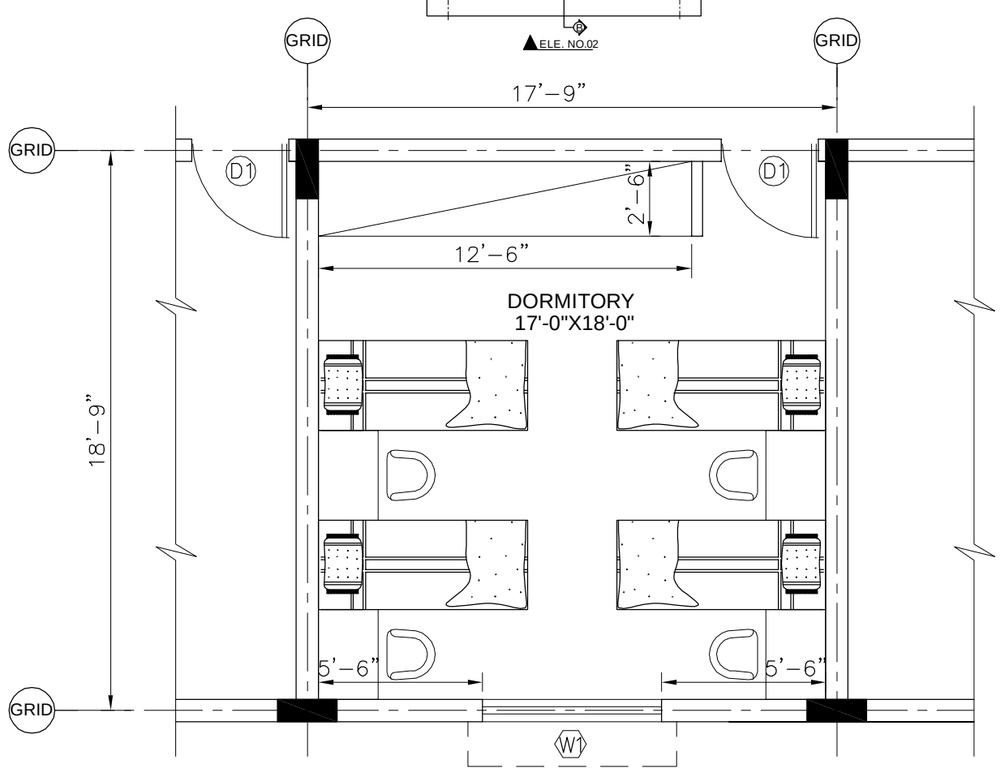
CLIENT: CADET COLLEGE SANGAR	DESCRIPTION : GOOGLE IMAGE
JOB TITLE : CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL	

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JOB NO :	303/10
DRG. NO. :	303/10 AR-101
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : N.T.S.	DATE : 22-11-2025



GROUND FLOOR PLAN
COVERED AREA = 11693.00 SQ.FT.



BLOWN UP PLAN

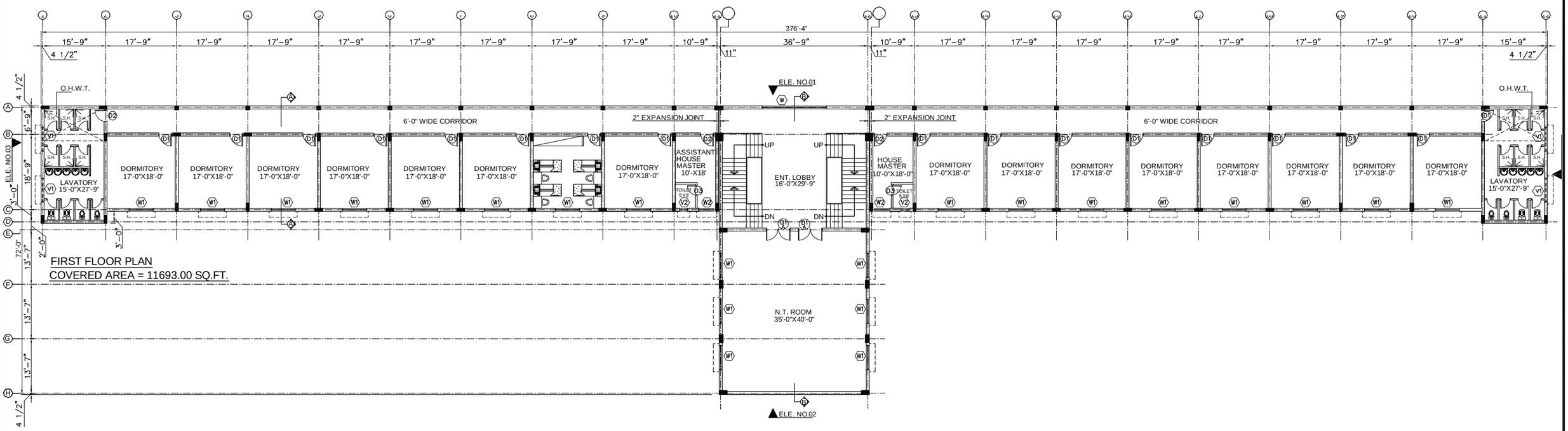
SCHEDULE OF DOORS, WINDOWS & VENTILATORS		
S.NO.	DOORS	
	SIZE	
	WIDTH	HEIGHT
FGD1	16'-0"	7'-0"
D1A	6'-0"	7'-0"
D1	3'-3"	7'-0"
D2	3-0"	7'-0"
D2	2'-6"	7'-0"
	WINDOWS	
	WIDTH	HEIGHT
W	16'-0"	4'-0"
W1	6'-0"	4'-0"
W2	4'-0"	4'-0"
	VENTILATORS	
	WIDTH	HEIGHT
V1	6'-0"	2'-0"
V2	2'-0"	2'-0"

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGAR	DESCRIPTION : GROUND FLOOR PLAN
JOB TITLE : CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL	

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FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO :	303/10
DRG. NO. :	303/10 AR-102
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=25'-0"	DATE : 22-11-2025



FIRST FLOOR PLAN
COVERED AREA = 11693.00 SQ.FT.

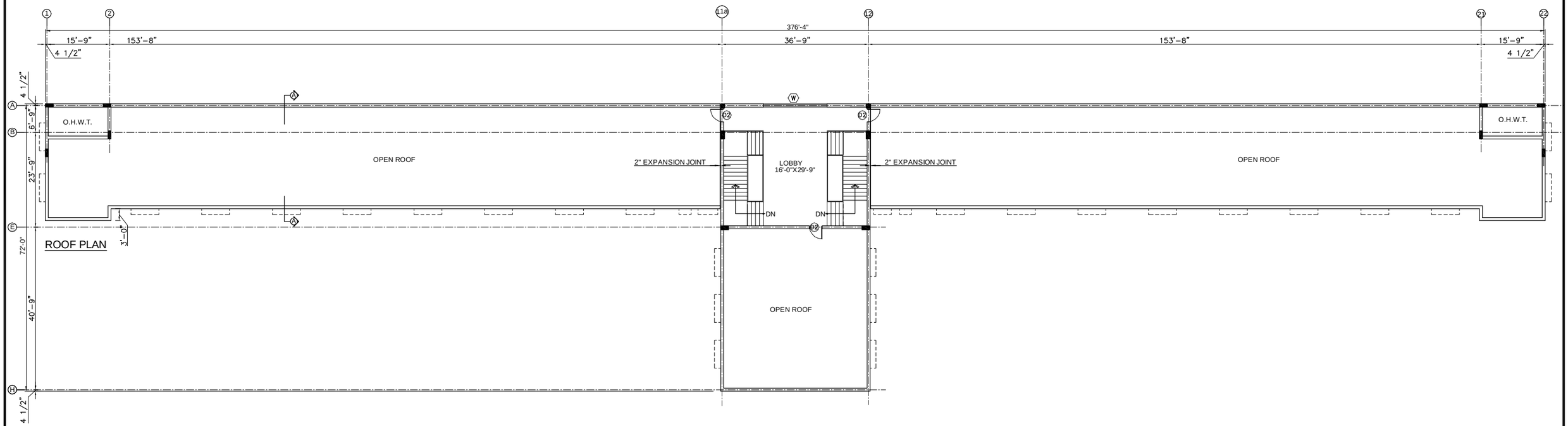
SCHEDULE OF DOORS, WINDOWS & VENTILATORS		
S.NO.	DOORS	
	SIZE	
	WIDTH	HEIGHT
FGD1	16'-0"	7'-0"
D1A	6'-0"	7'-0"
D1	3'-3"	7'-0"
D2	3-0"	7'-0"
D2	2'-6"	7'-0"
	WINDOWS	
	WIDTH	HEIGHT
W	16'-0"	4'-0"
W1	6'-0"	4'-0"
W2	4'-0"	4'-0"
	VENTILATORS	
	WIDTH	HEIGHT
V1	6'-0"	2'-0"
V2	2'-0"	2'-0"

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGAR	DESCRIPTION :	FIRST FLOOR PLAN
JOB TITLE :	CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL		

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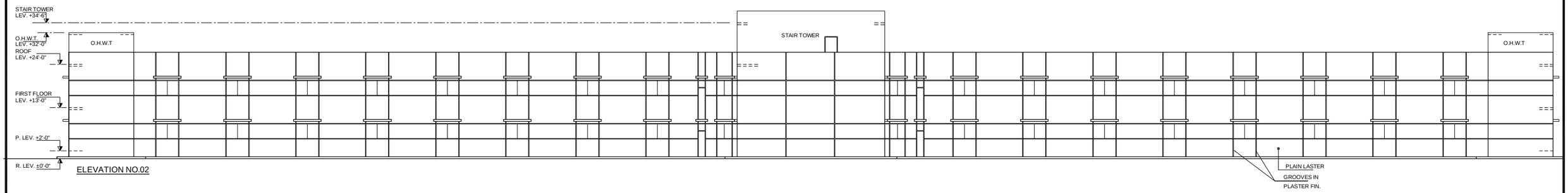
JOB NO :	303/10		
DRG. NO. :	303/10 AR-103		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1"=25'-0"	DATE :	22-11-2025



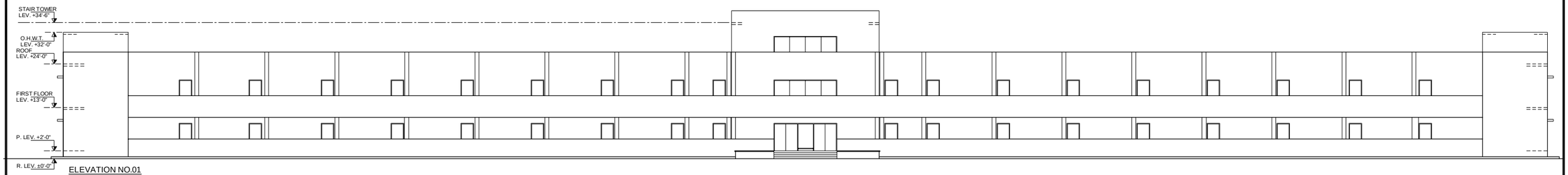
ROOF PLAN

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

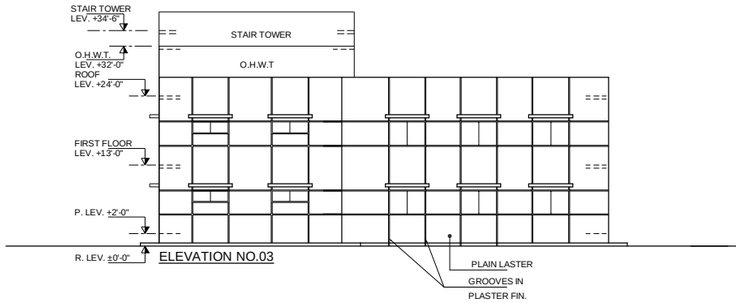
CLIENT:	CADET COLLEGE SANGAR	DESCRIPTION :	ROOF PLAN
JOB TITLE :	CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL		
YOUNG ASSOCIATES CONSULTING ENGINEERS & ARCHITECTS 9-C 24 th Commercial street, Phase 2 (Extn), Defence Housing Authority, Karachi-75500 Tel :021-35396444, 021-35312244 FAX: 021-35883106 E-mail: info@youngassociates.com.pk		JOB NO :	303/10
		DRG. NO. :	303/10 AR-104
		DRAWN BY : AAMIR	CHECKED BY : MUNEER
		SCALE : 1"=25'-0"	DATE : 22-11-2025



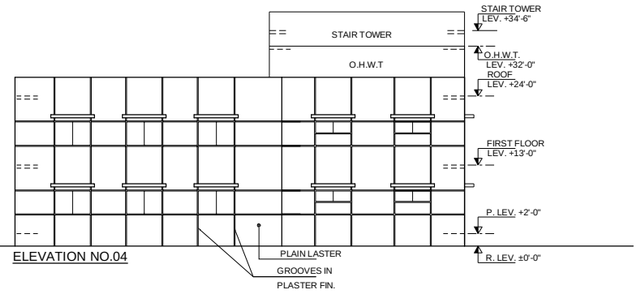
ELEVATION NO.02



ELEVATION NO.01



ELEVATION NO.03



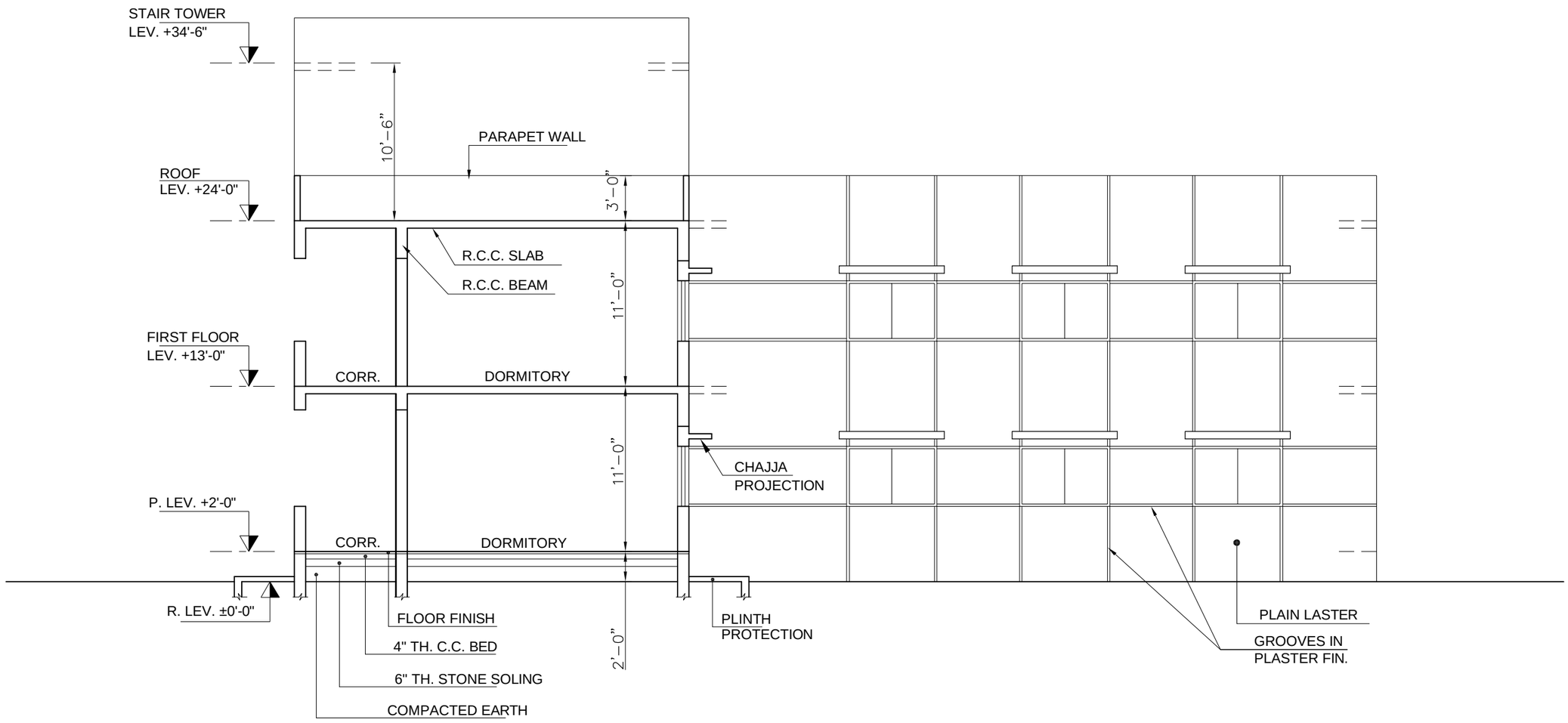
ELEVATION NO.04

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGAR	DESCRIPTION :	ELEVATION NO.01, 02, 03 & 04
JOB TITLE :	CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL		

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FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO :	303/10	
DRG. NO. :	303/10 AR-105	
DRAWN BY : AAMIR		CHECKED BY : MUNEER
SCALE : 1"=25'-0"		DATE : 22-11-2025



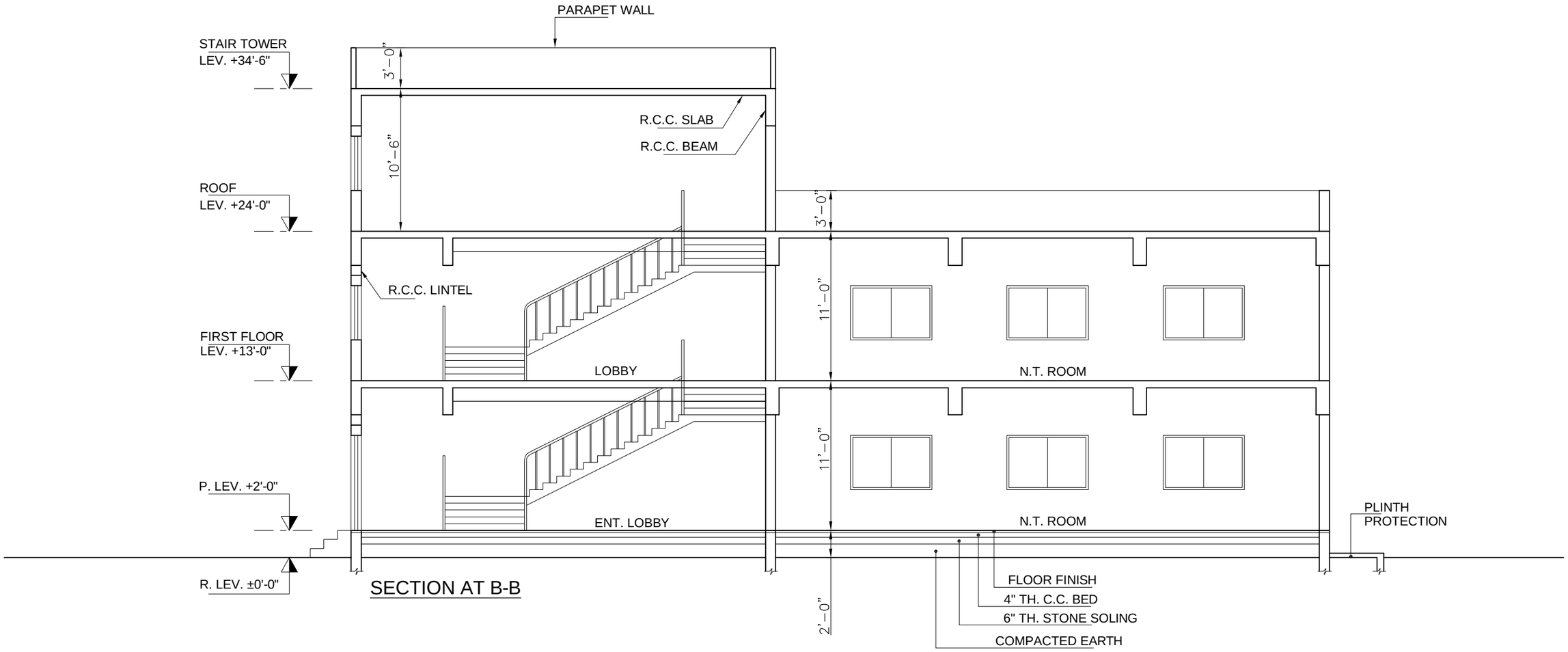
SECTION AT A-A

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGAR	DESCRIPTION :	
JOB TITLE :	CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL		SECTION AT A-A

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FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO :	303/10		
DRG. NO. :	303/10 AR-106		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1/8"=1'-0"	DATE :	22-11-2025



SECTION AT B-B

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGAR	DESCRIPTION : SECTION AT B-B
JOB TITLE : CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL	

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JOB NO :	303/10
DRG. NO. :	303/10 AR-107
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1/8"=1'-0"	DATE : 22-11-2025

CADET COLLEGE SANGHAR

CONSTRUCTION OF
LAL SHAHBAZ QALANDAR BOYS HOSTEL

STRUCTURAL DRAWINGS

TENDER DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 th Commercial Street, Phase II (Extension)Defence Housing Authority, Karachi-75500
Tel :021-35396444, 021-35312244, FAX : 021-35883106
E-mail: info @ young associates .com.pk

LIST OF STRUCTURAL DRAWINGS

S.NO.	DWG. NO.	DESCRIPTION
1	303/10 AR-00	LIST OF DRAWINGS
2	303/10 GN-01	GENERAL NOTES
3	303/10 ST-01	FOUNDATION LAYOUT PLAN
4	303/10 ST-02	PLINTH BEAM PLAN @LEV.+1'-9"
5	303/10 ST-03	FIRST FLOOR FRAMING PLAN @ LEV.+12'-9"
6	303/10 ST-04	FIRST FLOOR REINF. PLAN @ LEV.+12'-9"
7	303/10 ST-05	ROOF FRAMING PLAN @ LEV.+23'-9"
8	303/10 ST-06	ROOF REINF. PLAN @ LEV.+23'-9"

3rd Revision : ---------- Date : ---------

2nd Revision : ---------- Date : ---------

1st Revision : ---------- Date : ---------

ISSUED FOR TENDER DRAWING Date : 09-12-2025

CLIENT: CADET COLLEGE SANGAR

JOB TITLE : CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL

DESCRIPTION : LIST OF STRUCTURAL DRAWINGS

YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 th Commercial street, Phase 2 (Extn),
Defence Housing Authority, Karachi-75500
Tel :021-35396444, 021-35312244
FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO : 303/10

DRG. NO. : 303/10 ST-00

DRAWN BY : AAMIR

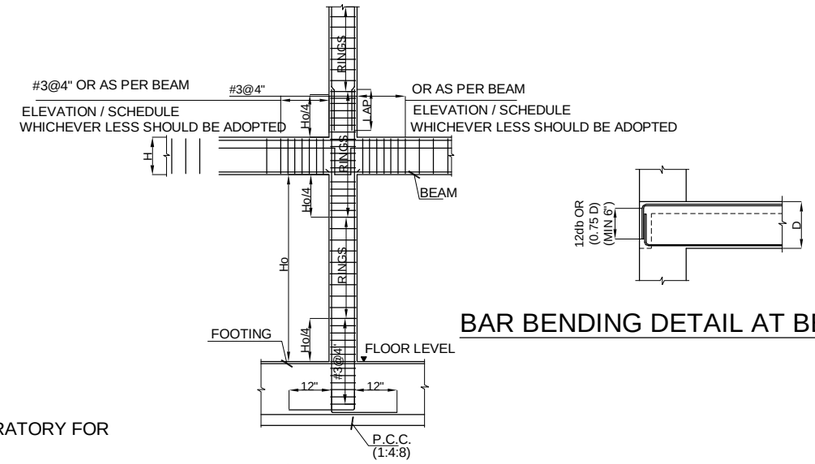
CHECKED BY : MUNEER

SCALE : 1"=25'-0"

DATE : 22-11-2025

GENERAL NOTES

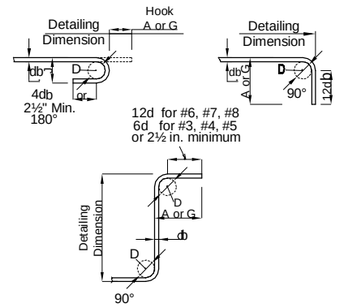
1. REINFORCED CONCRETE DESIGN IS BASED ON BUILDING CODE REQUIREMENT FOR REINFORCED CONCRETE (ACI 318-02)
2. FOUNDATION DESIGN IS BASED UPON A SAFE SOIL BEARING CAPACITY OF 0.50 T/SQ.FT. AT 6'-6" BELOW EXISTING GROUND FLOOR LEVEL.
3. COORDINATE STRUCTURAL DRAWING'S WITH ARCHITECTURAL DRAWINGS IN CASE OF DISCREPANCY REFER TO ENGINEER IN CHARGE
4. ALL DIMENSIONS ARE IN FEET/INCHES.
5. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSIONS OR REFER TO CONSULTANT
6. THE CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS AND LEVELS BEFORE EXECUTION
7. ALL ERRORS AND OMISSIONS TO BE REFERED TO THE CONSULTANT / ENGINEER PRIOR TO EXECUTION OF WORK
8. PRIOR TO CASTING CONCRETE REFER TO ARCHITECTURAL, PLUMBING , ELECTRICAL AND HAVC DRAWINGS FOR EMBEDDED ITEMS.
9. ALL MATERIALS SHALL CONFIRM TO THE SPECIFICATIONS SHOWN ON THE DRAWINGS IN ABSENCE OF ANY SPECIFICATION ALL MATERIALS SHOULD CONFIRM TO RELEVANT ACI STANDARDS AND SHALL SUBJECT TO APPROVAL OF THE CONSULTANT.
10. CONCRETE CUBES SHALL BE AVAILABAL AT SITE AND SAMPLE FROM RANDOM BATCHES WILL BE TAKEN DURING CONCRETING TEST CUBES MOULDS
11. SLUMP CONE SHALL BE MADE AVAILBLE AT SITE BY THE CONTRACTOR AND RANDOM SAMPLES WILL BE CHECKED DURING CONCRETING.
12. THE WATER USED FOR CONCRETE MIXING AND CURING SHOULD BE OF POTABLE QUALITY AND WITHOUT ANY IMPURITIES. A SAMPLE SHOULD BE TESTED IN LABORATORY FOR SULPHATE AND CHLORIDE CONTENTS.
13. FINE AND COARSE AGGREGATES SHOULD BE FREE FROM CLAY, LOAMS OR ANY OTHER ORGANIC IMPURITIES. A TEST SHOULD BE CARRIED OUT BEFORE USE.
14. ATMOSPHERIC TEMPERATURE SHOULD BE BETWEEN 32 C TO 5 C, AT THE TIME OF CONCRETE POURING.
15. R.C.C.CONCRETE (STANDARD CYLINDRICAL) STRENGTHS (fc IN PSI) AT 28 DAYS FOR VARIOUS STRUCTURAL MEMBERS SHALL BE.
    - FOUNDATION/ BEAMS/ SLAB (fc' = 3000 psi)
    - COLUMNS (fc' = 4000 psi)
    - LEAN CONCRETE (fc' = 1500 psi)
16. ALL R.C.C.WORKS SHALL BE CONTINUOUSLY MOIST CURED FOR AT LEAST 14 DAYS OR CURED BY CURING COMPOUND.
17. FORM WORK SUPPORTING R.C.C. MEMBERS SHALL BE REMOVED ATLEAST AFTER 14 DAYS.
18. ALL R.C.C.WORKS SHALL BE INTERNALLY VIBRATED WITH ELECTRO MECHANICAL VIBRATOR.
19. MINIMUM CLEAR CONCRETE COVER TO REINFORCEMENT SHALL BE AS FOLLOWS.
    - FOUNDATION.....3"
    - BEAMS .....1 1/2"
    - COLUMNS/WALLS .....1 1/2" / 1"
    - SLAB..... 3/4"
    - WATER RETAINING STRUCTURES..... 2"
20. BEAMS AND SLABS SHOULD BE CASTED MONOLITHIC.
21. PRIOR TO PLACING CONCRETE ALL REINFORCING SHALL BE FREE OF LOOSE RUST AND SCALE OR ANY FOREIGN MATERIALS.
22. SPLICE LENGTH SHALL BE 60 TIMES DIA OF BAR
23. ALL INTERNAL & EXTERNAL PLASTER ON R.C.C. MEMBERS TO BE OF RATIO 1:4 AND THICKNESS SHOULD NOT EXCEED 3/4".U.O.N.



BAR BENDING DETAIL AT BEAM END

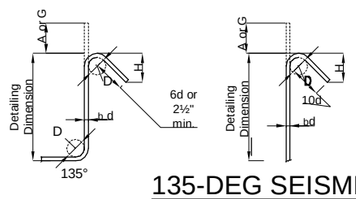
SEISMIC BEAM/COLUMN JOINT DETAIL

RECOMENDED END HOOKS, ALL GRADES				
Bar Size	Finished bend diameter D,in.	180-deg hooks		90-deg hooks
		A or G, in.	J, in.	A or G, in.
#3	2¼	5	3	6
#4	3	6	4	8
#5	3¾	7	5	10
#6	4½	8	6	12
#7	5¼	10	7	14
#8	6	11	8	16
#9	9½	15	11¾	19
#10	10¾	17	13¼	20
#11	12	19	14 ¾	24
#14	18¼	27	21¾	31
#18	24	36	28½	41



STIRRUP AND TIE HOOKS

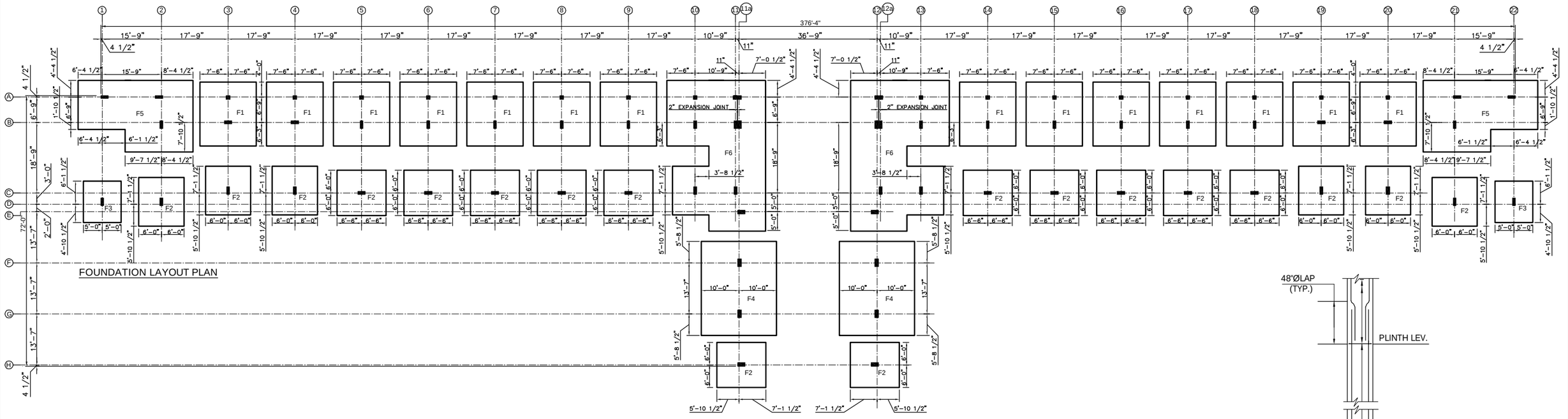
Bar Size	D (in.)	135 deg Stirrup-tie hook dimensions, in.	
		135-deg hooks	
		A or G, in.	H approx
#3	1½	5	3½
#4	2	6½	4½
#6	4½	10 ¾	6½

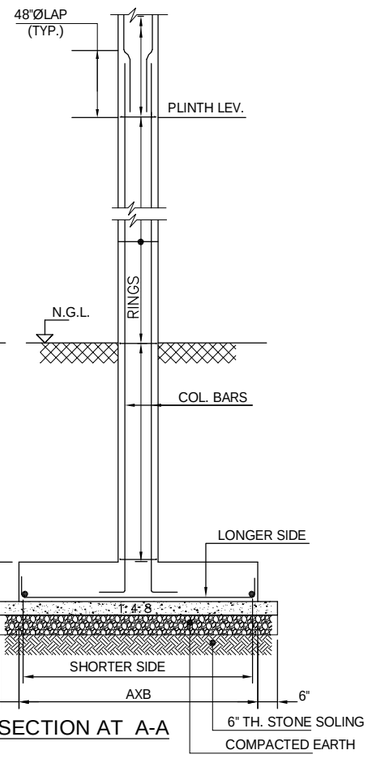


135-DEG SEISMIC STIRRUP/TIE HOOKS

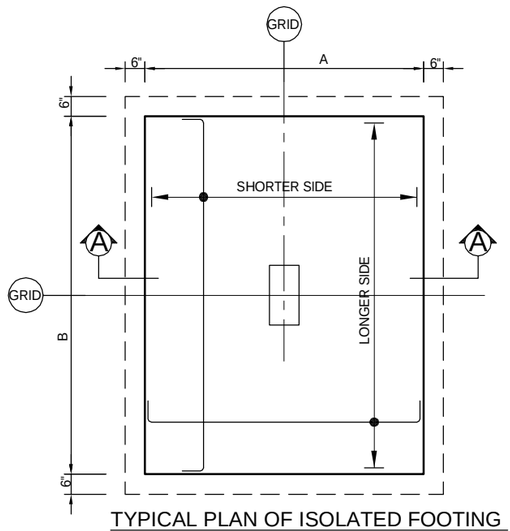
3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGAR	DESCRIPTION :	GENERAL NOTES
JOB TITLE :	CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL		
YOUNG ASSOCIATES CONSULTING ENGINEERS & ARCHITECTS 9-C 24 th Commercial street, Phase 2 (Extn), Defence Housing Authority, Karachi-75500 Tel :021-35396444, 021-35312244 FAX: 021-35883106 E-mail: info@youngassociates.com.pk		JOB NO :	303/10
		DRG. NO. :	303/10 GN-01
		DRAWN BY : AAMIR	CHECKED BY : MUNEER
		SCALE : 1"=25'-0"	DATE : 22-11-2025





SECTION AT A-A



TYPICAL PLAN OF ISOLATED FOOTING

SCALE:- 1/4"=1'-0"

SCHEDULE OF FOOTINGS

FOOTING NOTATION	EXCAVATION SIZE	SIZE A	SIZE B	SIZE C	BOTTOM REINFORCEMENT LONGER SIDE	BOTTOM REINFORCEMENT SHORTER SIDE	TOP REINFORCEMENT T1	TOP REINFORCEMENT T2
F1	16'-0"X18'-0"	15'-0"	17'-0"	24"	———	———	———	———
F2	13'-0"X14'-0"	12'-0"	13'-0"	24"	———	———	———	———
F3	11'-0"X12'-0"	10'-0"	11'-0"	24"	———	———	———	———
F4	21'-0"X26'-0"	20'-0"	25'-0"	30"	———	———	———	———
F5	SEE PLAN			30"	———	———	———	———
F6	SEE PLAN			30"	———	———	———	———

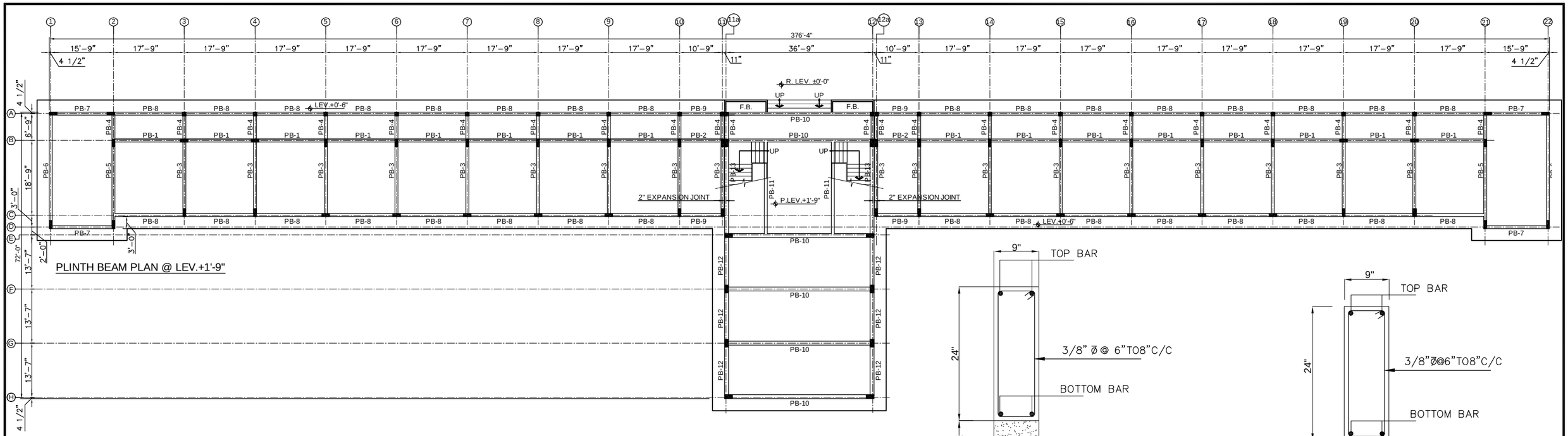
NOTES:
1. FOR GENERAL NOTES, REFER DWG. NO. GN-01

3rd Revision :	----------	Date : ---------
2nd Revision :	----------	Date : ---------
1st Revision :	----------	Date : ---------
ISSUED FOR	TENDER DRAWING	Date : 09-12-2025

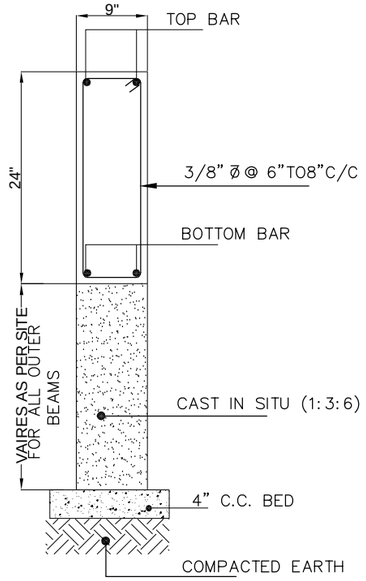
CLIENT: CADET COLLEGE SANGAR	DESCRIPTION : FOUNDATION LAYOUT PLAN
JOB TITLE : CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL	

YOUNG ASSOCIATES
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9-C 24 th Commercial street, Phase 2 (Extn),
Defence Housing Authority, Karachi-75500
Tel :021-35396444, 021-35312244
FAX: 021-35883106
E-mail: info@youngassociates.com.pk

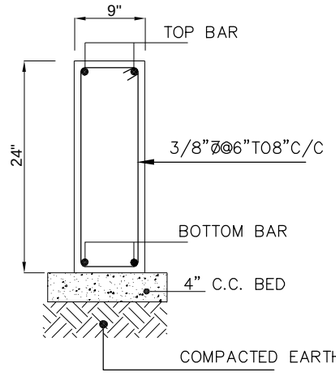
JOB NO :	303/10
DRG. NO. :	303/10 ST-01
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=25'-0"	DATE : 22-11-2025



PLINTH BEAM PLAN @ LEV.+1'-9"



(TYP. SEC. OF EXTERNAL PLINTH BEAM)

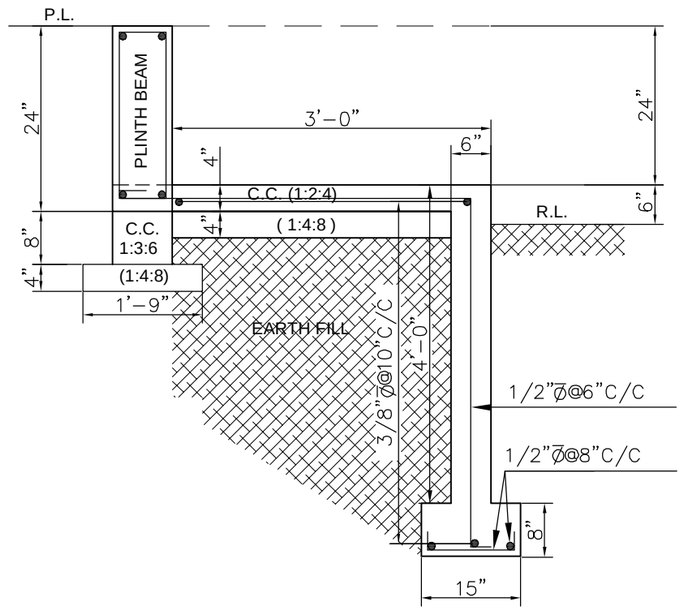


(TYP. SEC. OF INTERNAL PLINTH BEAM)

SCALE:- 3/4"=1'-0"

SCHEDULE OF PLINTH BEAMS

BEAMS NO.S	BEAMS SIZE B X H	TOP BARS CONT.	BOTT. STEEL CONT.	EXTRA ON CONT. SUPPORT		EXTRA BOTTOM	RINGS @ L/4	RINGS @ CENTER
				L-SUPP.	R-SUPP.			
PB-1	9"X24"							
PB-2	9"X24"							
PB-3	9"X24"							
PB-4	9"X24"							
PB-5	9"X24"							
PB-6	9"X24"							
PB-7	9"X24"							
PB-8	9"X24"							
PB-9	9"X24"							
PB-10	12"X30"							
PB-11	9"X18"							
PB-12	12"X24"							
PB-13	12"X30"							



TYP. DETAIL OF PLINTH PROTECTION

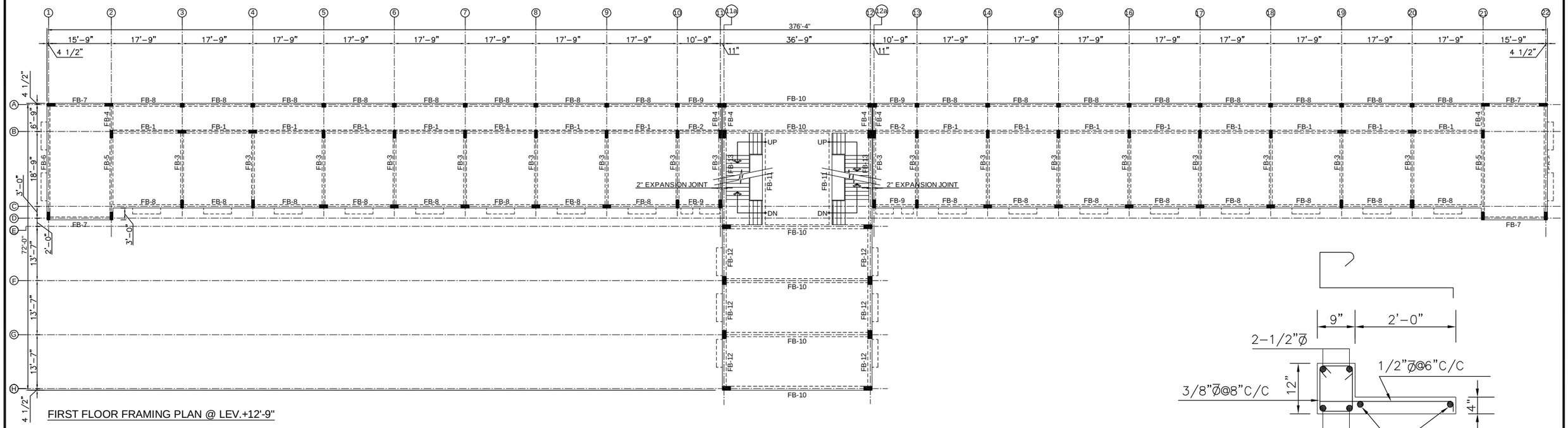
NOTES:
1. FOR GENERAL NOTES, REFER DWG. NO. GN-01

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

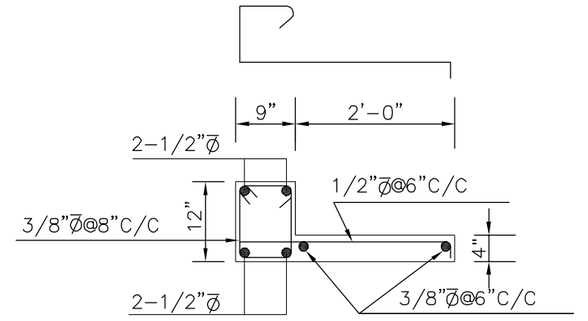
CLIENT:	CADET COLLEGE SANGAR	DESCRIPTION :	PLINTH BEAM PLAN @ LEV.+1'-9"
JOB TITLE :	CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL		

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FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO :	303/10		
DRG. NO. :	303/10 ST-02		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1"=25'-0"	DATE :	22-11-2025



FIRST FLOOR FRAMING PLAN @ LEV.+12'-9"



TYP. DETAIL OF LINTEL & CHAJJA PROJECTION

SCHEDULE OF FIRST FLOOR BEAMS

BEAMS NO.S	BEAMS SIZE B X H	TOP BARS CONT.	BOTT. STEEL CONT.	EXTRA ON CONT. SUPPORT		EXTRA BOTTOM	RINGS @ L/4	RINGS @ CENTER
				L-SUPP.	R-SUPP.			
FB-1	9"X24"							
FB-2	9"X24"							
FB-3	9"X24"							
FB-4	9"X24"							
FB-5	9"X24"							
FB-6	9"X24"							
FB-7	9"X24"							
FB-8	9"X24"							
FB-9	9"X24"							
FB-10	12"X30"							
FB-11	9"X18"							
FB-12	12"X24"							
FB-13	12"X30"							

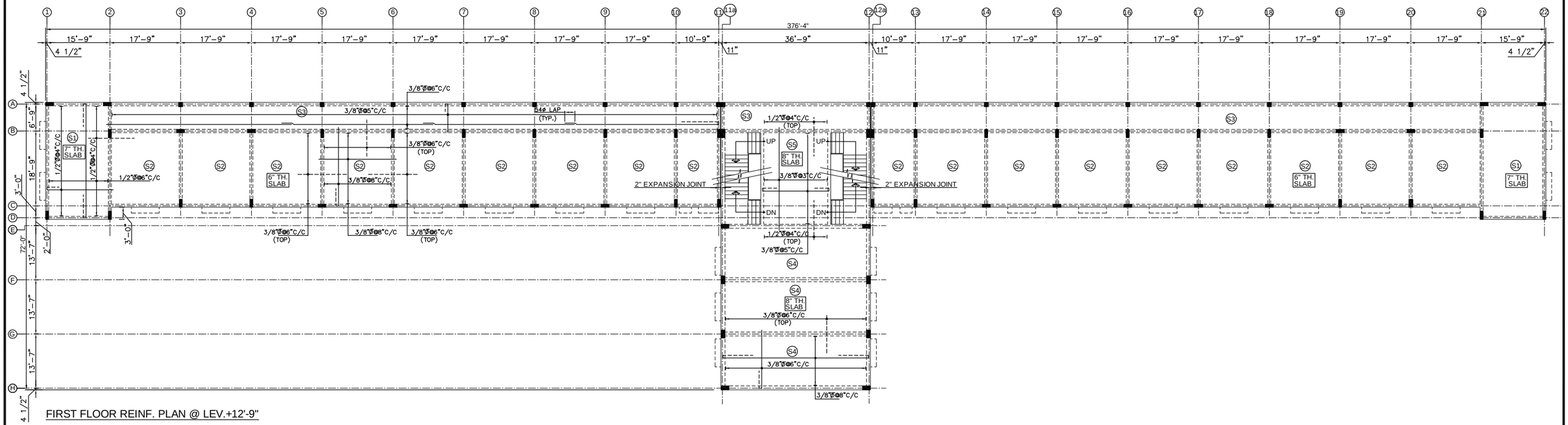
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1. FOR GENERAL NOTES, REFER DWG. NO. GN-01

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGAR	DESCRIPTION : FIRST FLOOR FRAMING PLAN @ LEV.+12'-9"
JOB TITLE : CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL	

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E-mail: info@youngassociates.com.pk

JOB NO :	303/10
DRG. NO. :	303/10 ST-03
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=25'-0"	DATE : 22-11-2025



FIRST FLOOR REINF. PLAN @ LEV.+12'-9"

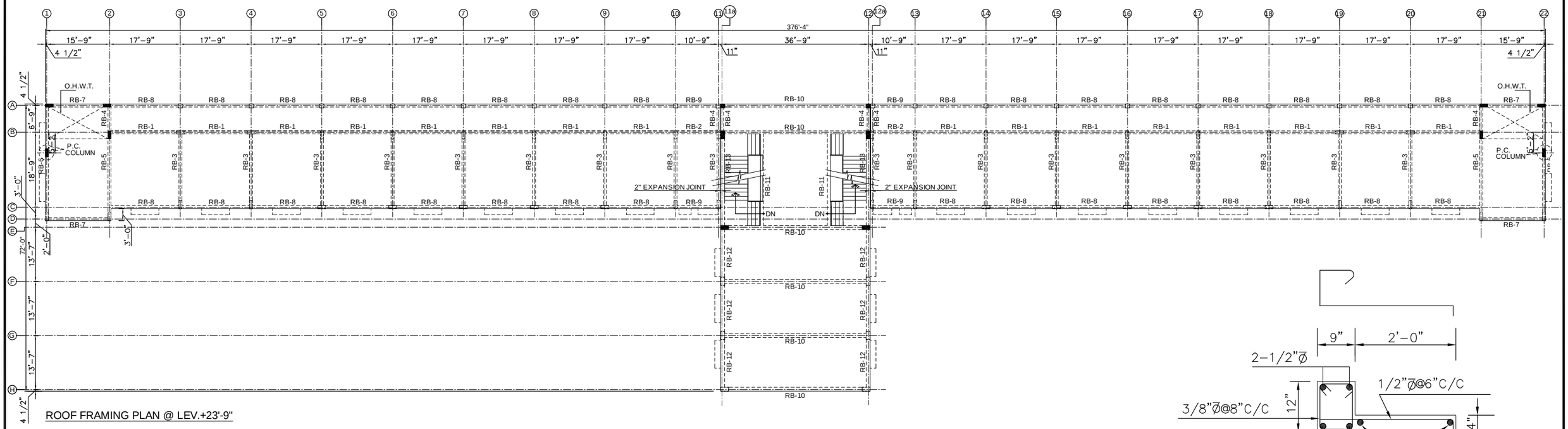
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1. FOR GENERAL NOTES, REFER DWG. NO. GN-01

3rd Revision :	----------	Date :	---------
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1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

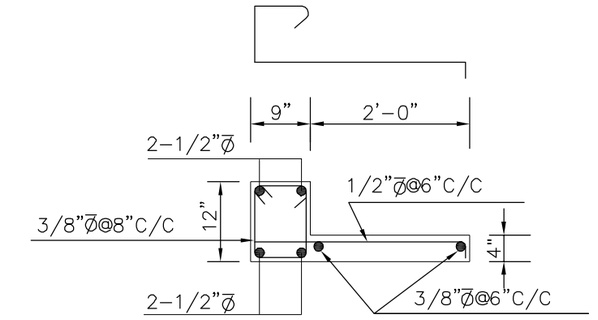
CLIENT: CADET COLLEGE SANGAR	DESCRIPTION : FIRST FLOOR REINF. PLAN @ LEV.+12'-9"
JOB TITLE : CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL	

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JOB NO :	303/10
DRG. NO. :	303/10 ST-04
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=25'-0"	DATE : 22-11-2025



ROOF FRAMING PLAN @ LEV.+23'-9"



TYP. DETAIL OF LINTEL & CHAJJA PROJECTION

SCHEDULE OF ROOF BEAMS

BEAMS NO.S	BEAMS SIZE B X H	TOP BARS CONT.	BOTT. STEEL CONT.	EXTRA ON CONT. SUPPORT		EXTRA BOTTOM	RINGS @ L/4	RINGS @ CENTER
				L-SUPP.	R-SUPP.			
RB-1	9"X24"							
RB-2	9"X24"							
RB-3	9"X24"							
RB-4	9"X24"							
RB-5	9"X24"							
RB-6	9"X24"							
RB-7	9"X24"							
RB-8	9"X24"							
RB-9	9"X24"							
RB-10	12"X30"							
RB-11	9"X18"							
RB-12	12"X24"							
RB-13	12"X30"							

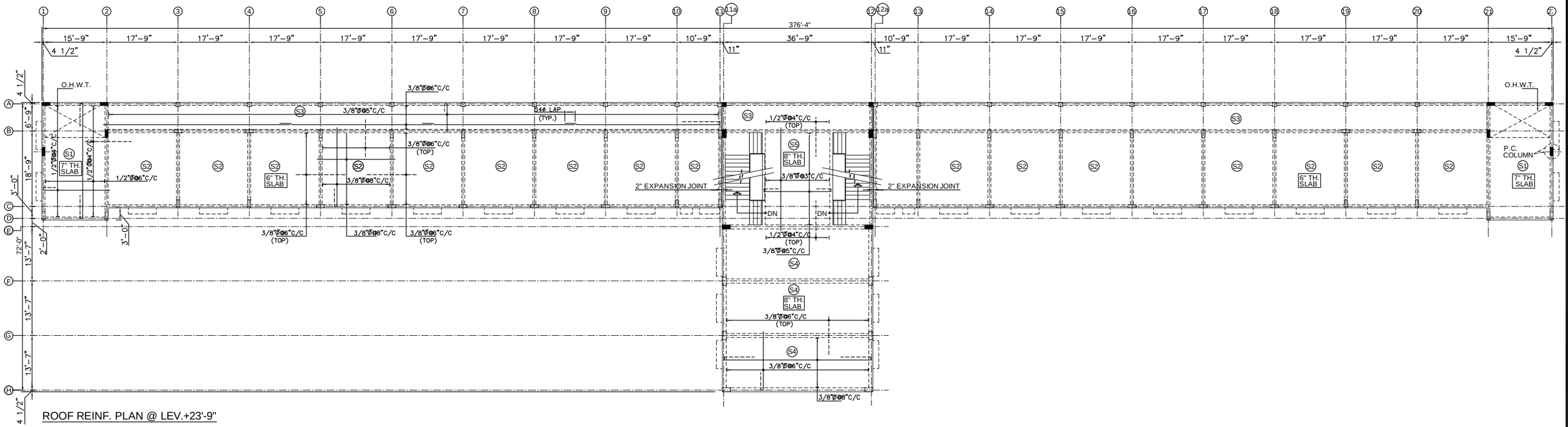
NOTES:
1. FOR GENERAL NOTES, REFER DWG. NO. GN-01

3rd Revision : ---------- Date : ---------
2nd Revision : ---------- Date : ---------
1st Revision : ---------- Date : ---------
ISSUED FOR TENDER DRAWING Date : 09-12-2025

CLIENT: CADET COLLEGE SANGAR
JOB TITLE : CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL
DESCRIPTION : ROOF FRAMING PLAN @LEV.+23'-9"

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E-mail: info@youngassociates.com.pk

JOB NO : 303/10
DRG. NO. : 303/10 ST-05
DRAWN BY : AAMIR
CHECKED BY : MUNEER
SCALE : 1"=25'-0"
DATE : 22-11-2025



ROOF REINF. PLAN @ LEV.+23'-9"

NOTES:
1. FOR GENERAL NOTES, REFER DWG. NO. GN-01

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2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGAR	DESCRIPTION :	ROOF REINF. PLAN @LEV.+23'-9"
JOB TITLE :	CONSTRUCTION OF LAL SHAHBAZ QALANDAR BOYS HOSTEL		

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JOB NO :	303/10		
DRG. NO. :	303/10 ST-06		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1"=25'-0"	DATE :	22-11-2025

CADET COLLEGE SANGHAR

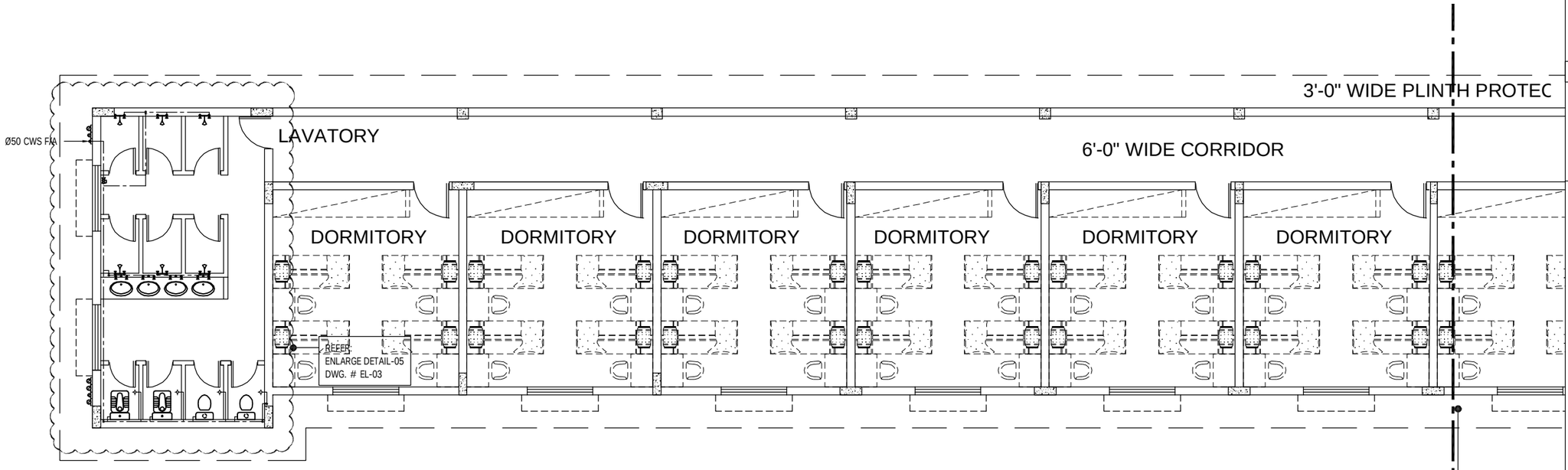
CONSTRUCTION OF
LAL SHAHBAZ QALANDAR BOYS HOSTEL

PLUMBING DRAWINGS

TENDER DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
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GROUND FLOOR PLAN

KEY PLAN

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REV. NO.	DESCRIPTION	DATE

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CONSULTANTS:
MB ASSOCIATES
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☎ 00-021-33380396
✉ info1.mbassociates@gmail.com
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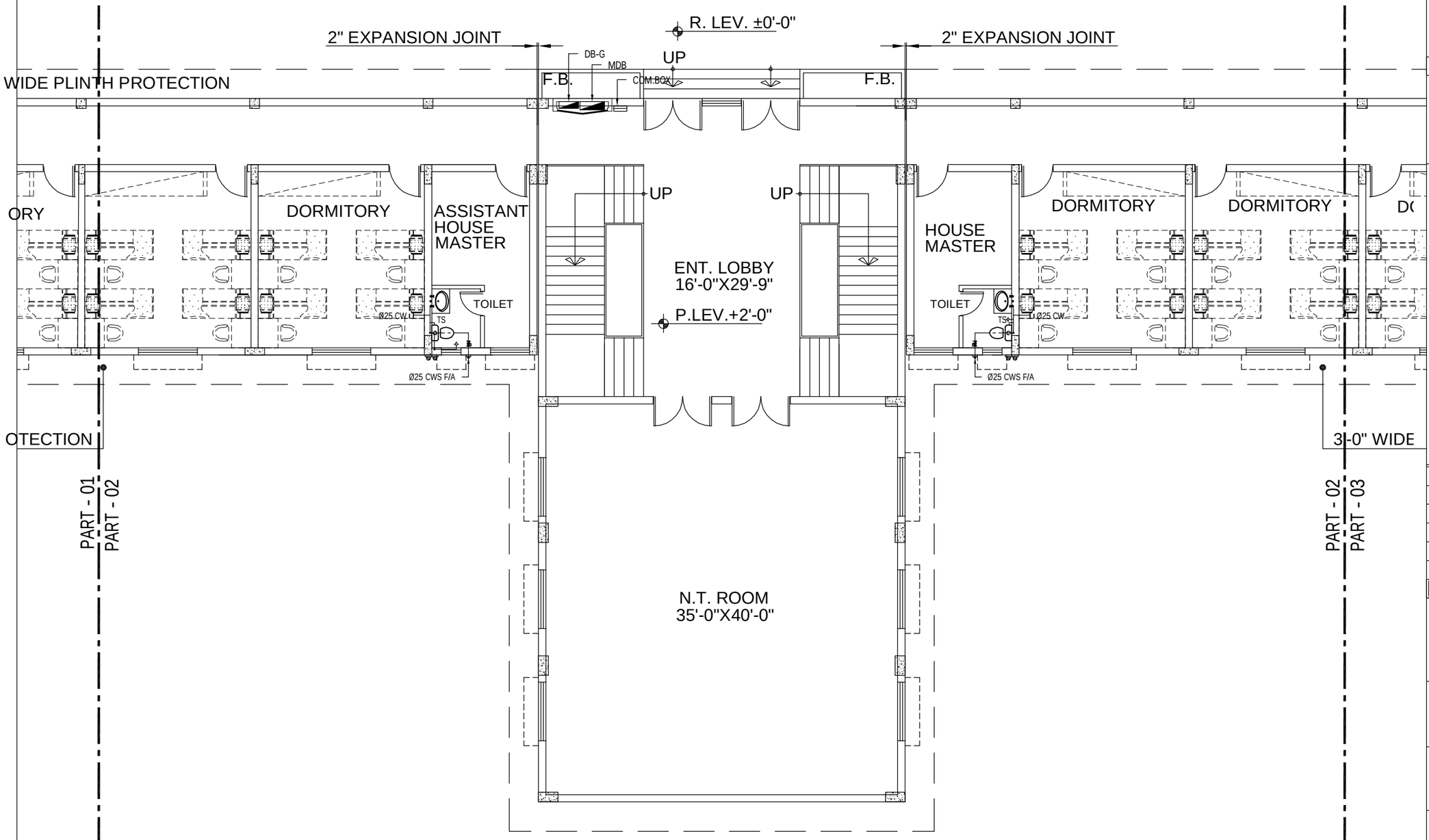
PROJECT:
CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 TH COMMERCIAL STREET, PHASE 2 (EXTN),
DEFENCE HOUSING AUTHORITY, KARACHI-75500
TEL: 021-35396444, 021-35312244
FAX: 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:
GROUND FLOOR PLAN
(PART-1)
WATER SUPPLY SERVICES

DESIGNED BY	SCALE	DATE
SH	3/32"=1'-0"	DEC, 2025
DRAWN BY	JOB NO.	DRAWING NO.
AI	MBA/293/25	WS-01A
CHECKED BY	ORIGINAL SHT SIZE:	
BR	A3	
APPROVED BY	PLOTTED SHT SIZE:	
MB	A3	

CAD FILE NAME:
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REV. NO.	DESCRIPTION	DATE

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CONSULTANTS:

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☎ 00-021-33380396
✉ info1.mbassociates@gmail.com
✉ info@mbassociates.com.pk

PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:

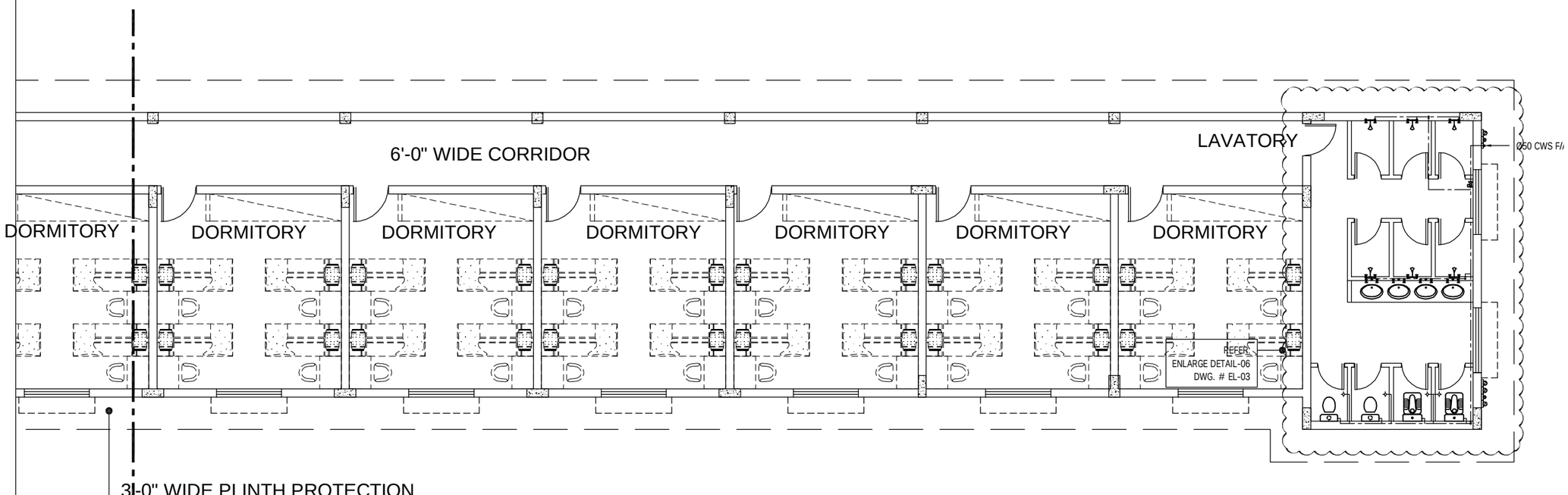
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CONSULTING ENGINEERS & ARCHITECTS
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DEFENCE HOUSING AUTHORITY, KARACHI-75500
TEL 021-35396444, 021-35312244
FAX 021-35883106
E-MAIL INFO@YOUNGASSOCIATES.COM.PK

TITLE:

GROUND FLOOR PLAN
(PART-2)
WATER SUPPLY SERVICES

DESIGNED BY: SH	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: AI	JOB NO.: MBA/293/25	DRAWING NO.: WS-01B
CHECKED BY: BR	ORIGINAL SHT SIZE: A3	
APPROVED BY: MB	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
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REV. NO.	DESCRIPTION	DATE

TENDER DRAWING

CONSULTANTS:

MB ASSOCIATES
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☎ 00-021-33380396
✉ info1.mbassociates@gmail.com
✉ info@mbassociates.com.pk

PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:

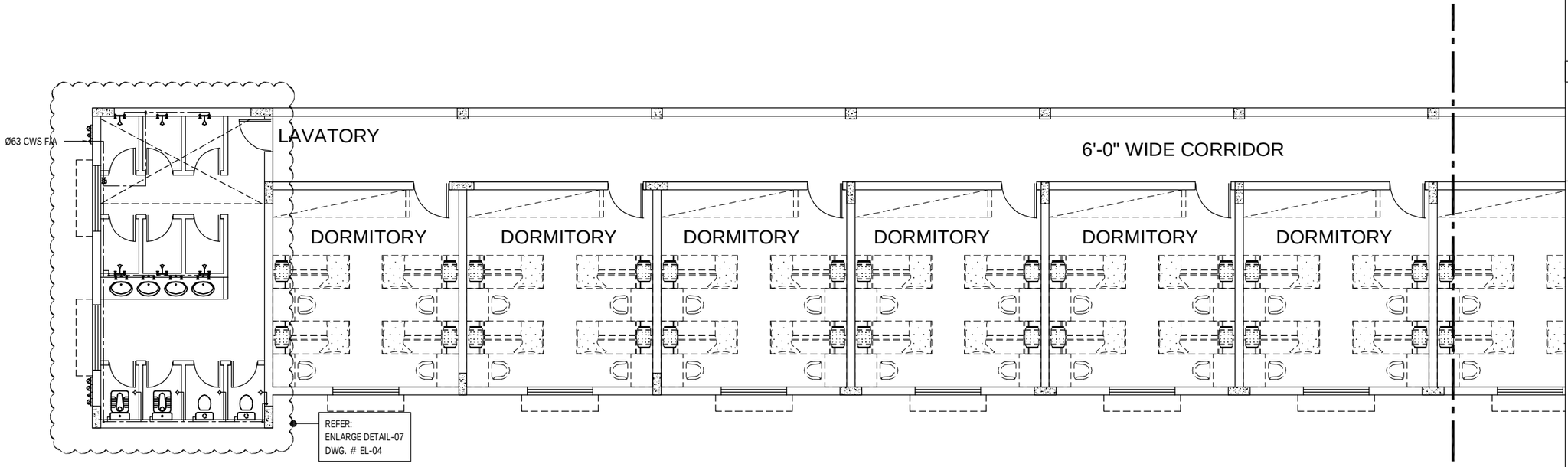
YOUNG ASSOCIATES
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9-C 24 TH COMMERCIAL STREET, PHASE 2 (EXTN),
DEFENCE HOUSING AUTHORITY, KARACHI-75500
TEL: 021-35396444, 021-35312244
FAX: 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:

GROUND FLOOR PLAN
(PART-3)
WATER SUPPLY SERVICES

DESIGNED BY	SCALE	DATE
SH	3/32"=1'-0"	DEC, 2025
DRAWN BY	JOB NO.	DRAWING NO.
AI	MBA/293/25	WS-01C
CHECKED BY	ORIGINAL SHT SIZE:	
BR	A3	
APPROVED BY	PLOTTED SHT SIZE:	
MB	A3	

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FIRST FLOOR PLAN

PART - 01
PART - 02

KEY PLAN

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REV. NO.	DESCRIPTION	DATE

TENDER DRAWING

CONSULTANTS:

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☎ 00-021-33380396
✉ info1.mbassociates@gmail.com
✉ info@mbassociates.com.pk

PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:

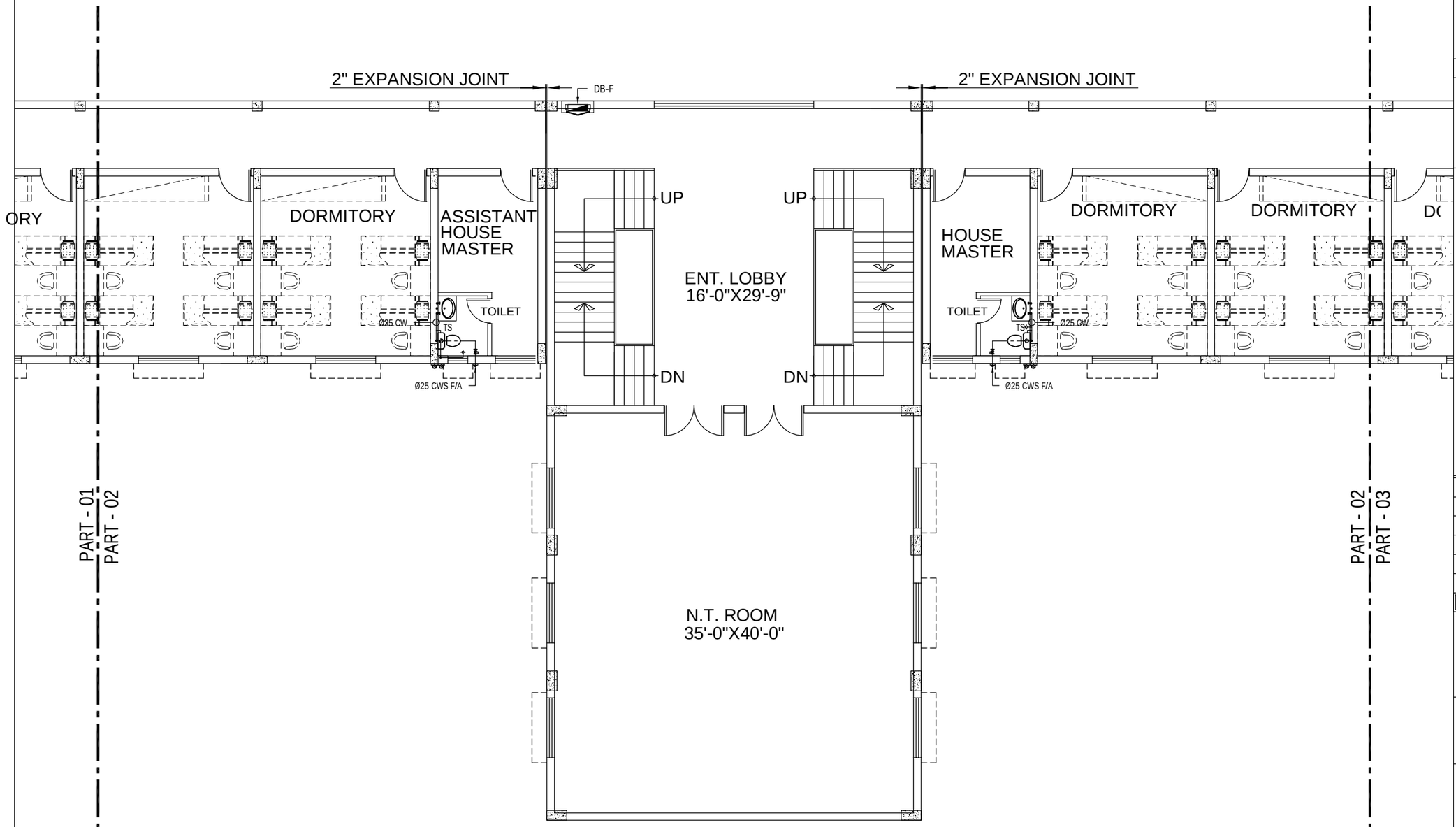
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 th Commercial street, Phase 2 (Extn),
Defence Housing Authority, Karachi-75500
Tel: 021-35396444, 021-35312244
FAX: 021-35883106
E-mail: info@youngassociates.com.pk

TITLE:

1ST FLOOR PLAN
(PART-1)
WATER SUPPLY SERVICES

DESIGNED BY	SCALE	DATE
SH	3/32"=1'-0"	DEC, 2025
DRAWN BY	JOB NO.	DRAWING NO.
AI	MBA/293/25	WS-02A
CHECKED BY	ORIGINAL SHT SIZE:	
BR	A3	
APPROVED BY	PLOTTED SHT SIZE:	
MB	A3	

CAD FILE NAME:
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REV. NO.	DESCRIPTION	DATE

TENDER DRAWING

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HOUSE NO. 71/4, STREET 19, MUSLIMABAD, KARACHI
☎ 00-021-33380396
✉ info1.mbassociates@gmail.com
✉ info@mbassociates.com.pk

PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:

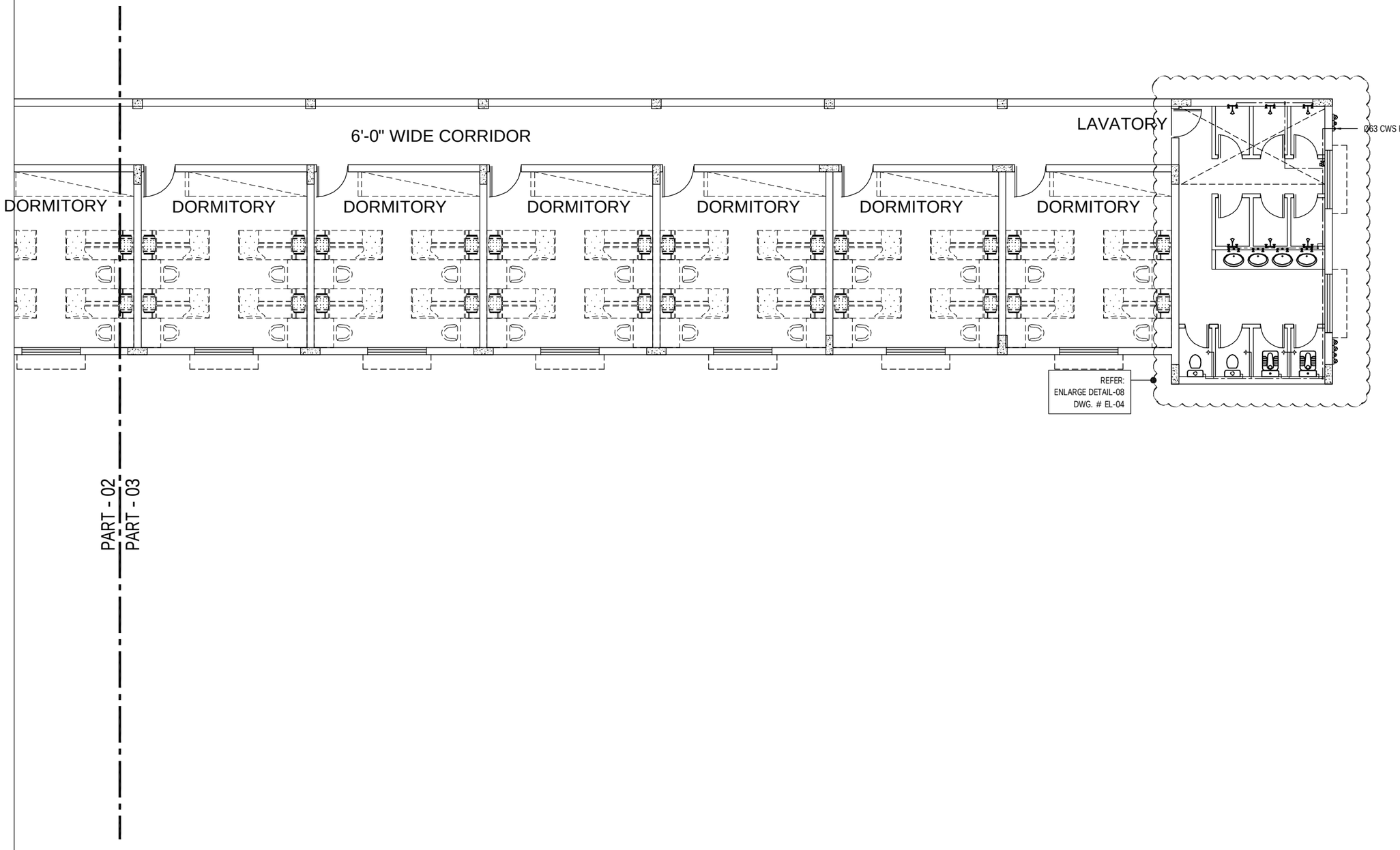
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DEFENCE HOUSING AUTHORITY, KARACHI-75500
TEL 021-35396444, 021-35312244
FAX 021-35883106
E-MAIL INFO@YOUNGASSOCIATES.COM.PK

TITLE:

1ST FLOOR PLAN
(PART-2)
WATER SUPPLY SERVICES

DESIGNED BY	SCALE	DATE
SH	3/32"=1'-0"	DEC, 2025
DRAWN BY	JOB NO.	DRAWING NO.
AI	MBA/293/25	WS-02B
CHECKED BY	ORIGINAL SHT SIZE:	
BR	A3	
APPROVED BY	PLOTTED SHT SIZE:	
MB	A3	

CAD FILE NAME:
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KEY PLAN

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REV. NO.	DESCRIPTION	DATE

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✉ info@mbassociates.com.pk

PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:

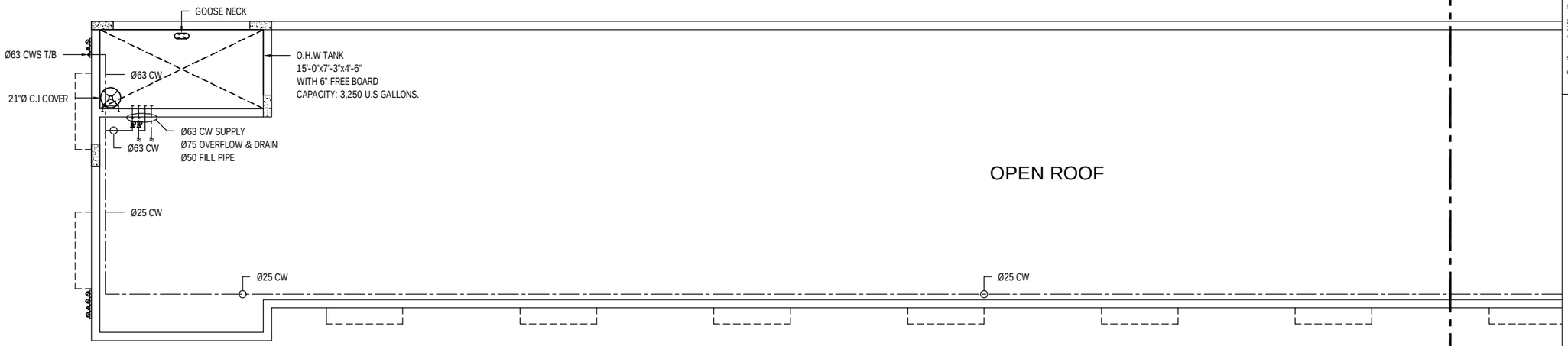
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FAX: 021-35883106
E-mail: info@youngassociates.com.pk

TITLE:

1ST FLOOR PLAN
(PART-3)
WATER SUPPLY SERVICES

DESIGNED BY	SCALE	DATE
SH	3/32"=1'-0"	DEC, 2025
DRAWN BY	JOB NO.	DRAWING NO.
AI	MBA/293/25	WS-02C
CHECKED BY	ORIGINAL SHT SIZE:	
BR	A3	
APPROVED BY	PLOTTED SHT SIZE:	
MB	A3	

CAD FILE NAME:
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ROOF PLAN

PART - 01
PART - 02

KEY PLAN

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REV. NO.	DESCRIPTION	DATE

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PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:

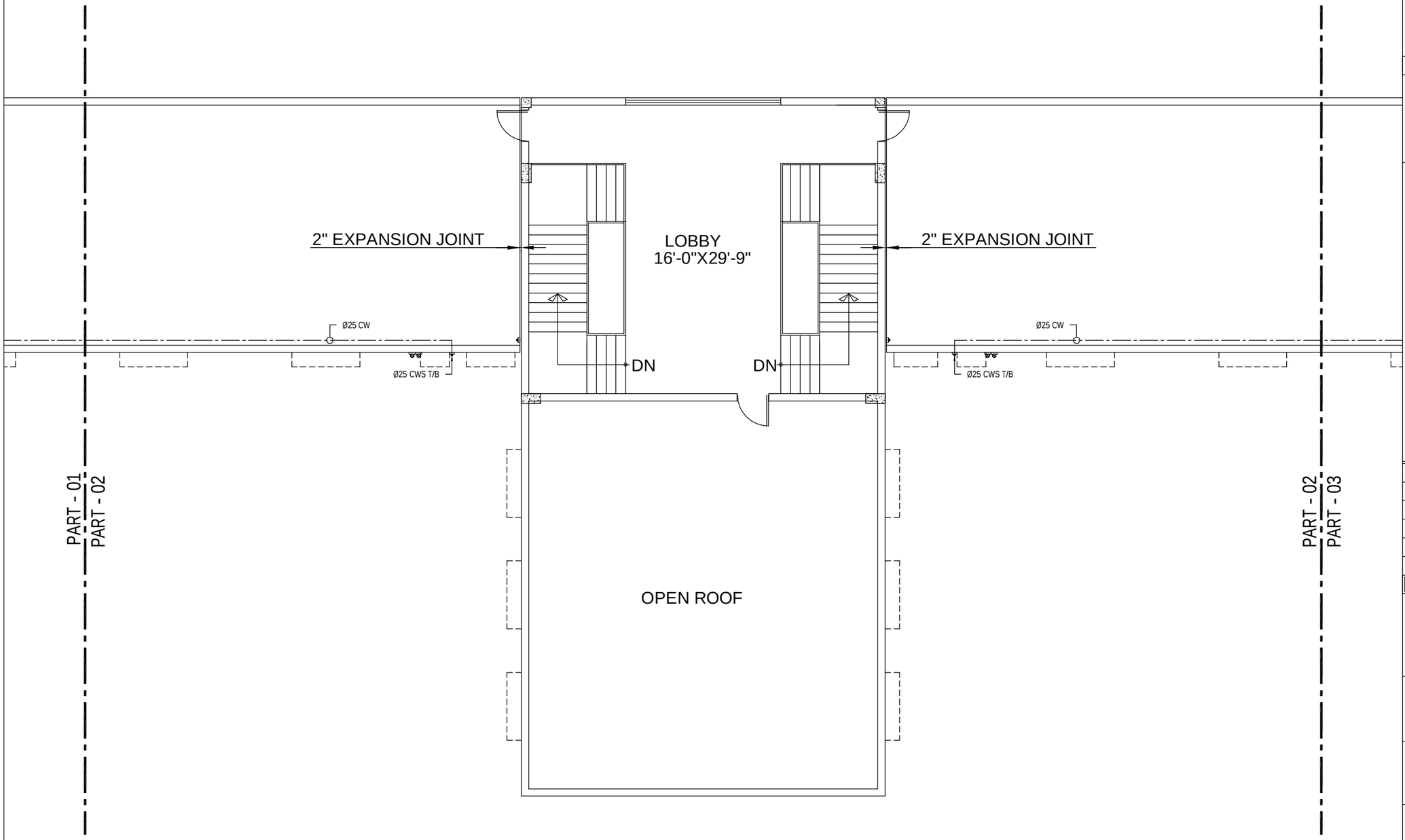
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FAX. 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:

ROOF PLAN
(PART-1)
WATER SUPPLY SERVICES

DESIGNED BY: SH	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: AI	JOB NO.: MBA/293/25	DRAWING NO.: WS-03A
CHECKED BY: BR	ORIGINAL SHT SIZE: A3	
APPROVED BY: MB	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
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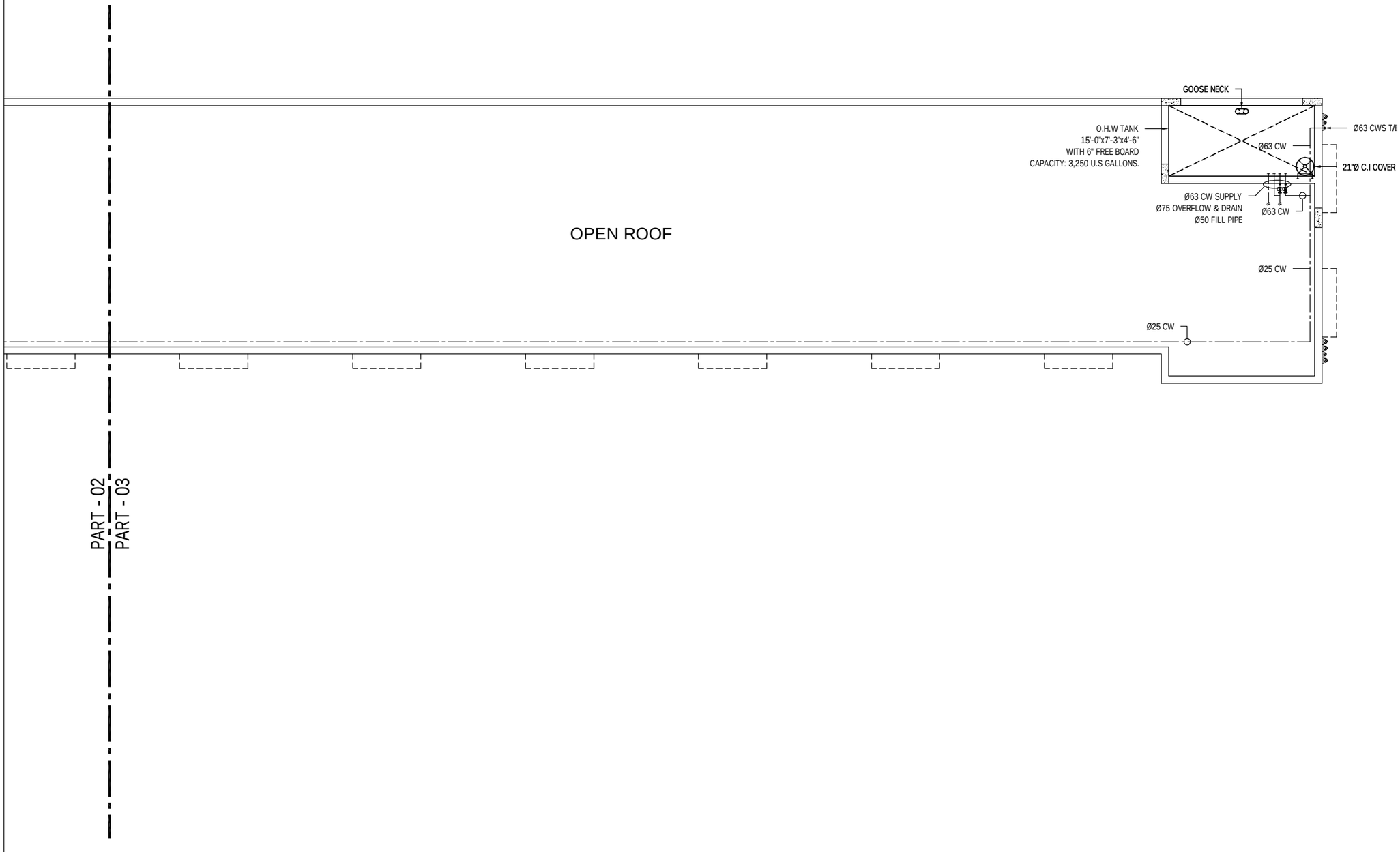
PROJECT:
CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:
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CONSULTING ENGINEERS & ARCHITECTS
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FAX: 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:
ROOF PLAN
(PART-2)
WATER SUPPLY SERVICES

DESIGNED BY: SH	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: AI	JOB NO.: MBA/293/25	DRAWING NO.: WS-03B
CHECKED BY: BR	ORIGINAL SHT SIZE: A3	
APPROVED BY: MB	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
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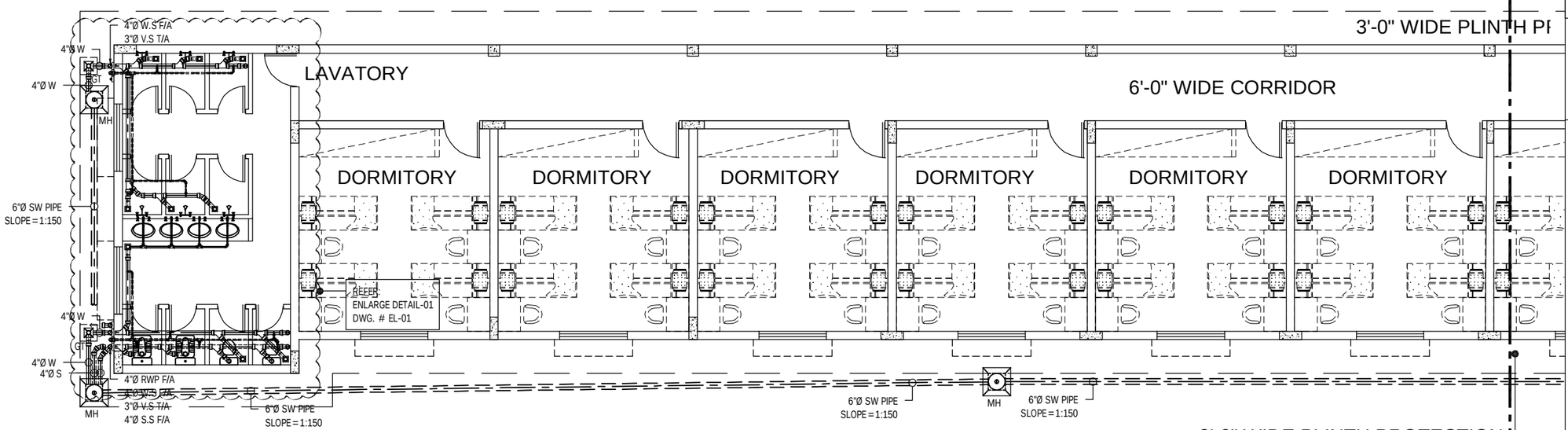
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E-mail: info@youngassociates.com.pk

TITLE:

ROOF PLAN
(PART-3)
WATER SUPPLY SERVICES

DESIGNED BY	SCALE	DATE
SH	3/32"=1'-0"	DEC, 2025
DRAWN BY	JOB NO.	DRAWING NO.
AI	MBA/293/25	WS-03C
CHECKED BY	ORIGINAL SHT SIZE:	
BR	A3	
APPROVED BY	PLOTTED SHT SIZE:	
MB	A3	

CAD FILE NAME:
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GROUND FLOOR PLAN

KEY PLAN

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PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

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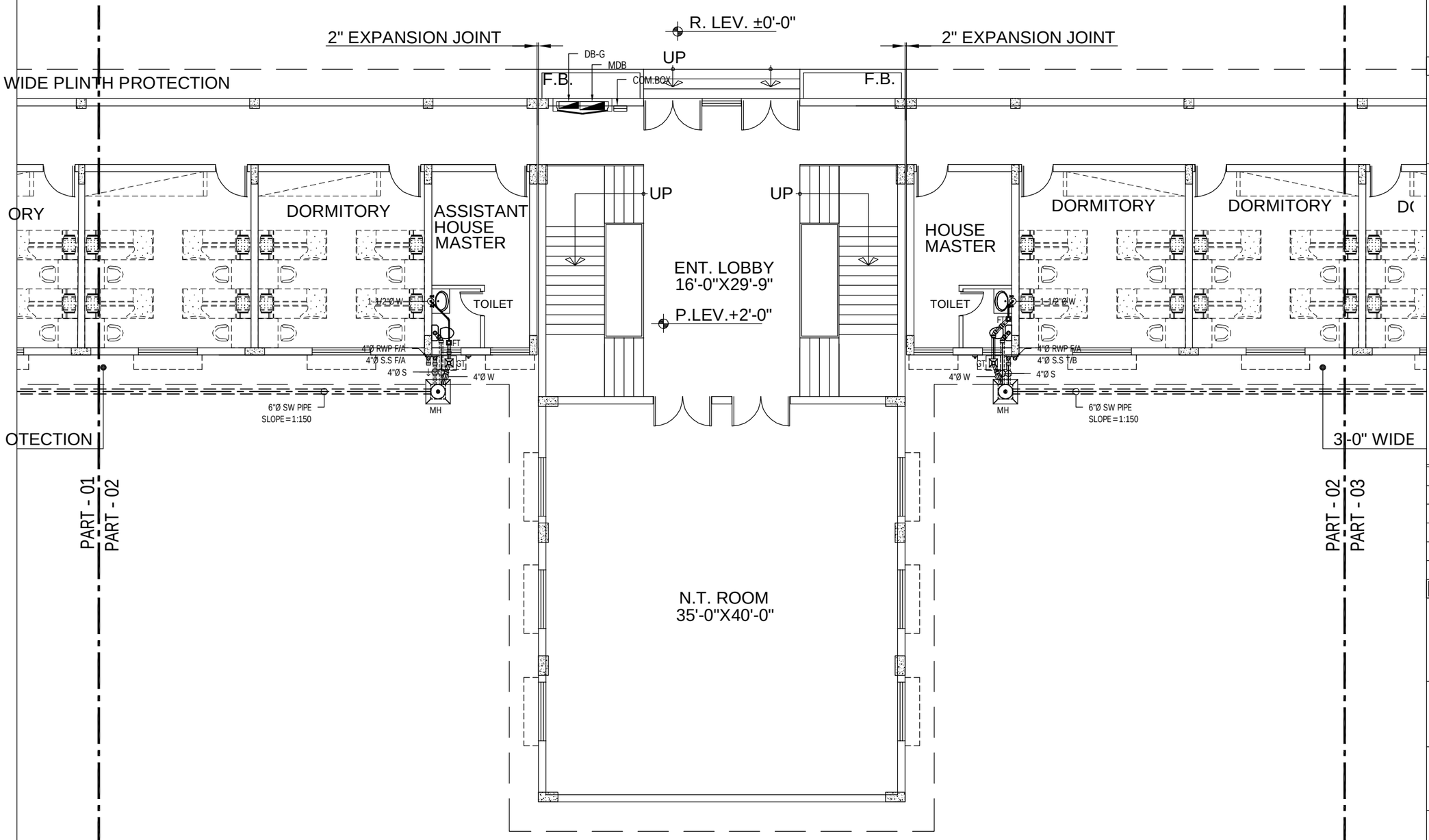
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Fax: 021-35883106
E-mail: info@youngassociates.com.pk

TITLE:

GROUND FLOOR PLAN
(PART-1)
DRAINAGE SERVICES

DESIGNED BY	SCALE	DATE
SH	3/32"=1'-0"	DEC, 2025
DRAWN BY	JOB NO.	DRAWING NO.
AI	MBA/293/25	DR-01A
CHECKED BY	ORIGINAL SHT SIZE:	
BR	A3	
APPROVED BY	PLOTTED SHT SIZE:	
MB	A3	

CAD FILE NAME:
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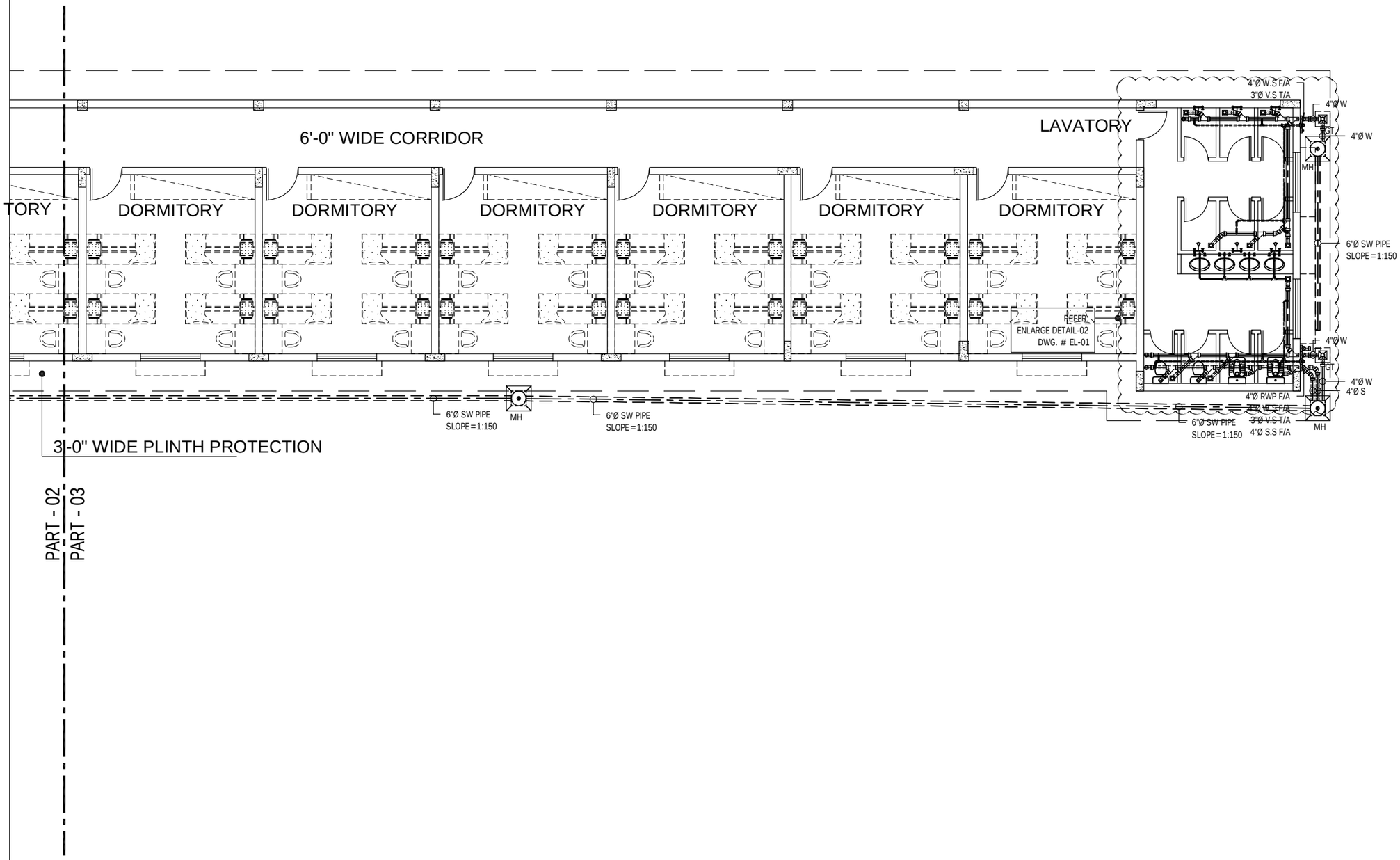
PROJECT:
CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:
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CONSULTING ENGINEERS & ARCHITECTS
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FAX 021-35883106
E-MAIL INFO@YOUNGASSOCIATES.COM.PK

TITLE:
GROUND FLOOR PLAN
(PART-2)
DRAINAGE SERVICES

DESIGNED BY	SCALE	DATE
SH	3/32"=1'-0"	DEC, 2025
DRAWN BY	JOB NO.	DRAWING NO.
AI	MBA/293/25	DR-01B
CHECKED BY	ORIGINAL SHT SIZE:	
BR	A3	
APPROVED BY	PLOTTED SHT SIZE:	
MB	A3	

CAD FILE NAME:
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PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:

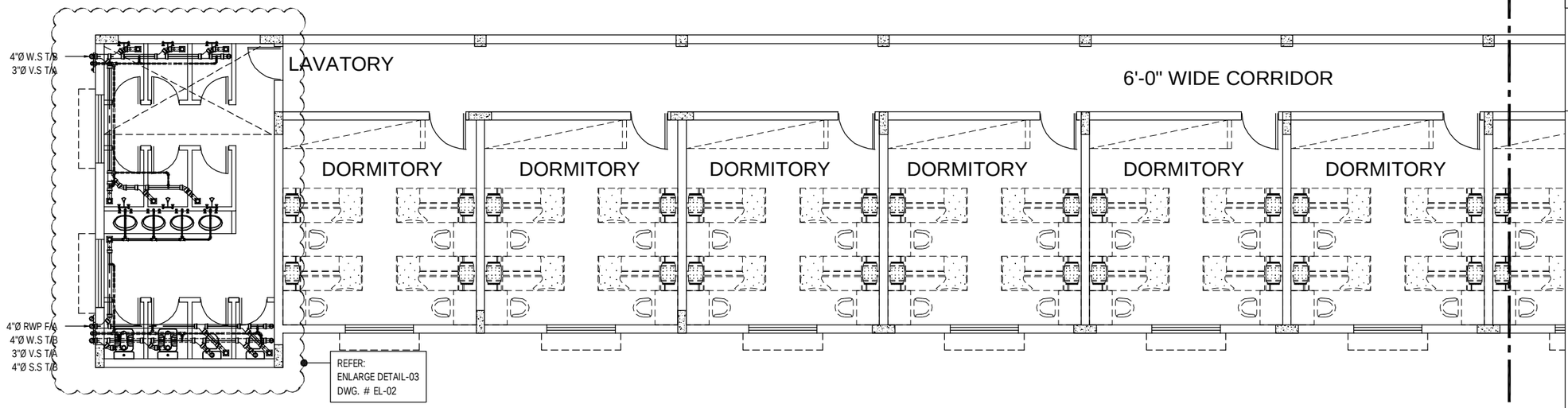
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E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:

GROUND FLOOR PLAN
(PART-3)
DRAINAGE SERVICES

DESIGNED BY	SCALE	DATE
SH	3/32"=1'-0"	DEC, 2025
DRAWN BY	JOB NO.	DRAWING NO.
AI	MBA/293/25	DR-01C
CHECKED BY	ORIGINAL SHT SIZE:	
BR	A3	
APPROVED BY	PLOTTED SHT SIZE:	
MB	A3	

CAD FILE NAME:
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FIRST FLOOR PLAN

PART - 01
PART - 02

KEY PLAN

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PROJECT:

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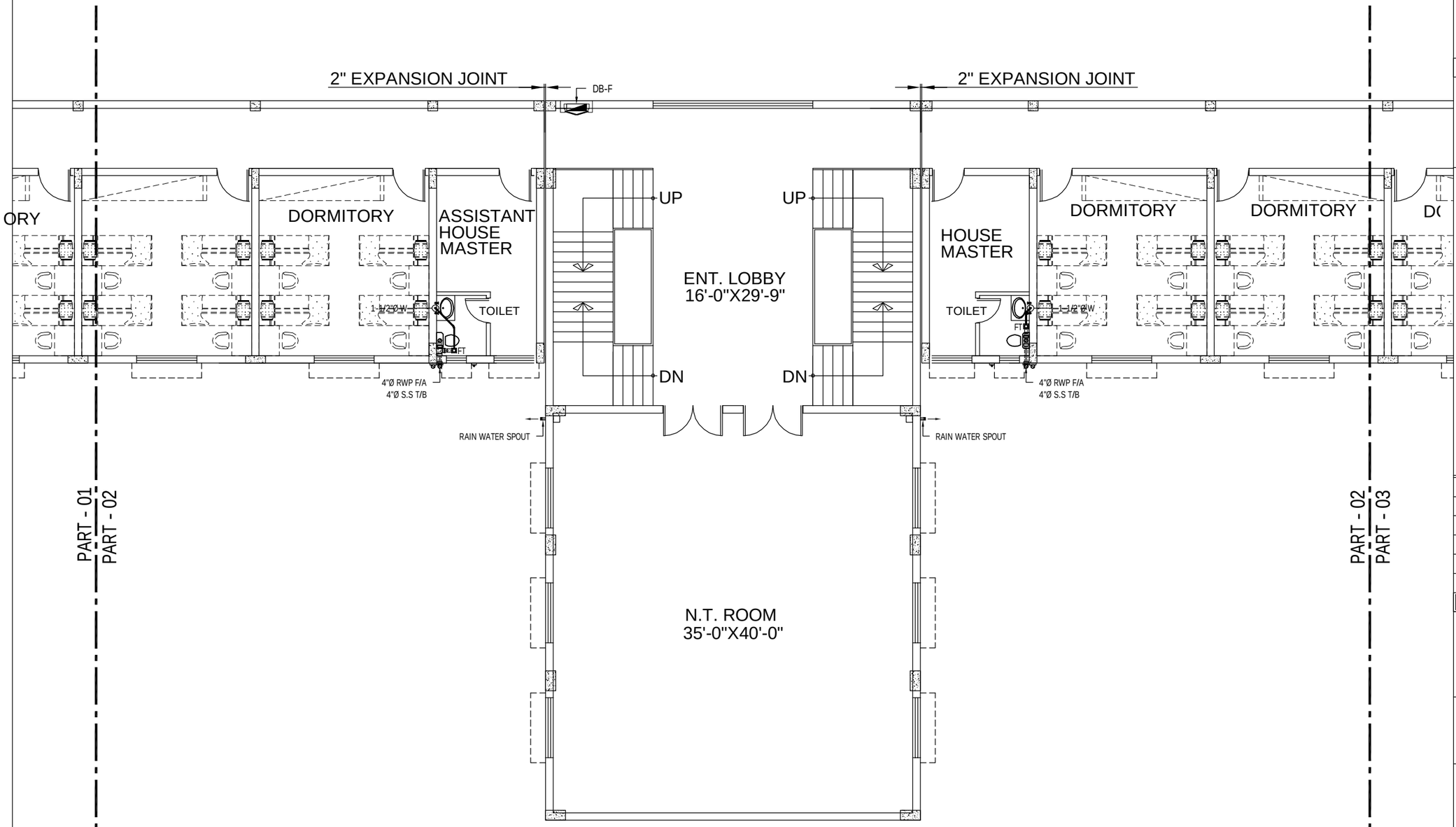
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TEL 021-35396444, 021-35312244
FAX: 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:

1ST FLOOR PLAN
(PART-1)
DRAINAGE SERVICES

DESIGNED BY	SCALE	DATE
SH	3/32"=1'-0"	DEC, 2025
DRAWN BY	JOB NO.	DRAWING NO.
AI	MBA/293/25	DR-02A
CHECKED BY	ORIGINAL SHT SIZE:	
BR	A3	
APPROVED BY	PLOTTED SHT SIZE:	
MB	A3	

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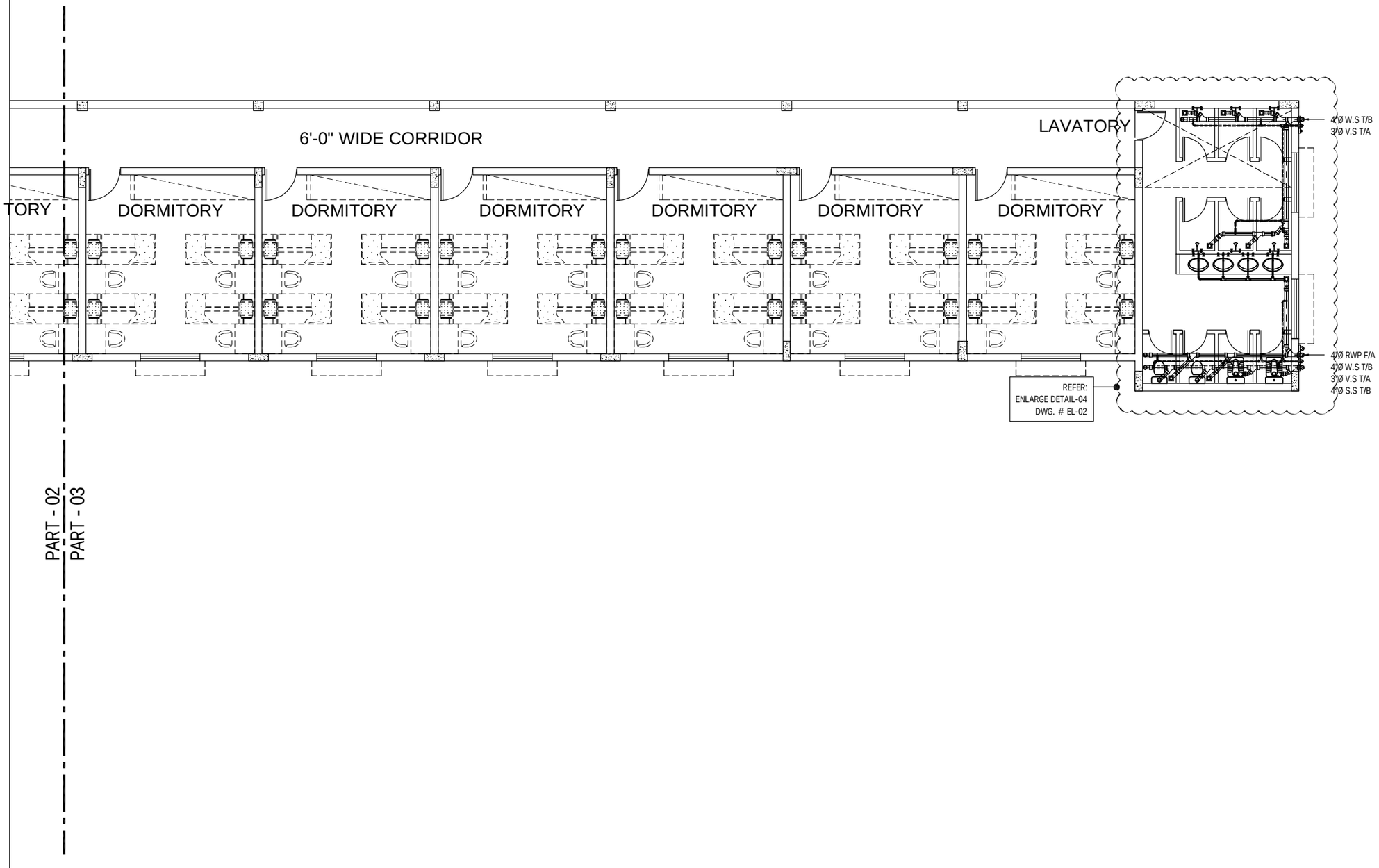
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HOSTEL BUILDING

ARCHITECTS:
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CONSULTING ENGINEERS & ARCHITECTS
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TEL. 021-35396444, 021-35312244
FAX: 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:
1ST FLOOR PLAN
(PART-2)
DRAINAGE SERVICES

DESIGNED BY: SH	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: AI	JOB NO.: MBA/293/25	DRAWING NO.: DR-02B
CHECKED BY: BR	ORIGINAL SHT SIZE: A3	
APPROVED BY: MB	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
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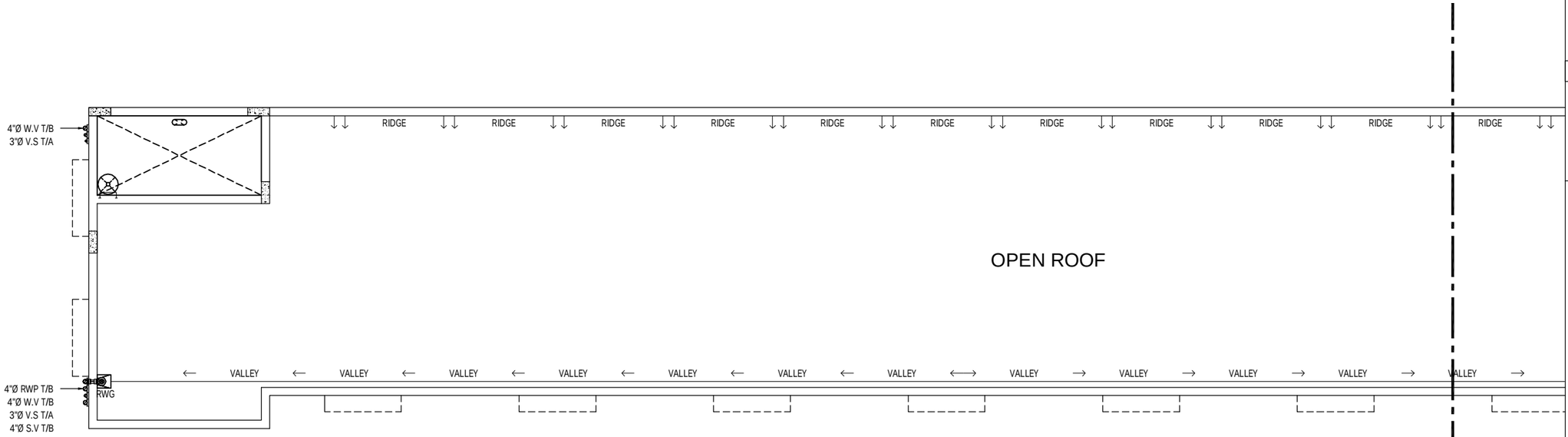
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Fax: 021-35883106
E-mail: info@youngassociates.com.pk

TITLE:

1ST FLOOR PLAN
(PART-3)
DRAINAGE SERVICES

DESIGNED BY	SCALE	DATE
SH	3/32"=1'-0"	DEC, 2025
DRAWN BY	JOB NO.	DRAWING NO.
AI	MBA/293/25	DR-02C
CHECKED BY	ORIGINAL SHT SIZE:	
BR	A3	
APPROVED BY	PLOTTED SHT SIZE:	
MB	A3	

CAD FILE NAME:
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ROOF PLAN

KEY PLAN

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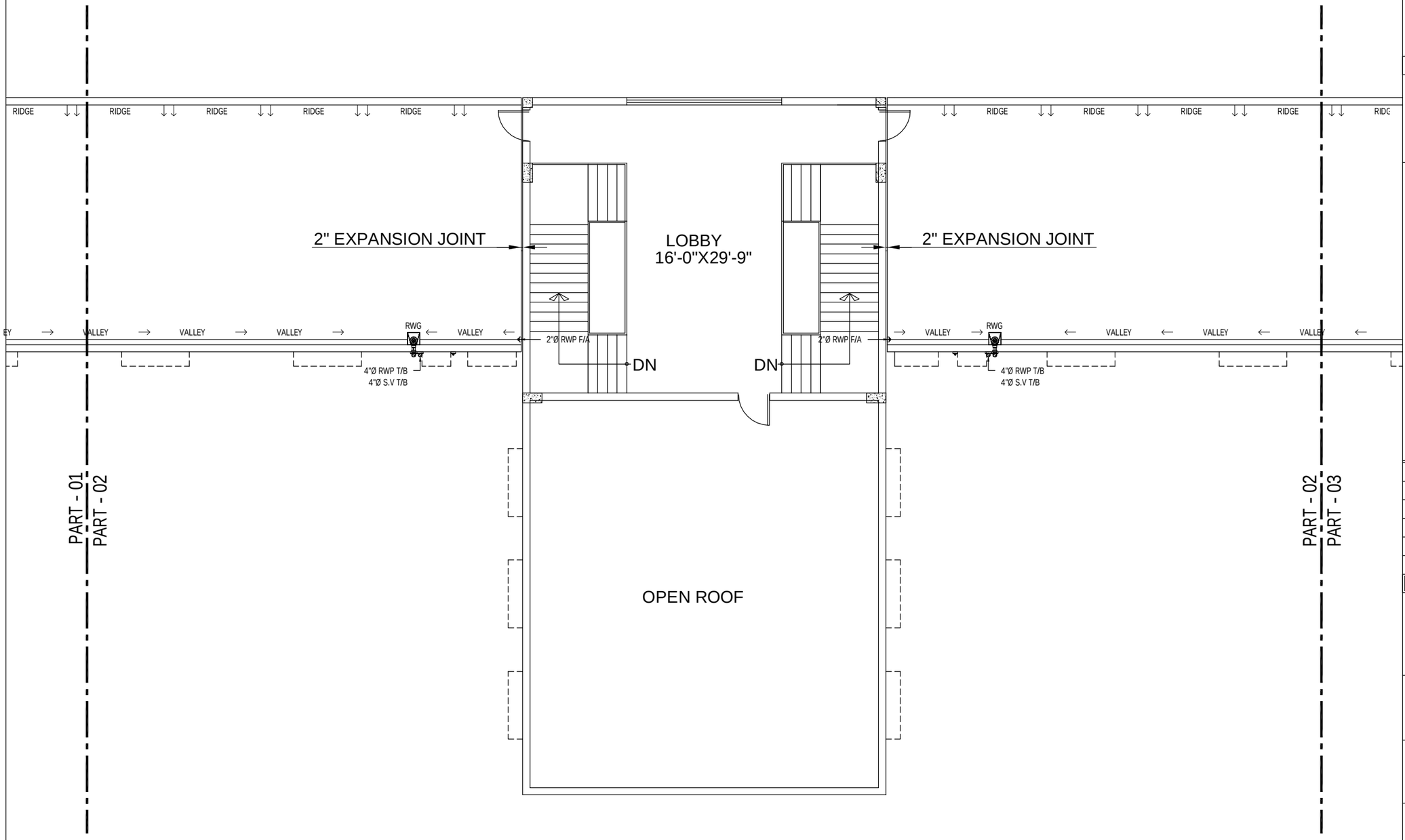
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Fax: 021-35883106
E-mail: info@youngassociates.com.pk

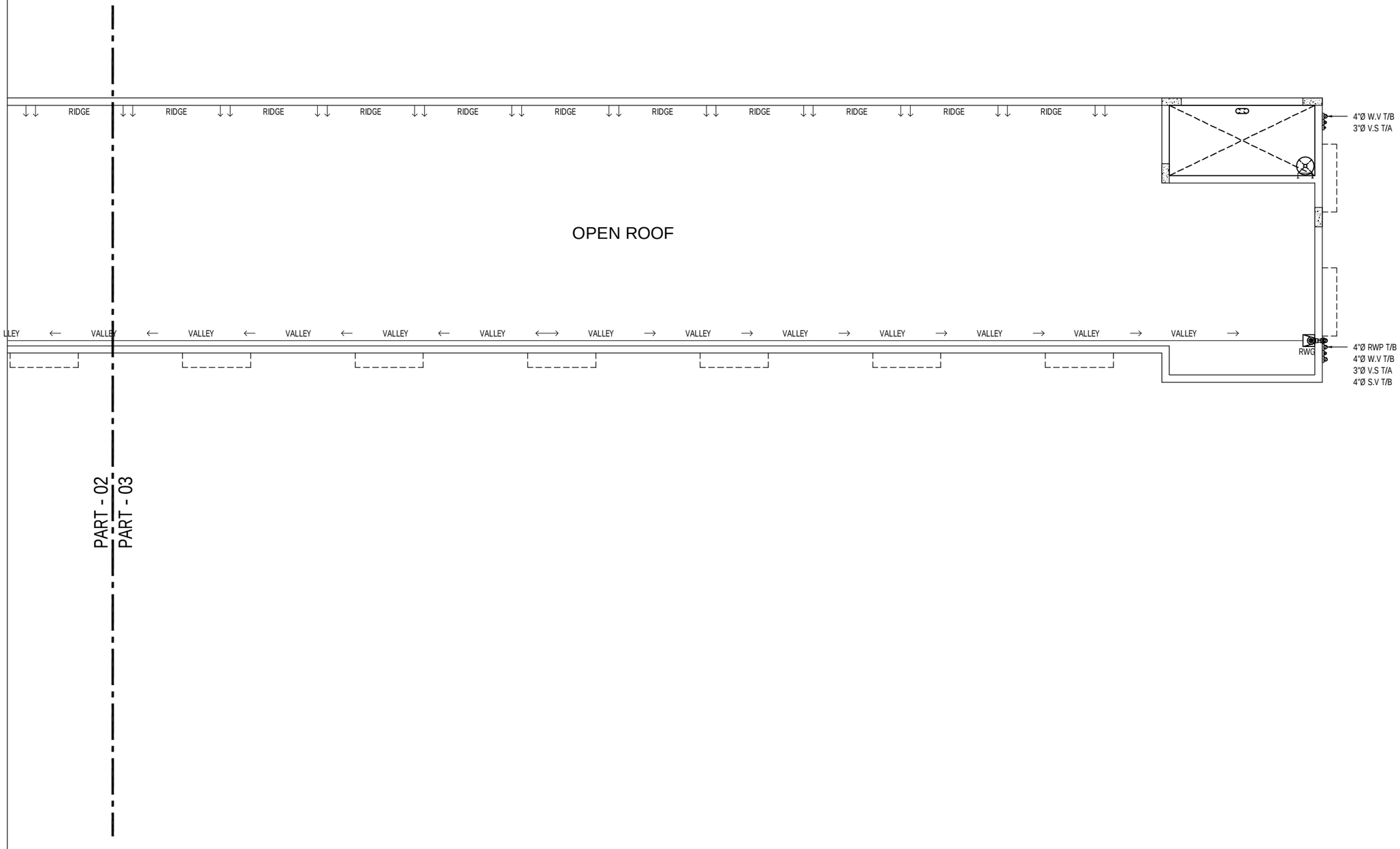
TITLE:

ROOF PLAN
(PART-1)
DRAINAGE SERVICES

DESIGNED BY: SH	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: AI	JOB NO.: MBA/293/25	DRAWING NO.: DR-03A
CHECKED BY: BR	ORIGINAL SHT SIZE: A3	
APPROVED BY: MB	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
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RIDGE
RIDGE
RIDGE



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REV. NO.	DESCRIPTION	DATE

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☎ 00-021-33380396
✉ info1.mbassociates@gmail.com
✉ info@mbassociates.com.pk

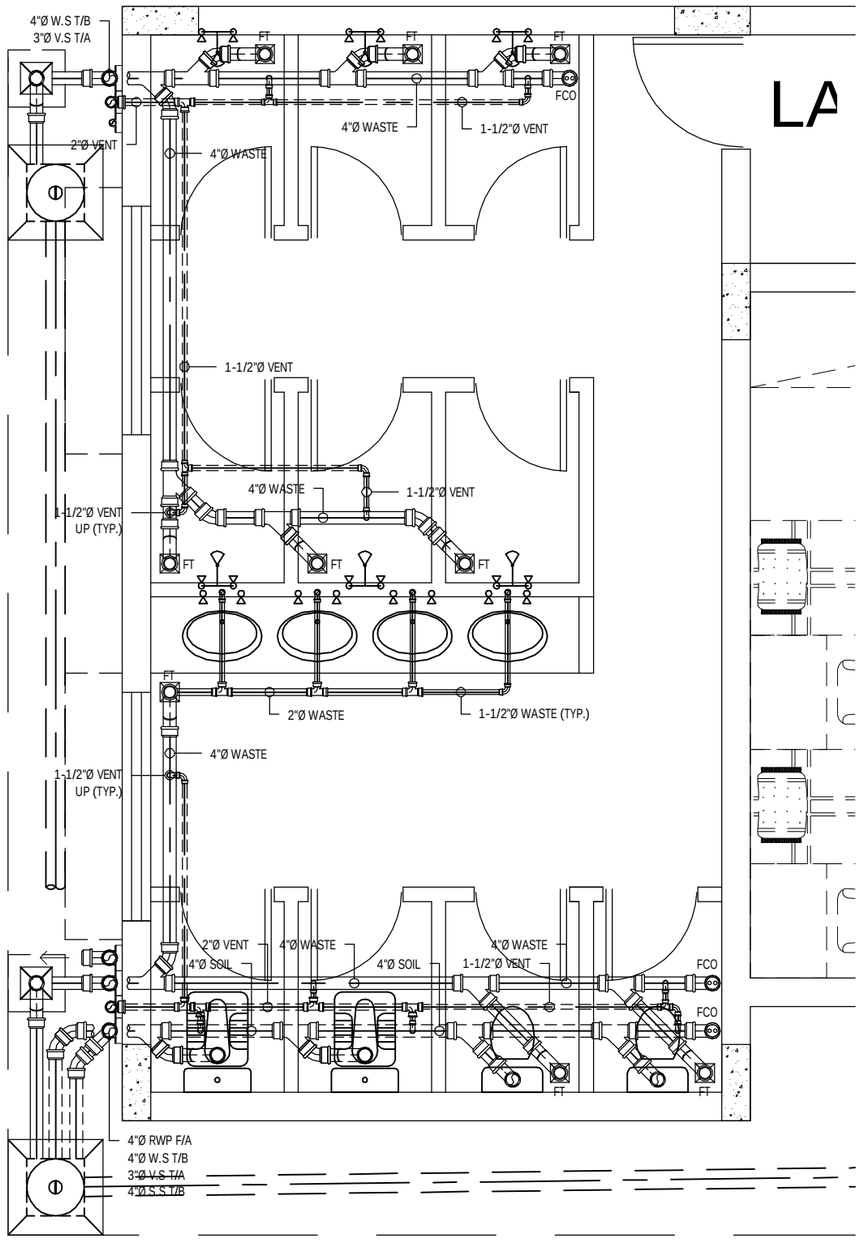
PROJECT:
CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 th Commercial street, Phase 2 (Extn),
Defence Housing Authority, Karachi-75500
Tel. 021-35396444, 021-35312244
FAX: 021-35883106
E-mail: info@youngassociates.com.pk

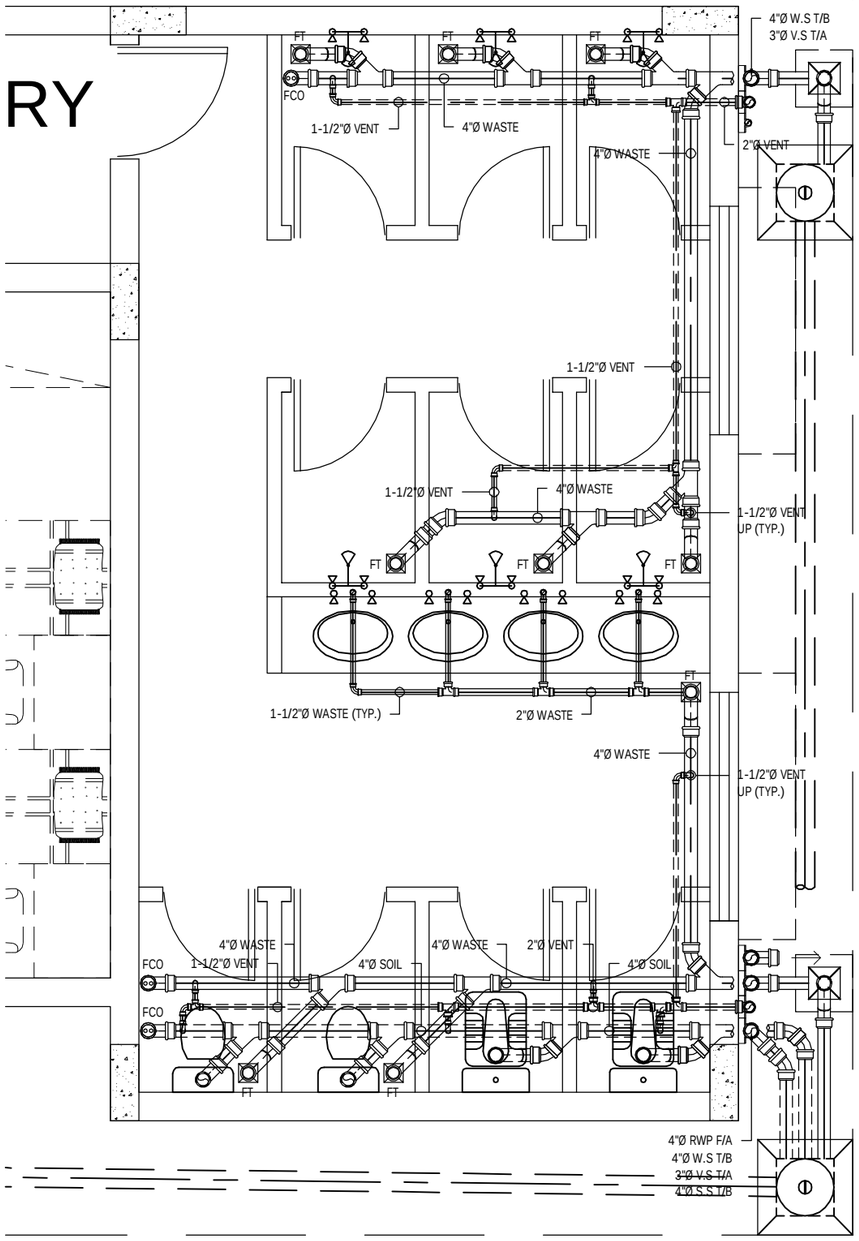
TITLE:
ROOF PLAN
(PART-3)
DRAINAGE SERVICES

DESIGNED BY	SCALE	DATE
SH	3/32"=1'-0"	DEC, 2025
DRAWN BY	JOB NO.	DRAWING NO.
AI	MBA/293/25	DR-03C
CHECKED BY	ORIGINAL SHT SIZE:	
BR	A3	
APPROVED BY	PLOTTED SHT SIZE:	
MB	A3	

CAD FILE NAME:
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ENLARGE DETAIL - 01



ENLARGE DETAIL - 02

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✉ info1.mbassociates@gmail.com
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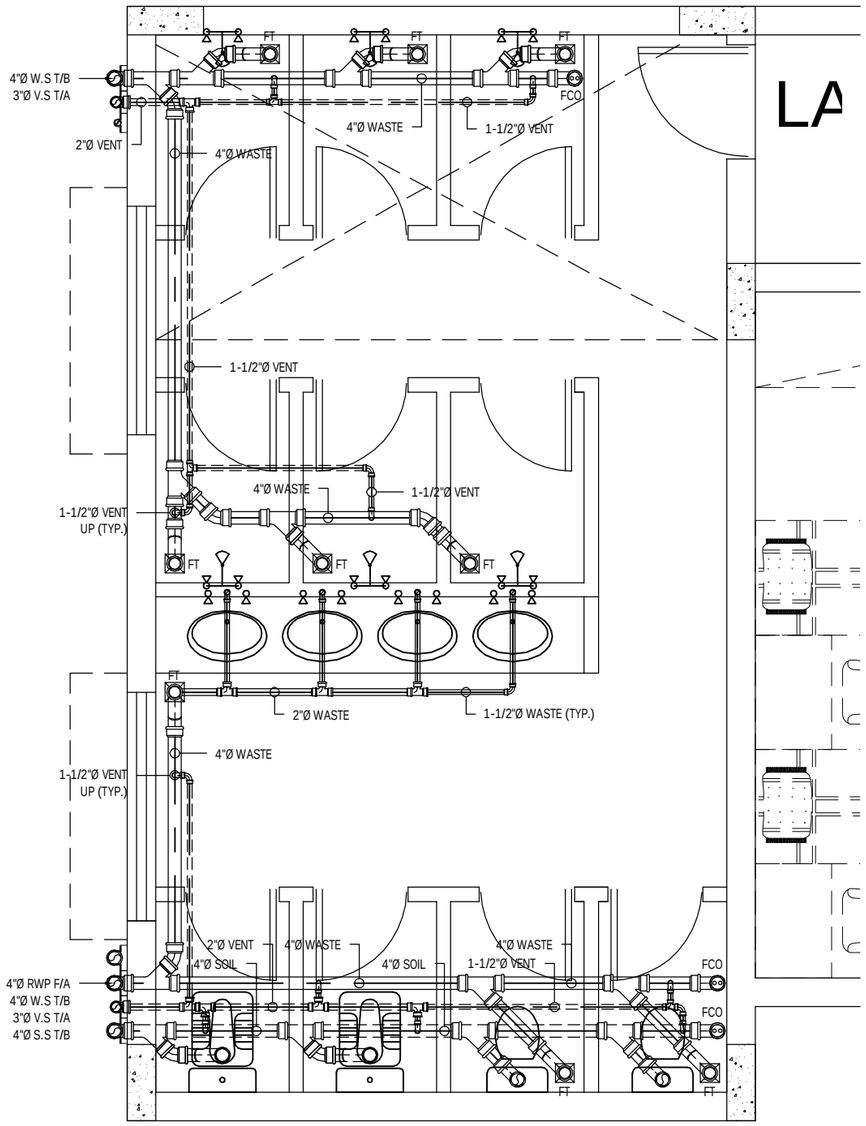
PROJECT:
CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 TH COMMERCIAL STREET, PHASE 2 (EXTN),
DEFENCE HOUSING AUTHORITY, KARACHI-75500
TEL: 021-35396444, 021-35312244
FAX: 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

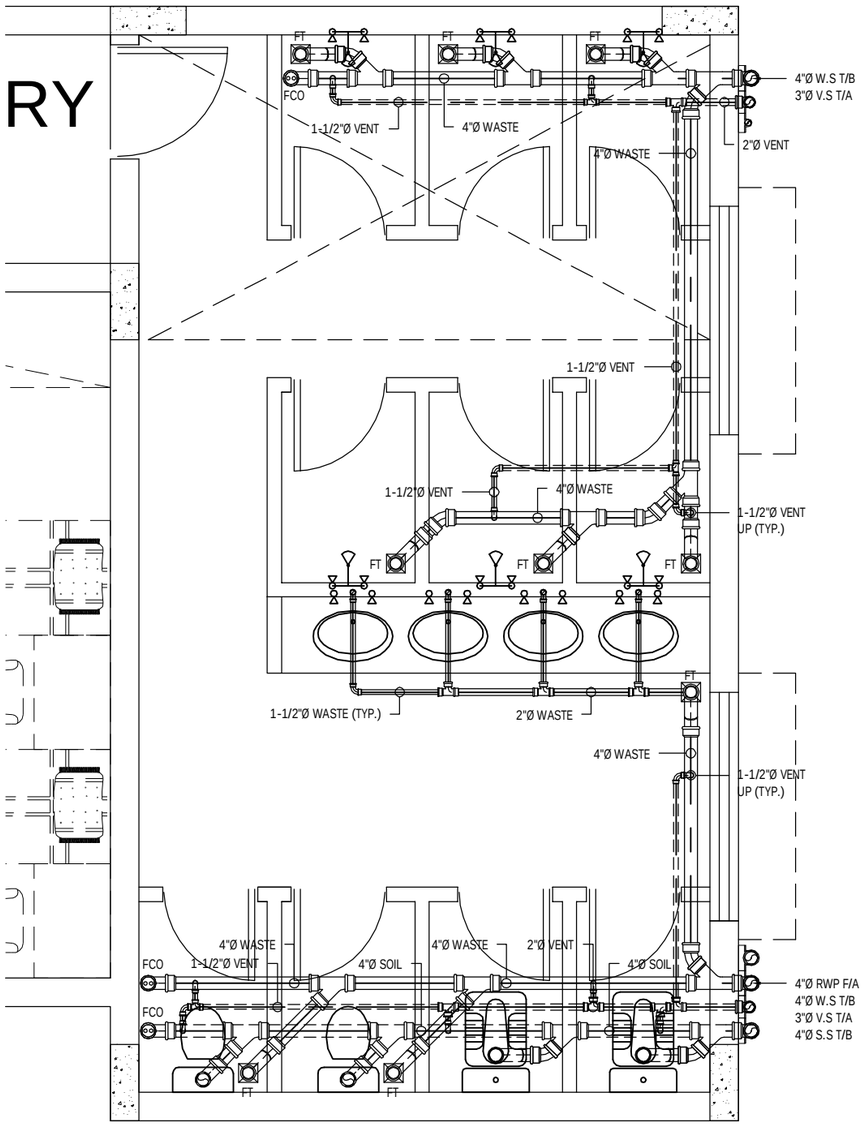
TITLE:
GROUND FLOOR PLAN
DRAINAGE SERVICES

DESIGNED BY: SH	SCALE: 1/4"=1'-0"	DATE: DEC, 2025
DRAWN BY: AI	JOB NO.: MBA/293/25	DRAWING NO.: ED-01
CHECKED BY: BR	ORIGINAL SHT SIZE: A3	
APPROVED BY: MB	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
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ENLARGE DETAIL - 03



ENLARGE DETAIL - 04

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REV. NO.	DESCRIPTION	DATE

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✉ info1.mbassociates@gmail.com
✉ info@mbassociates.com.pk

PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:

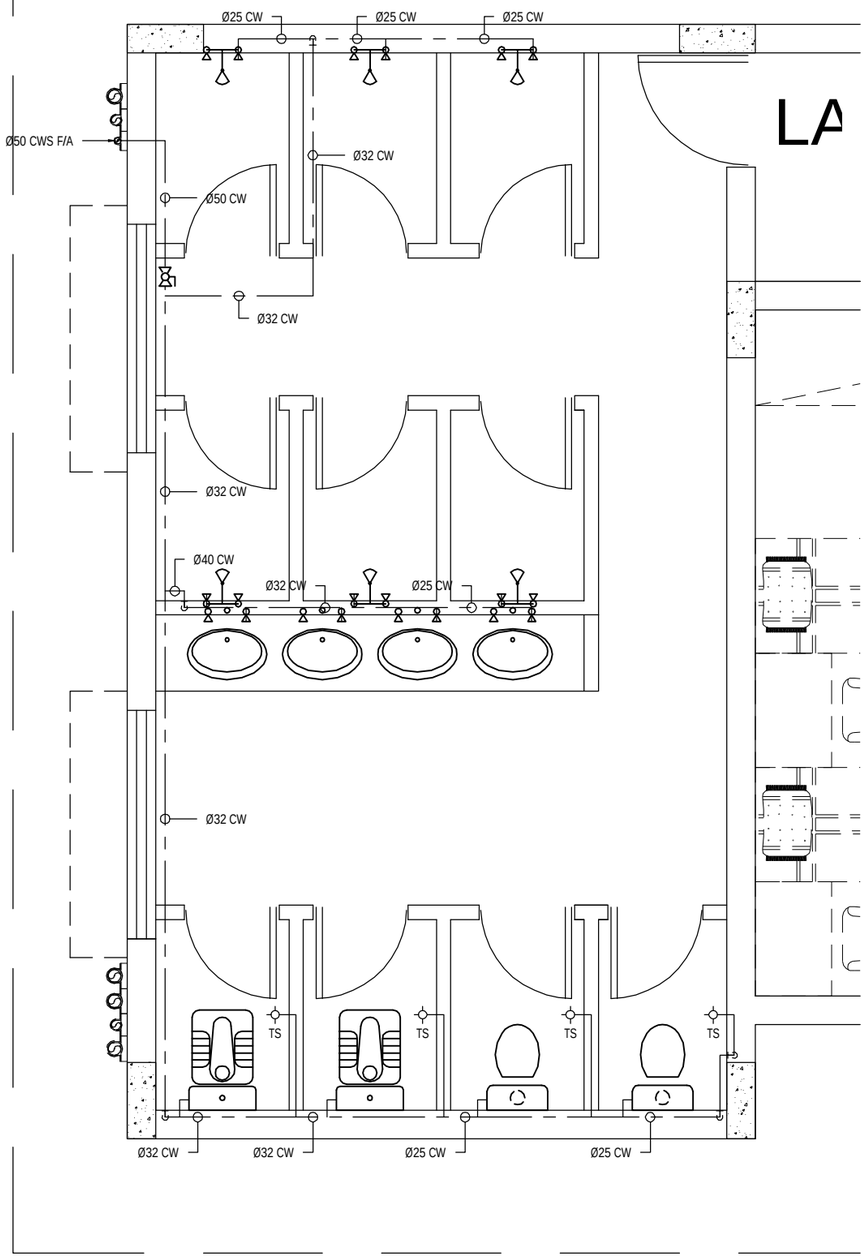
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 TH COMMERCIAL STREET, PHASE 2 (EXTN),
DEFENCE HOUSING AUTHORITY, KARACHI-75500
TEL: 021-35396444, 021-35312244
FAX: 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:

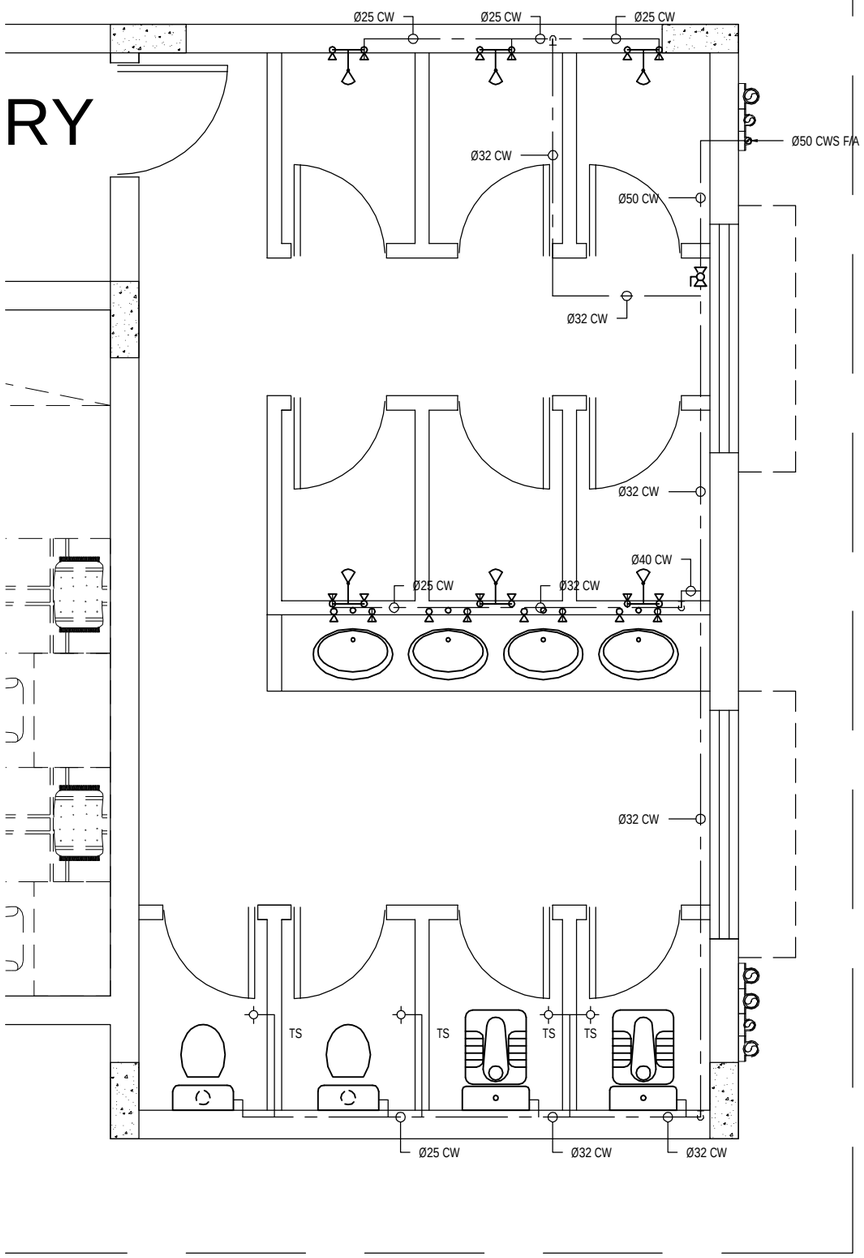
1ST FLOOR PLAN
DRAINAGE SERVICES

DESIGNED BY: SH	SCALE: 1/4"=1'-0"	DATE: DEC, 2025
DRAWN BY: AI	JOB NO.: MBA/293/25	DRAWING NO.: ED-02
CHECKED BY: BR	ORIGINAL SHT SIZE: A3	
APPROVED BY: MB	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
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ENLARGE DETAIL - 05



ENLARGE DETAIL - 06

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✉ info1.mbassociates@gmail.com
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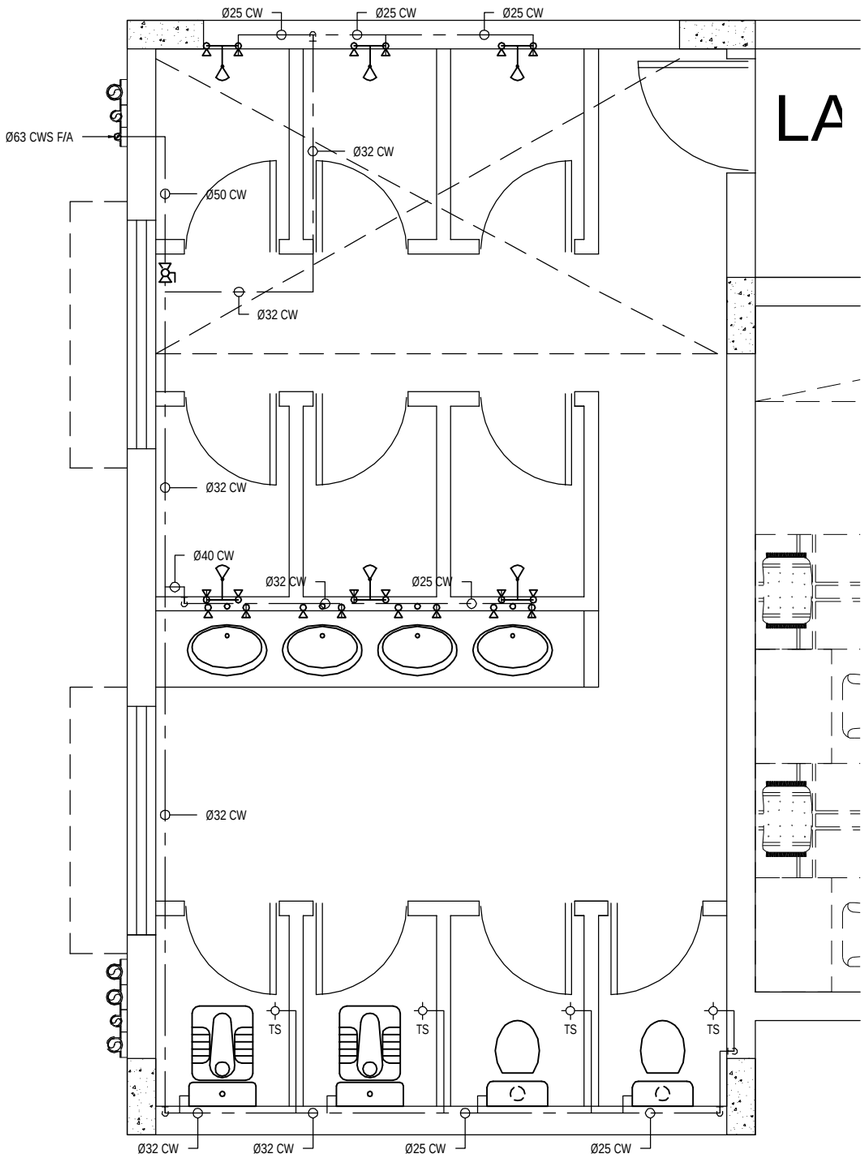
PROJECT:
CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 TH COMMERCIAL STREET, PHASE 2 (EXTN),
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TEL :021-35396444, 021-35312244
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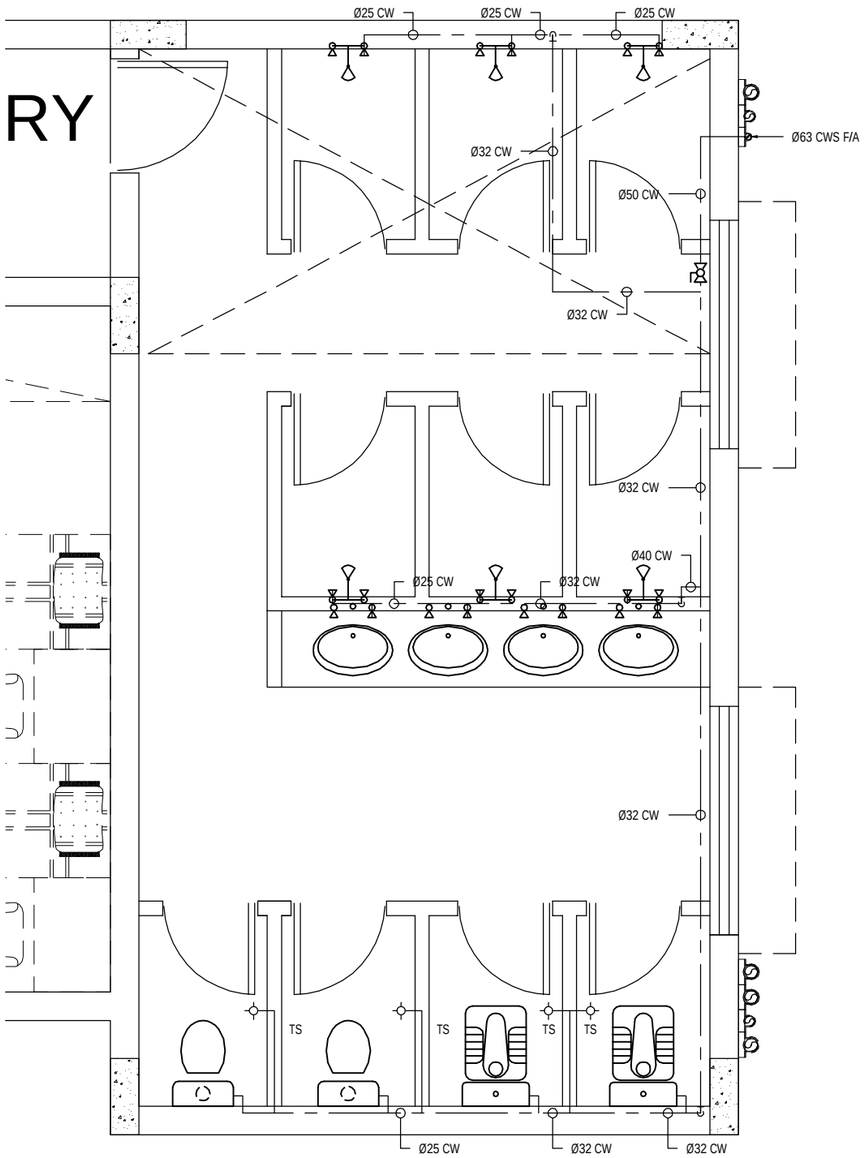
TITLE:
GROUND FLOOR PLAN
WATER SUPPLY SERVICES

DESIGNED BY: SH	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: AI	JOB NO.: 1/4"=1'-0"	DRAWING NO.: ED-03
CHECKED BY: BR	ORIGINAL SHT SIZE: A3	
APPROVED BY: MB	PLOTTED SHT SIZE: A3	

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ENLARGE DETAIL - 07



ENLARGE DETAIL - 08

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✉ info1.mbassociates@gmail.com
✉ info@mbassociates.com.pk

PROJECT:
CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:
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CONSULTING ENGINEERS & ARCHITECTS
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TEL :021-35396444, 021-35312244
FAX: 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:
1ST FLOOR PLAN
DRAINAGE SERVICES

DESIGNED BY: SH	SCALE: 1/4"=1'-0"	DATE: DEC, 2025
DRAWN BY: AI	JOB NO.: MBA/293/25	DRAWING NO.: ED-04
CHECKED BY: BR	ORIGINAL SHT SIZE: A3	
APPROVED BY: MB	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
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CADET COLLEGE SANGHAR

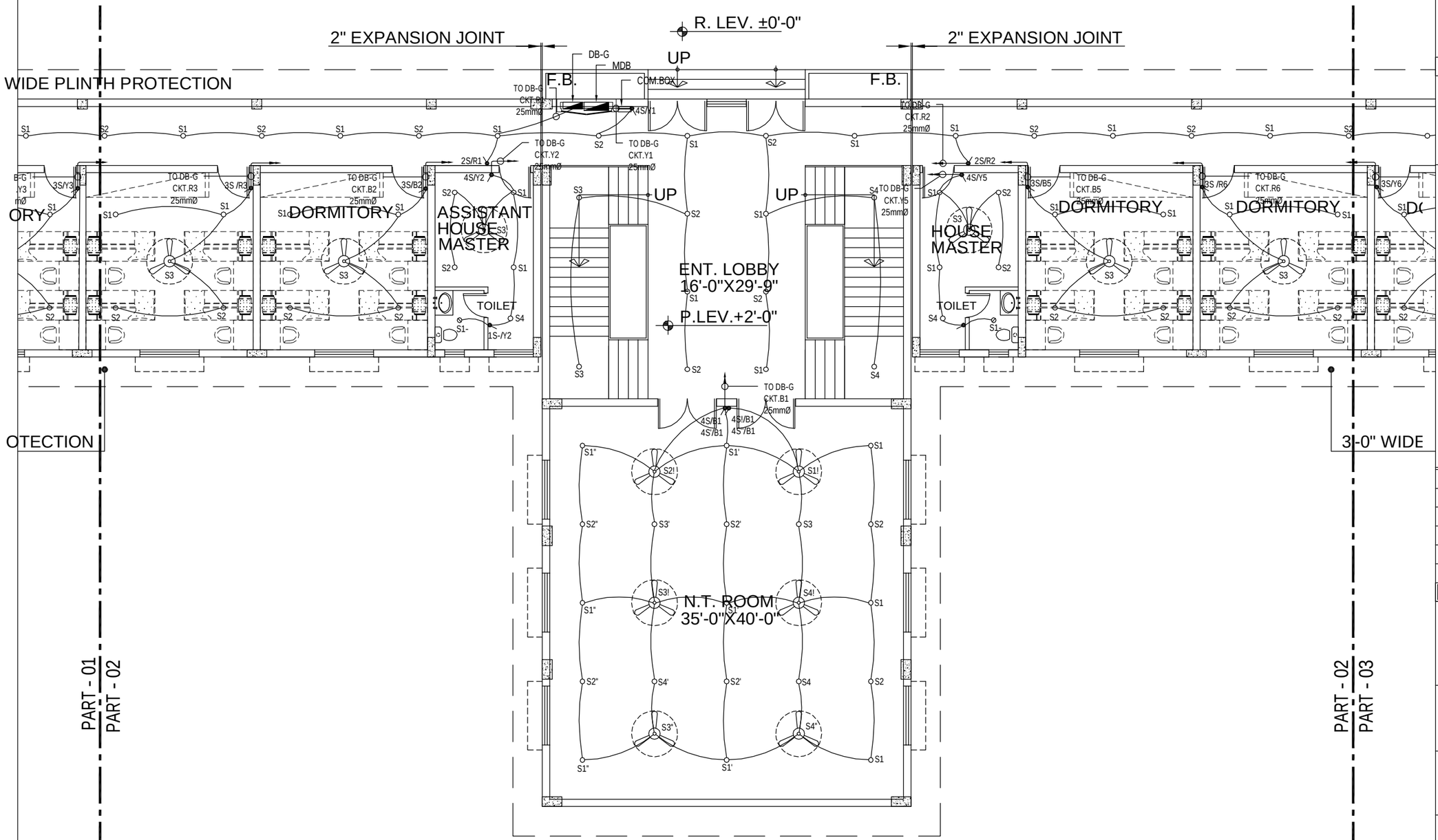
CONSTRUCTION OF
LAL SHAHBAZ QALANDAR BOYS HOSTEL

ELECTRICAL DRAWINGS

TENDER DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
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E-mail: info @ young associates .com.pk



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REV. NO.	DESCRIPTION	DATE

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✉ info@mbassociates.com.pk

PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:

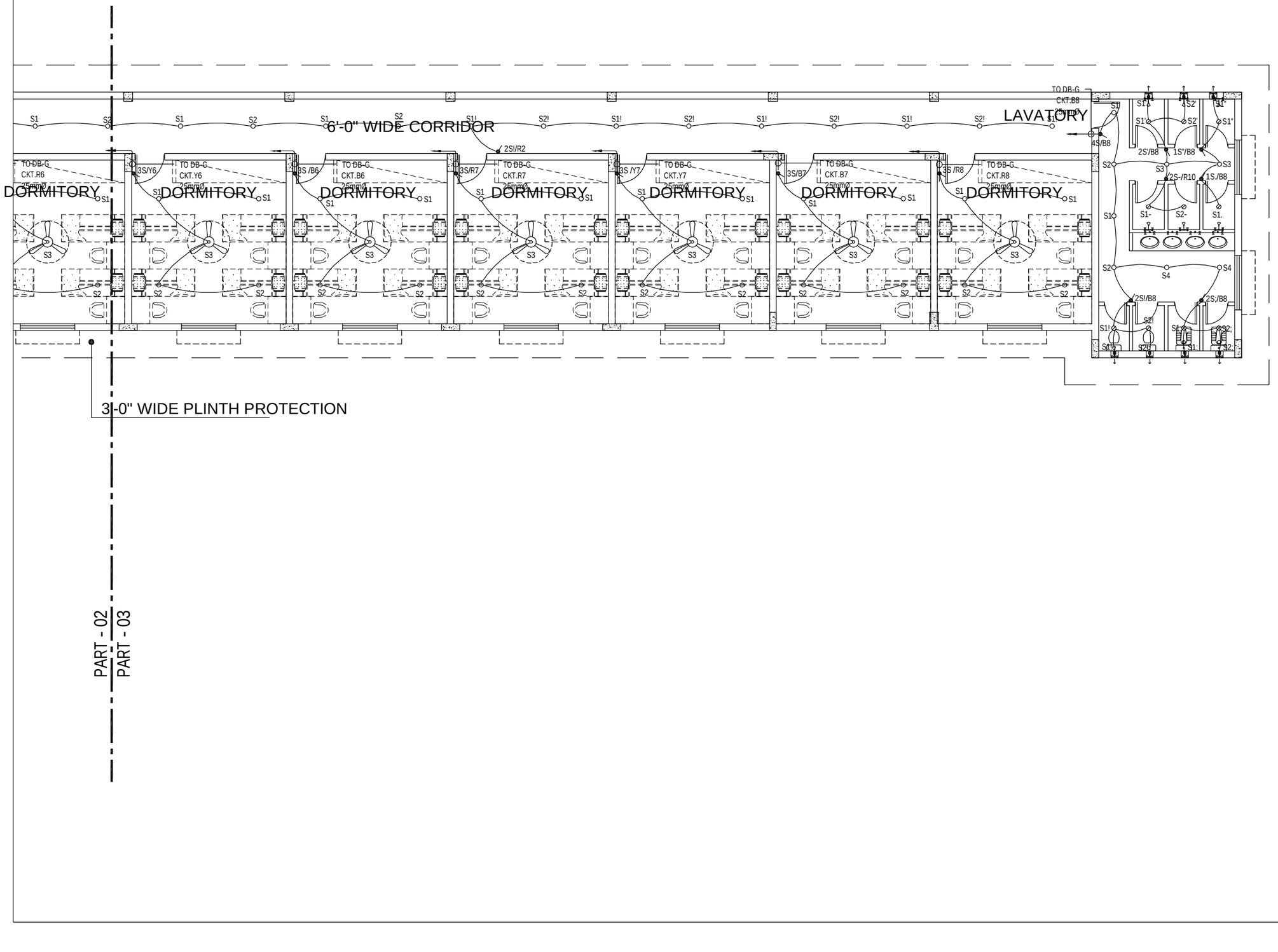
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9-C 24TH COMMERCIAL STREET, PHASE 2 (EXTN), DEFENCE HOUSING AUTHORITY, KARACHI-75500
TEL. 021-35396444, 021-35312244
FAX. 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:

GROUND FLOOR PLAN
(PART-2)
LIGHTING LAYOUT

DESIGNED BY	SCALE	DATE
LA	3/32"=1'-0"	DEC, 2025
DRAWN BY	JOB NO.	DRAWING NO.
LA	MBA/293/25	EL--01-01B
CHECKED BY	ORIGINAL SHT SIZE:	
SB	A3	
APPROVED BY	PLOTTED SHT SIZE:	
MA	A3	

CAD FILE NAME:
EL TENDER DRAWING, Cadet College Sanghar.dwg



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REV. NO.	DESCRIPTION	DATE

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☎ 00-021-33380396
✉ info1.mbassociates@gmail.com
✉ info@mbassociates.com.pk

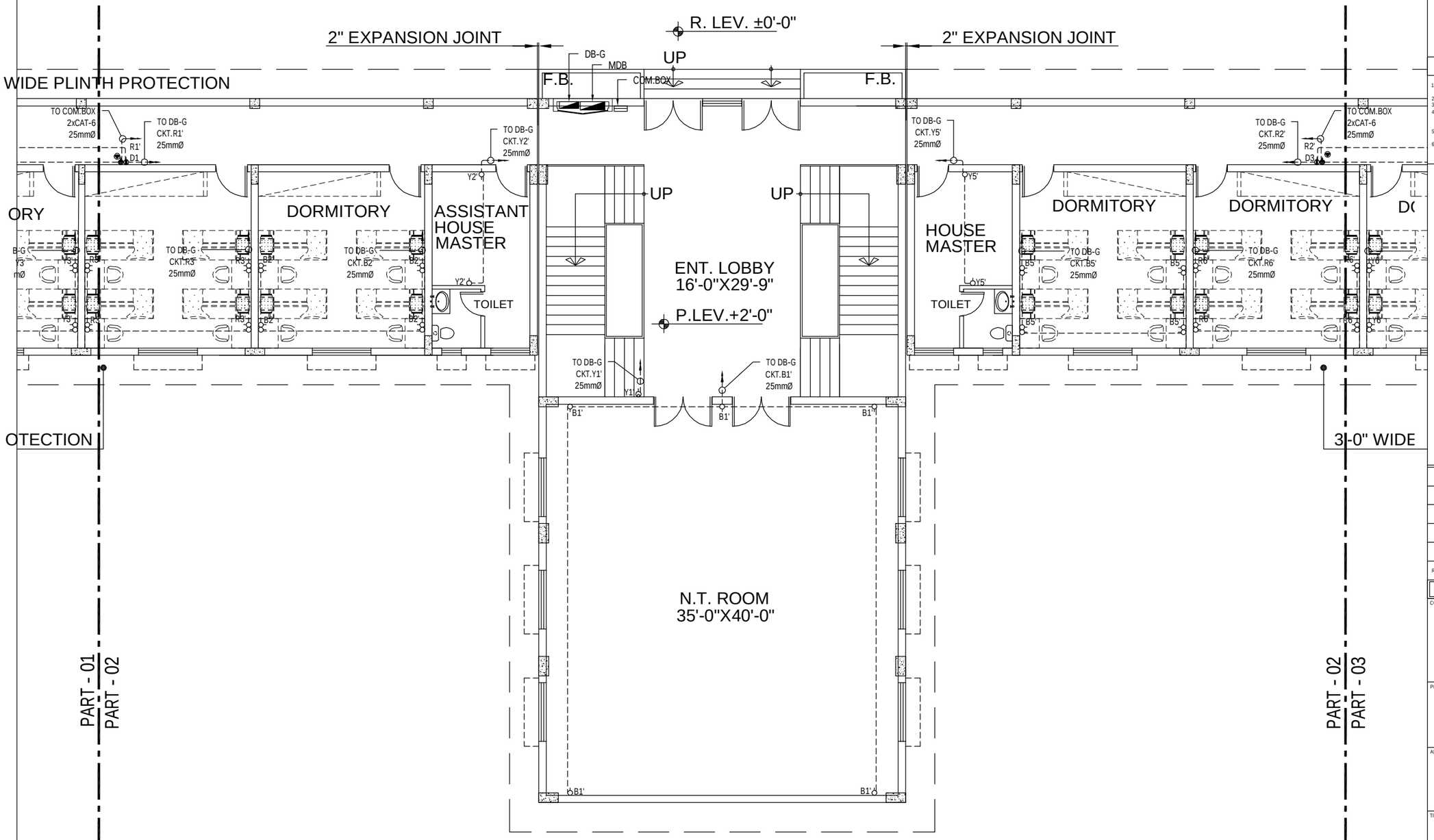
PROJECT:
CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 th Commercial street, Phase 2 (Extn),
Defence Housing Authority, Karachi-75500
Tel. 021-35396444, 021-35312244
FAX: 021-35883106
E-mail: info@youngassociates.com.pk

TITLE:
GROUND FLOOR PLAN
(PART-3)
LIGHTING LAYOUT

DESIGNED BY: LA	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: LA	JOB NO.: MBA/293/25	DRAWING NO.: EL-01-01C
CHECKED BY: SB	ORIGINAL SHT SIZE: A3	
APPROVED BY: MA	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
EL TENDER DRAWING, Cadet College Sanghar.dwg



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REV. NO.	DESCRIPTION	DATE

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✉ info1.mbassociates@gmail.com
✉ info@mbassociates.com.pk

PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:

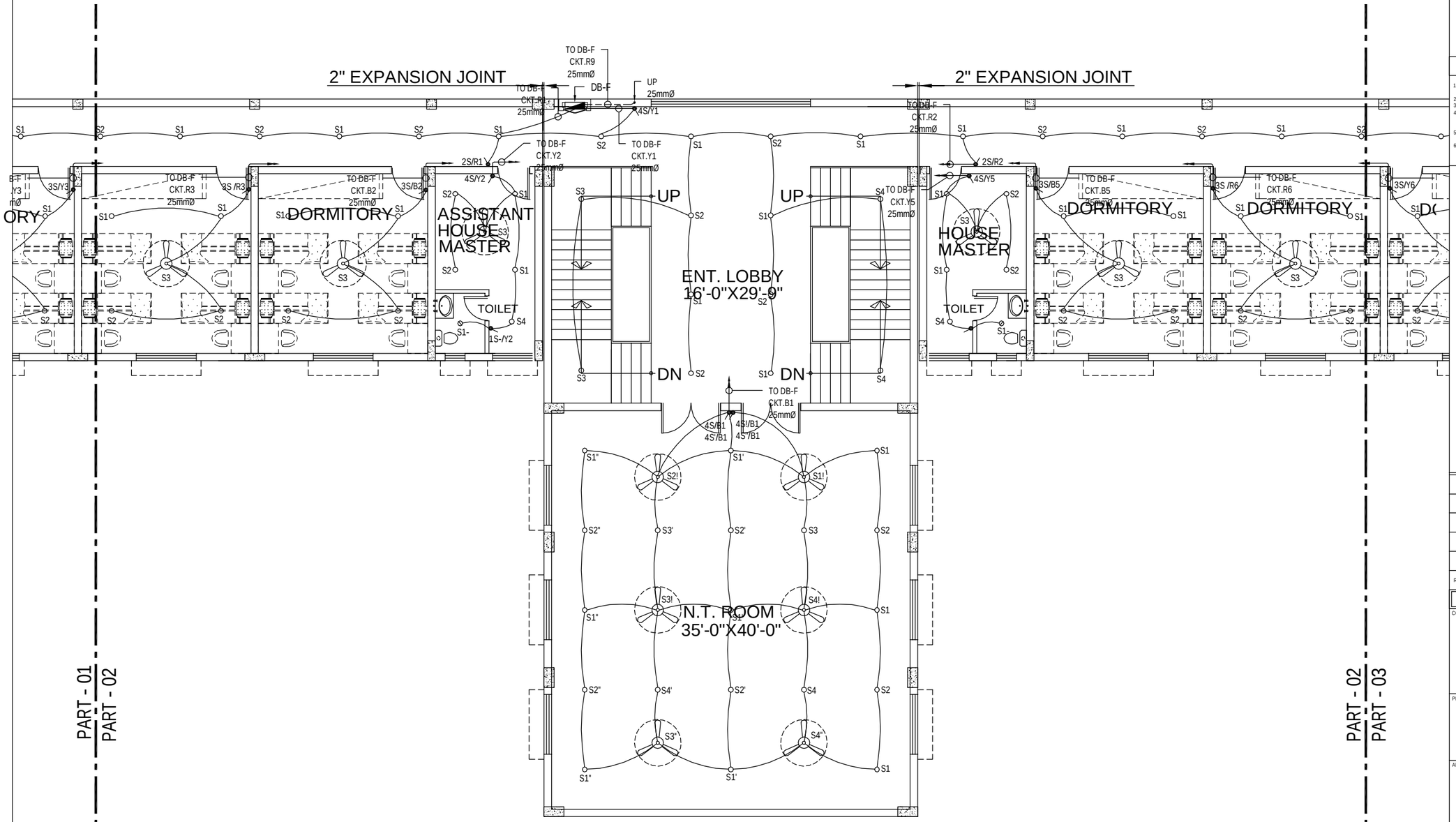
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 TH COMMERCIAL STREET, PHASE 2 (EXTN),
DEFENCE HOUSING AUTHORITY, KARACHI-75500
TEL 021-35396444, 021-35312244
FAX 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:

GROUND FLOOR PLAN
(PART-2)
POWER & COMMUNICATION LAYOUT

DESIGNED BY: LA	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: LA	JOB NO.: MBA/293/25	DRAWING NO.: EL--01-02B
CHECKED BY: SB	ORIGINAL SHT SIZE: A3	
APPROVED BY: MA	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
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PART - 01
PART - 02

PART - 02
PART - 03

KEY PLAN

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REV. NO.	DESCRIPTION	DATE

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✉ info@mbassociates.com.pk

PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:

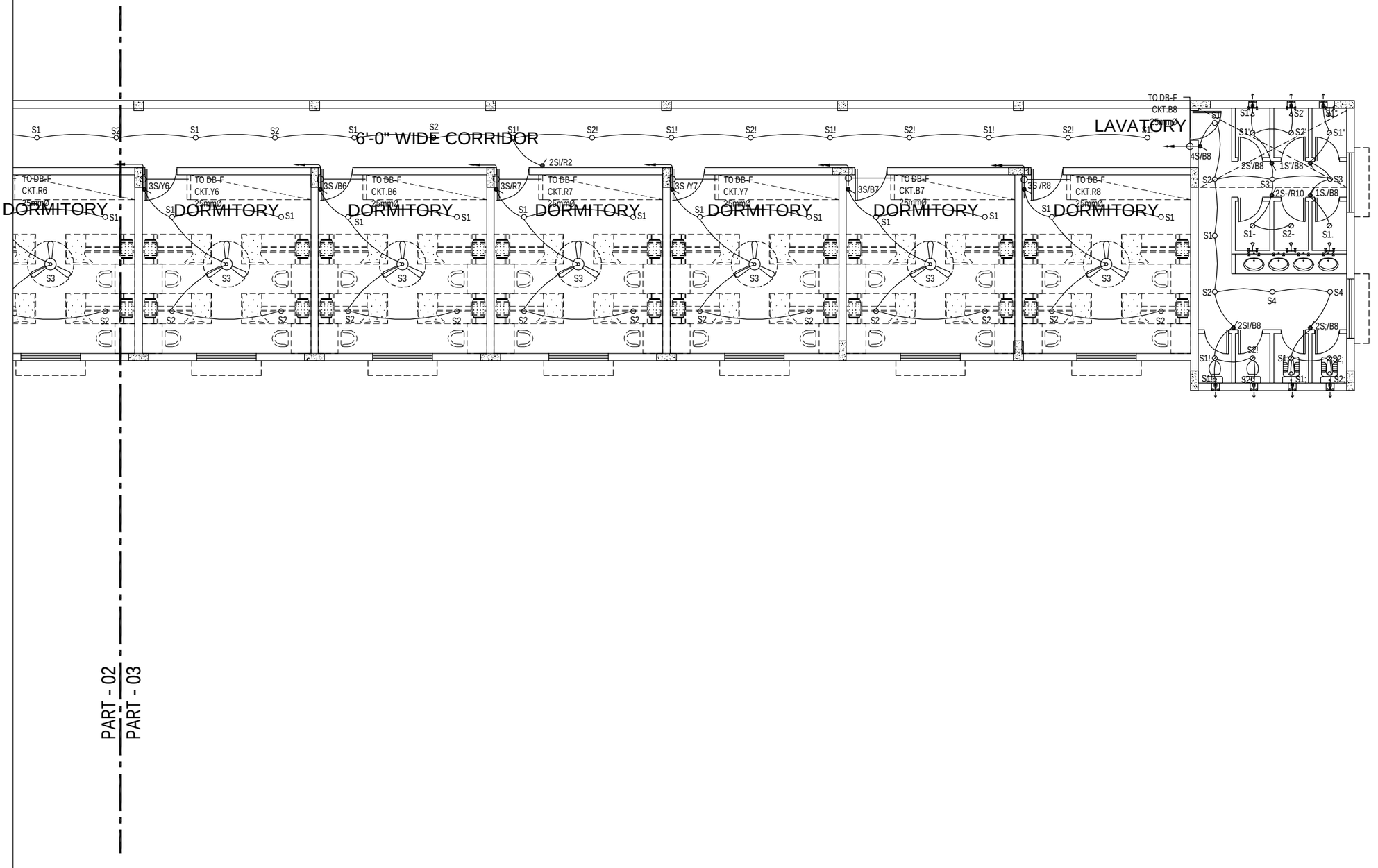
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 TH COMMERCIAL STREET, PHASE 2 (EXTN), DEFENCE HOUSING AUTHORITY, KARACHI-75500
TEL :021-35396444, 021-35312244
FAX: 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:

FIRST FLOOR PLAN
(PART-2)
LIGHTING LAYOUT

DESIGNED BY: LA	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: LA	JOB NO.: MBA/293/25	DRAWING NO.: EL--02-01B
CHECKED BY: SB	ORIGINAL SHT SIZE: A3	
APPROVED BY: MA	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
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REV. NO.	DESCRIPTION	DATE

TENDER DRAWING

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✉ info1.mbassociates@gmail.com
✉ info@mbassociates.com.pk

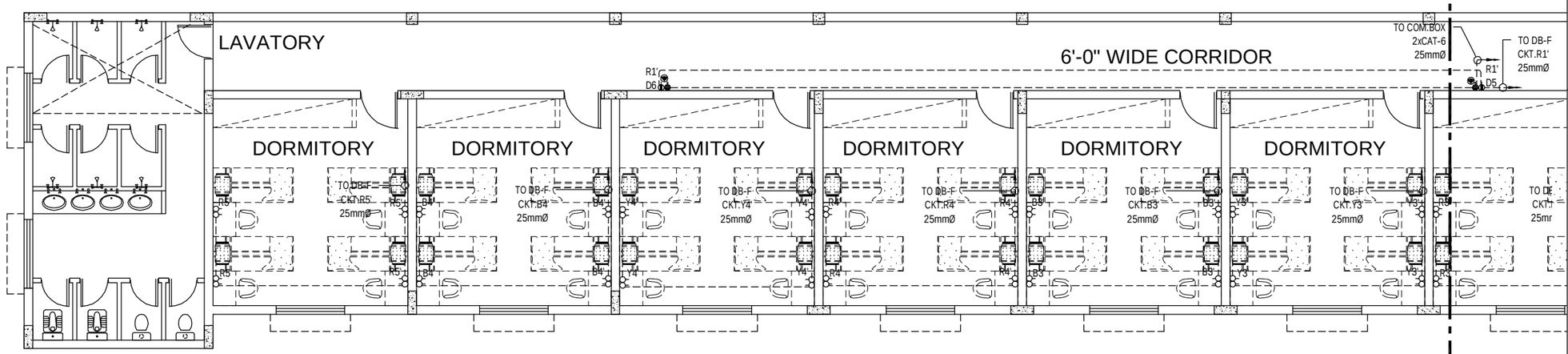
PROJECT:
CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 th Commercial street, Phase 2 (Extn),
Defence Housing Authority, Karachi-75500
Tel. 021-35396444, 021-35312244
FAX: 021-35883106
E-mail: info@youngassociates.com.pk

TITLE:
FIRST FLOOR PLAN
(PART-3)
LIGHTING LAYOUT

DESIGNED BY: LA	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: LA	JOB NO.: MBA/293/25	DRAWING NO.: EL-02-01C
CHECKED BY: SB	ORIGINAL SHT SIZE: A3	
APPROVED BY: MA	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
EL TENDER DRAWING, Cadet College Sanghar.dwg



FIRST FLOOR PLAN

PART - 01
PART - 02

KEY PLAN

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REV. NO.	DESCRIPTION	DATE

TENDER DRAWING

CONSULTANTS:
MB ASSOCIATES
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☎ 00-021-33380396
✉ info1.mbassociates@gmail.com
✉ info@mbassociates.com.pk

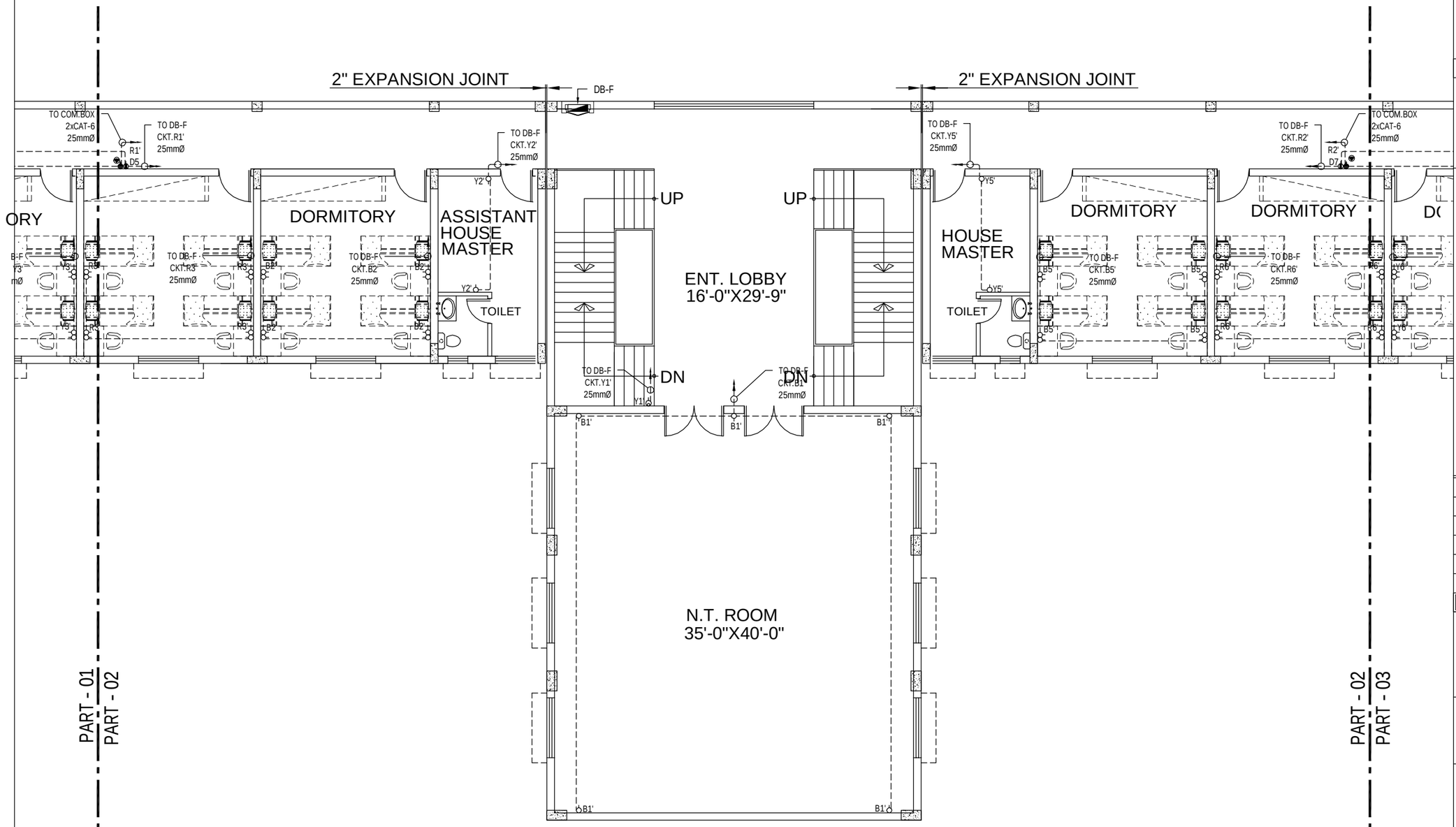
PROJECT:
CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 TH COMMERCIAL STREET, PHASE 2 (EXTN),
DEFENCE HOUSING AUTHORITY, KARACHI-75500
TEL :021-35396444, 021-35312244
FAX: 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:
FIRST FLOOR PLAN
(PART-1)
POWER & COMMUNICATION LAYOUT

DESIGNED BY: LA	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: LA	JOB NO.: MBA/293/25	DRAWING NO.: EL-02-02A
CHECKED BY: SB	ORIGINAL SHT SIZE: A3	
APPROVED BY: MA	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
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REV. NO.	DESCRIPTION	DATE

TENDER DRAWING

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✉ info1.mbassociates@gmail.com
✉ info@mbassociates.com.pk

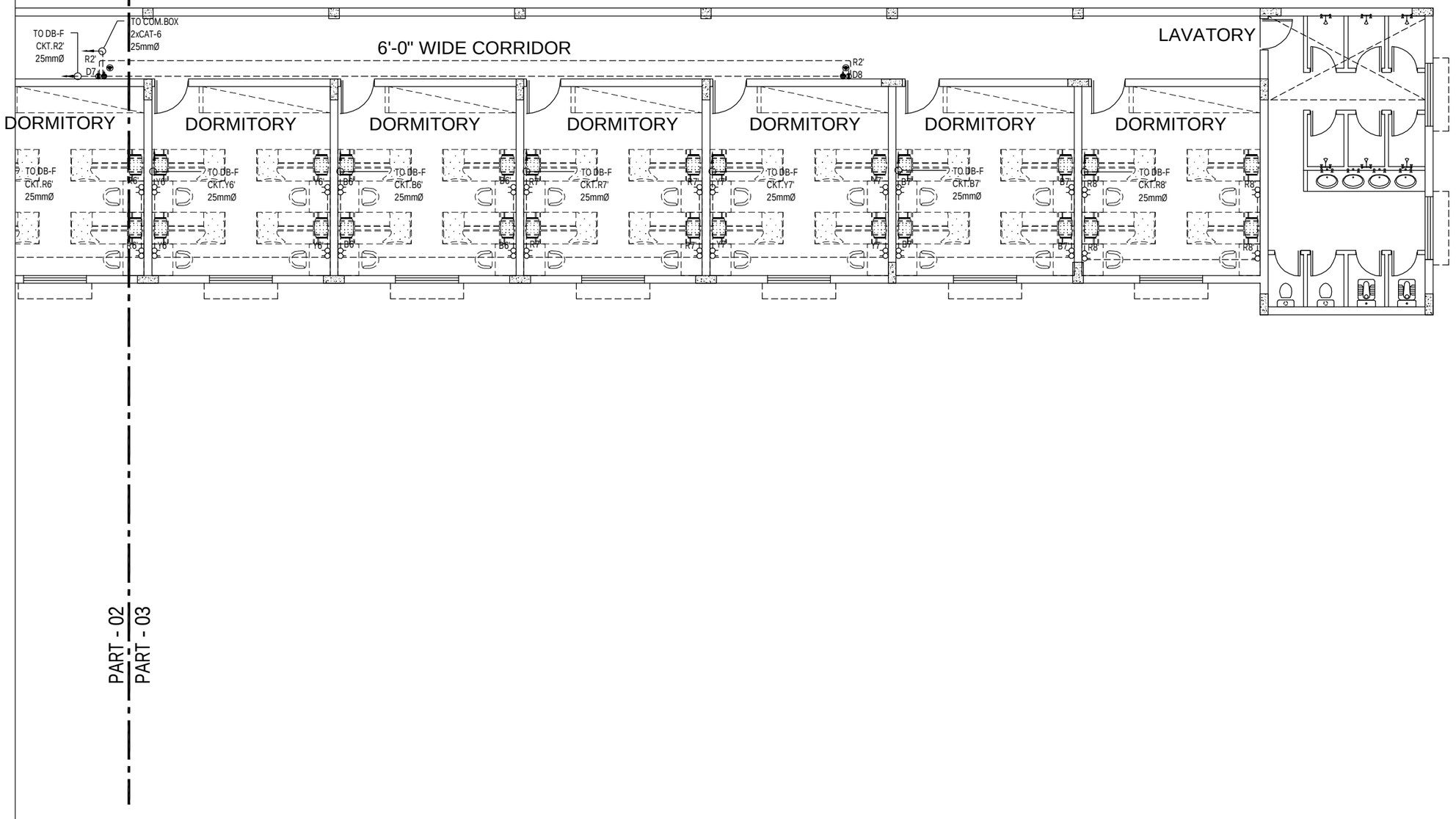
PROJECT:
CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 TH COMMERCIAL STREET, PHASE 2 (EXTN),
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TEL 021-35396444, 021-35312244
FAX 021-35883106
E-MAIL: INFO@YOUNGASSOCIATES.COM.PK

TITLE:
FIRST FLOOR PLAN
(PART-2)
POWER & COMMUNICATION LAYOUT

DESIGNED BY: LA	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: LA	JOB NO.: MBA/293/25	DRAWING NO.: EL--02-02B
CHECKED BY: SB	ORIGINAL SHT SIZE: A3	
APPROVED BY: MA	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
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REV. NO.	DESCRIPTION	DATE

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CONSULTANTS:

MB ASSOCIATES
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☎ 00-021-33380396
✉ info1.mbassociates@gmail.com
✉ info@mbassociates.com.pk

PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:

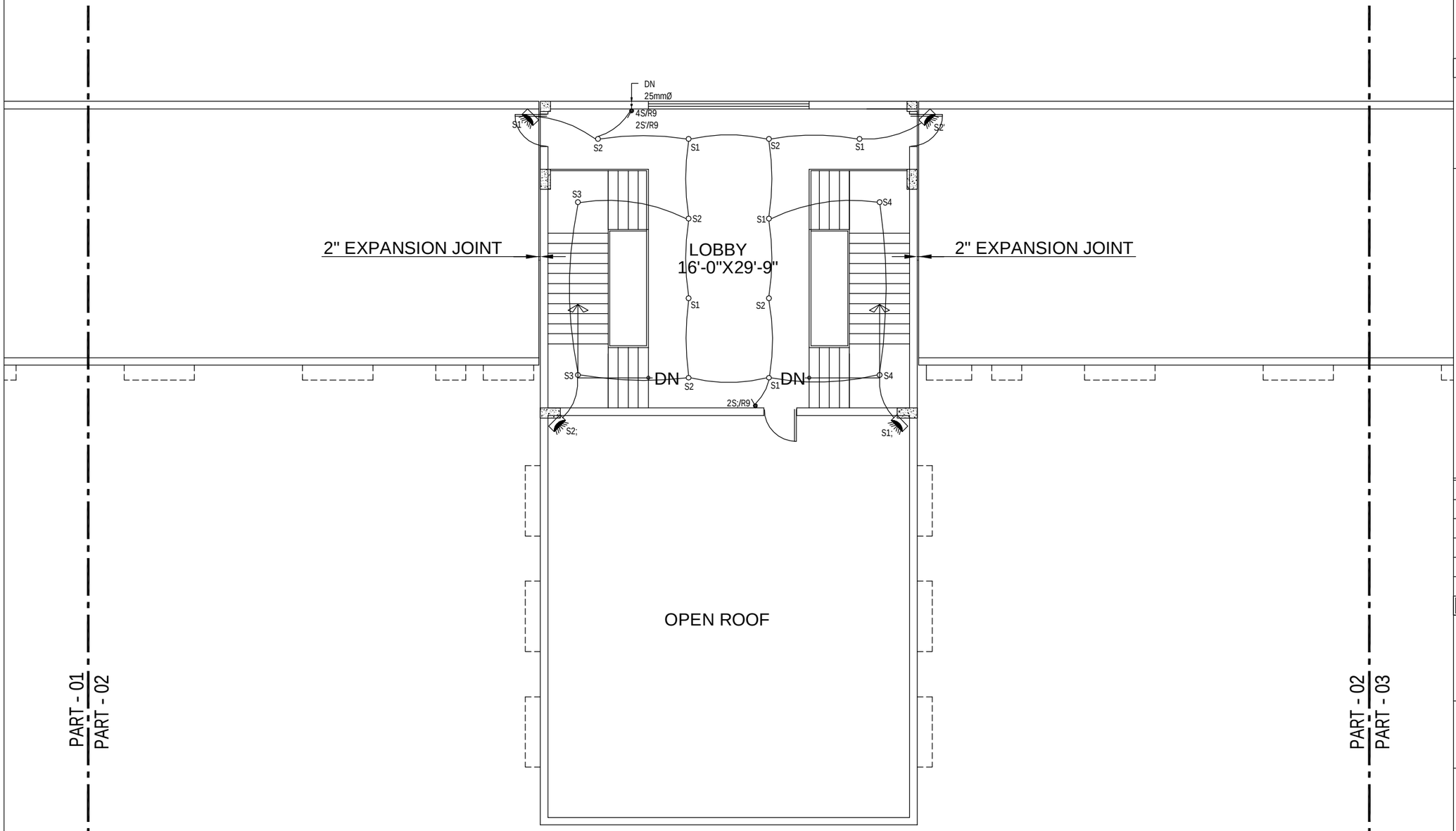
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 th Commercial street, Phase 2 (Extn),
Defence Housing Authority, Karachi-75500
Tel. 021-35396444, 021-35312244
FAX: 021-35883106
E-mail: info@youngassociates.com.pk

TITLE:

FIRST FLOOR PLAN
(PART-3)
POWER & COMMUNICATION LAYOUT

DESIGNED BY: LA	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: LA	JOB NO.: MBA/293/25	DRAWING NO.: EL-02-02C
CHECKED BY: SB	ORIGINAL SHT SIZE: A3	
APPROVED BY: MA	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
EL TENDER DRAWING, Cadet College Sanghar.dwg



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CONSULTANTS:

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PROJECT:

CADET COLLEGE SANGHAR
HOSTEL BUILDING

ARCHITECTS:

YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
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Defence Housing Authority, Karachi-75500
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Fax: 021-35883106
E-mail: info@youngassociates.com.pk

TITLE:

ROOF PLAN
(PART-2)
LIGHTING LAYOUT

DESIGNED BY: LA	SCALE: 3/32"=1'-0"	DATE: DEC, 2025
DRAWN BY: LA	JOB NO.: MBA/293/25	DRAWING NO.: EL--03-01A
CHECKED BY: SB	ORIGINAL SHT SIZE: A3	
APPROVED BY: MA	PLOTTED SHT SIZE: A3	

CAD FILE NAME:
EL TENDER DRAWING, Cadet College Sanghar.dwg

CADET COLLEGE SANGHAR

STAFF FAMILY QUARTERS / FLATS CATEGORY-IV
(OFFICERS COLONY)

TENDER DRAWINGS

ARCHITECTURAL , STRUCTURAL
ELECTRICAL & PLUMBING DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
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ARCHITECTURAL DRAWINGS

PREPARED BY:

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LIST OF ARCHITECTURAL DRAWINGS

S.NO.	DWG. NO.	DESCRIPTION
1	AR.00	LIST OF DRAWING
2	AR.01	SITE PLAN
3	AR.02	GROUND FLOOR PLAN
4	AR.03	FIRST FLOOR PLAN
5	AR.04	ROOF PLAN
6	AR.05	FRONT ELEVATION
7	AR.06	RIGHT SIDE ELEVATION
8	AR.07	LEFT SIDE ELEVATION
9	AR.08	REAR ELEVATION
10	AR.09	SECTION AT AA
11	AR.10	SECTION AT BB

3rd Revision : ---------- Date : --------

2nd Revision : ---------- Date : --------

1st Revision : ---------- Date : --------

ISSUED FOR TENDER DRAWING Date : 09-12--2025

CLIENT: CADET COLLEGE SANGHAR

JOB TITLE : SAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)

DESCRIPTION : LIST OF DRAWINGS

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9-C 24 th Commercial street, Phase 2 (Extn),
Defence Housing Authority, Karachi-75500
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FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO : 303 / 11

DRG. NO. : 303 / 11 AR-00

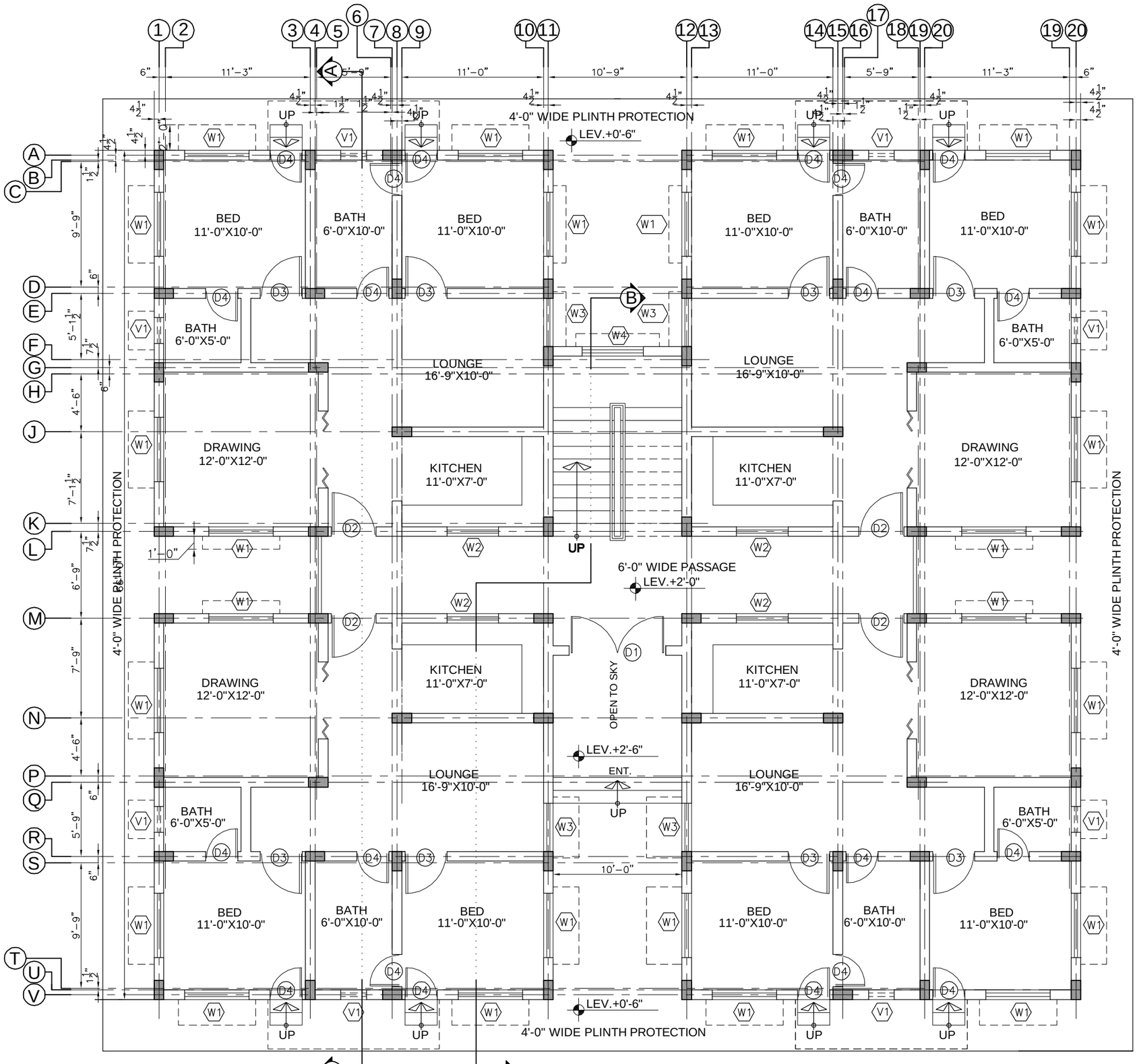
DRAWN BY : AAMIR | CHECKED BY : MUNEER

SCALE :1/10"=1'-0" | DATE : 09-12--2025



3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	GOOGL IMAGE
JOB TITLE :	STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)		
YOUNG ASSOCIATES CONSULTING ENGINEERS & ARCHITECTS 9-C 24 th Commercial street, Phase 2 (Extn), Defence Housing Authority, Karachi-75500 Tel :021-35396444, 021-35312244 FAX: 021-35883106 E-mail: info@youngassociates.com.pk		JOB NO :	303 / 11
		DRG. NO. :	303 / 11 AR-01
		DRAWN BY : AAMIR	CHECKED BY : MUNEER
		SCALE :1/10"=1'-0"	DATE : 09-12-2025



GROUND FLOOR PLAN
COVERED AREA = 4179.00 SQ.FT.

SCHEDULE OF DOORS, WINDOWS & VENTILATORS

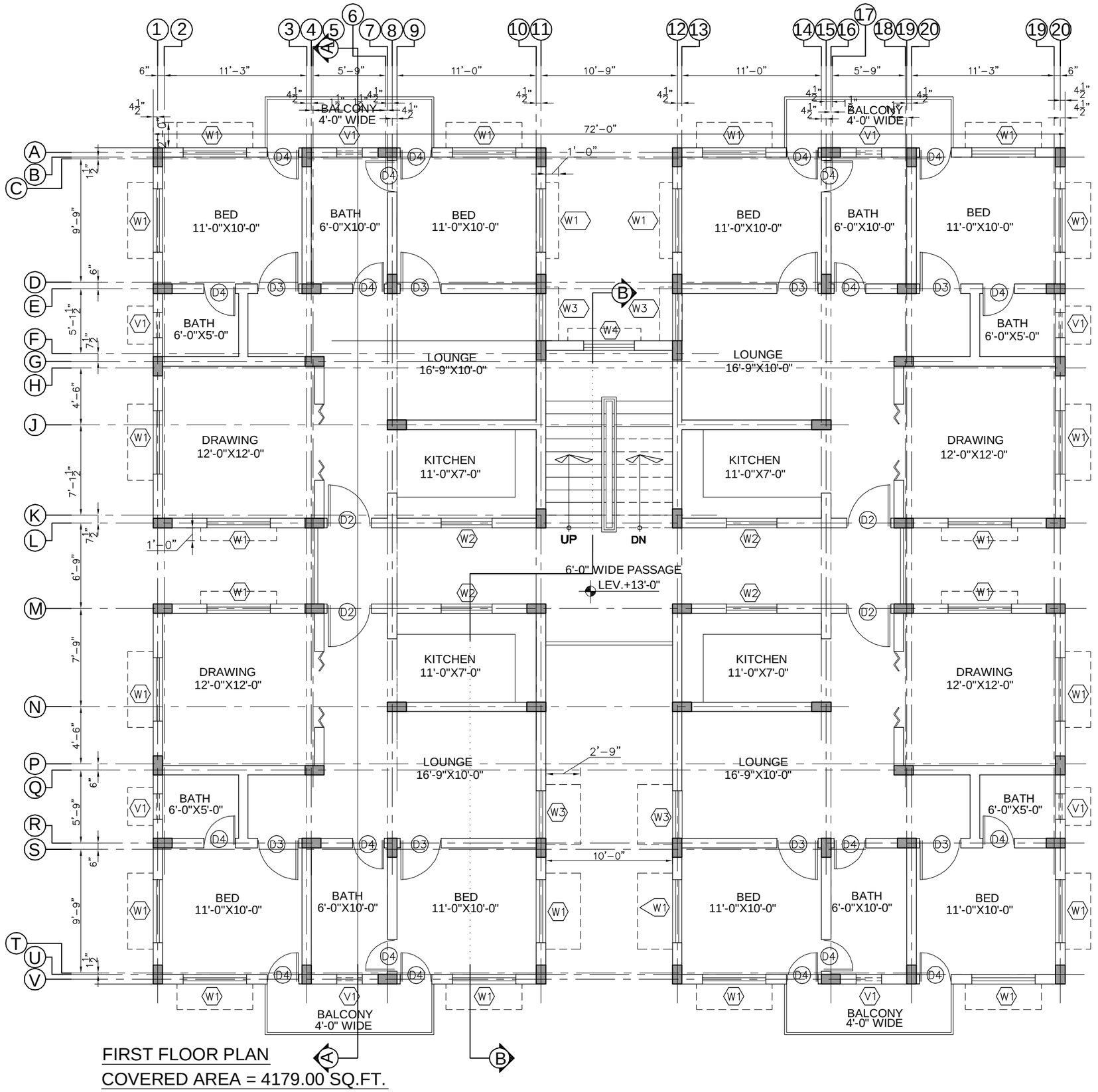
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D2	3'-3"	7'-0"
D3	3'-0"	7'-0"
D4	2'-6"	7'-0"
	WINDOWS	
	WIDTH	HEIGHT
W1	5'-0"	4'-0"
W2	4'-0"	3'-0"
W3	3'-9"	4'-0"
	VENTILATORS	
	WIDTH	HEIGHT
V1	2'-0"	2'-0"

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12--2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	GROUND FLOOR PLAN
JOB TITLE :	STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)		

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Tel :021-35396444, 021-35312244
FAX: 021-35893106
E-mail: info@youngassociates.com.pk

JOB NO :	303 / 11		
DRG. NO. :	303 / 11 AR-02		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :1/10"=1'-0"		DATE :	09-12--2025



FIRST FLOOR PLAN

COVERED AREA = 4179.00 SQ.FT.

SCHEDULE OF DOORS, WINDOWS & VENTILATORS

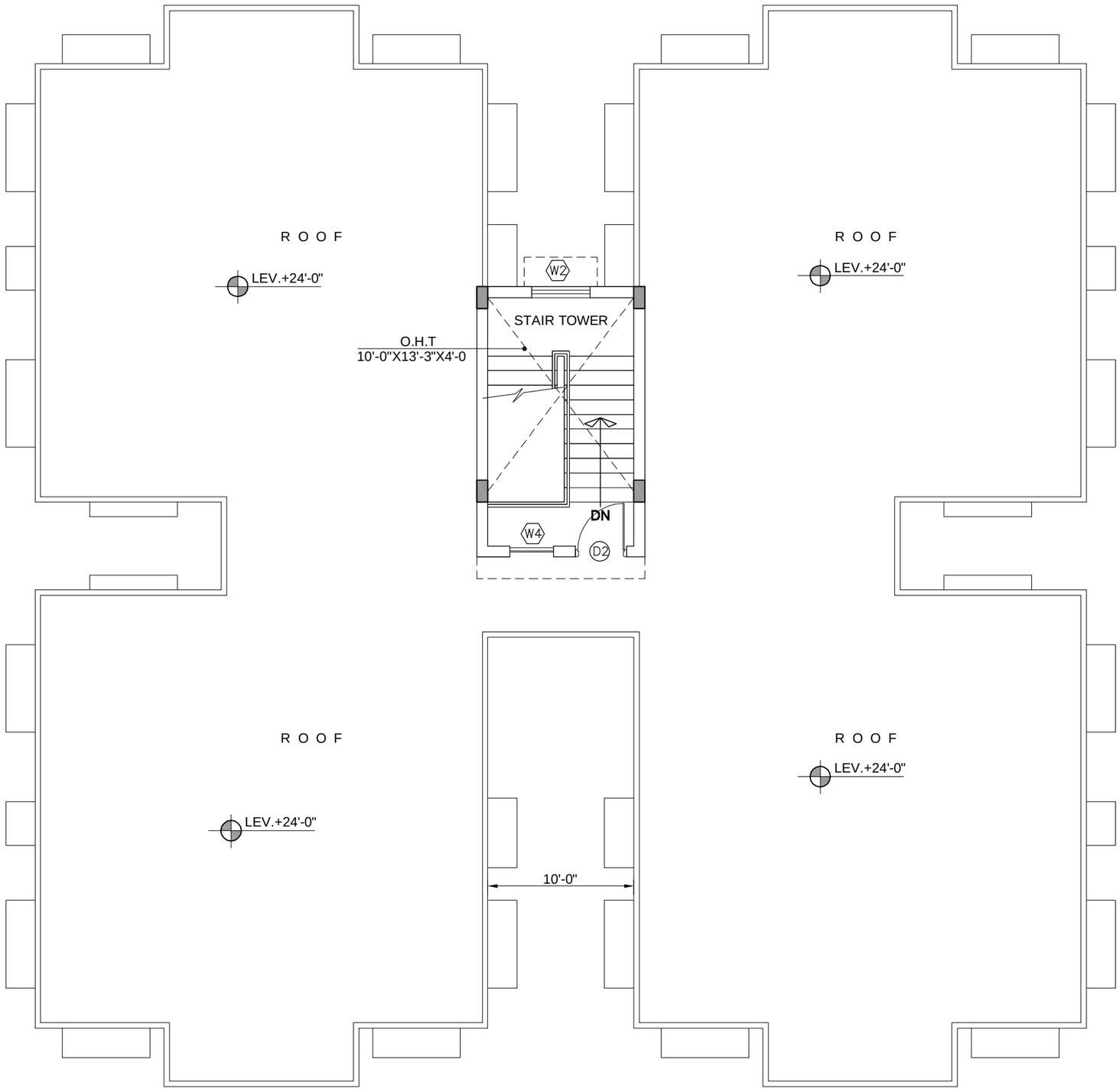
S.NO.	DOORS	
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	WIDTH	HEIGHT
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D2	3'-3"	7'-0"
D3	3'-0"	7'-0"
D4	2'-6"	7'-0"
	WINDOWS	
	WIDTH	HEIGHT
W1	5'-0"	4'-0"
W2	4'-0"	3'-0"
W3	3'-9"	4'-0"
	VENTILATORS	
	WIDTH	HEIGHT
V1	2'-0"	2'-0"

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12--2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	FIRST FLOOR PLAN
JOB TITLE :	STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)		

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E-mail: info@youngassociates.com.pk

JOB NO :	303 / 11		
DRG. NO. :	303/11 AR-03		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1/10"=1'-0"	DATE :	09-12--2025



ROOF PLAN

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12--2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	ROOF PLAN
JOB TITLE :	STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)		
YOUNG ASSOCIATES CONSULTING ENGINEERS & ARCHITECTS 9-C 24 th Commercial street, Phase 2 (Extn), Defence Housing Authority, Karachi-75500 Tel :021-35396444, 021-35312244 FAX: 021-35883106 E-mail: info@youngassociates.com.pk		JOB NO :	303 / 11
		DRG. NO. :	303 / 11 AR-04
		DRAWN BY : AAMIR	CHECKED BY : MUNEER
		SCALE :1/10"=1'-0"	DATE : 09-12--2025



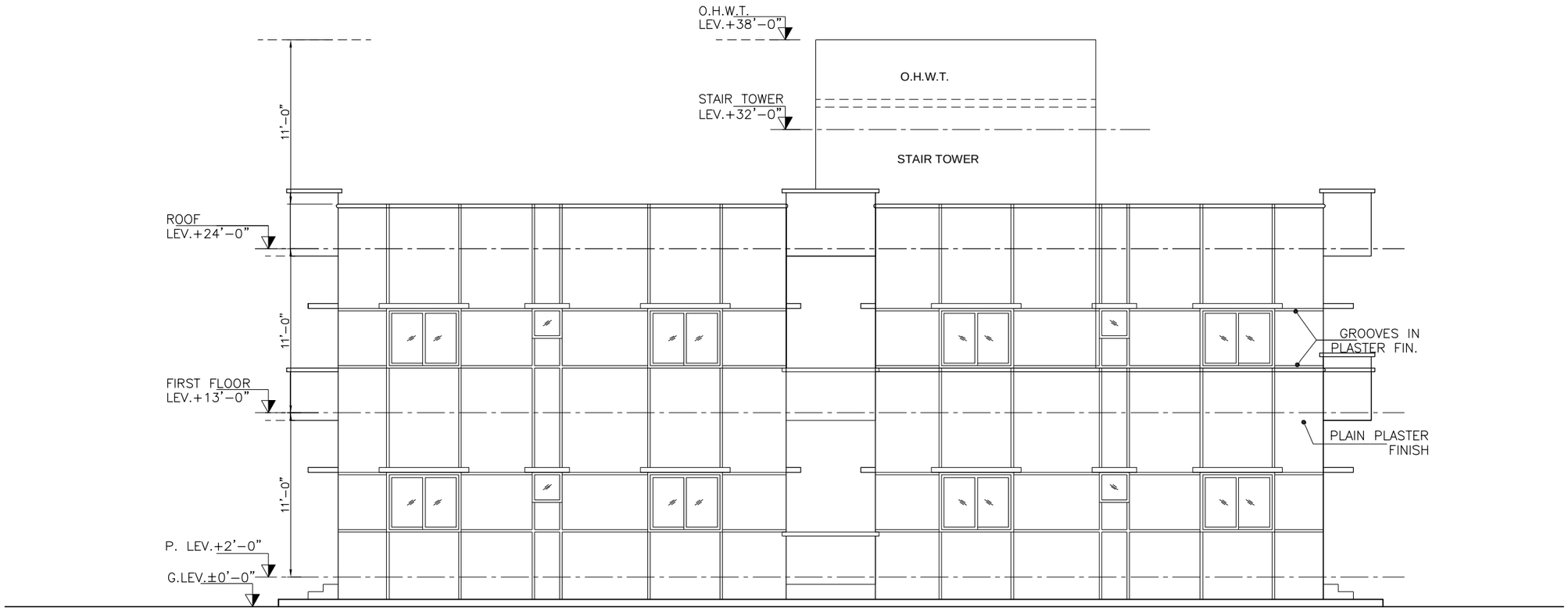
FRONT ELEVATION

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12--2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FRONT ELEVATION
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO : 303 / 11	
DRG. NO. : 303 / 11 AR-05	
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE :1/10"=1'-0"	DATE : 09-12--2025



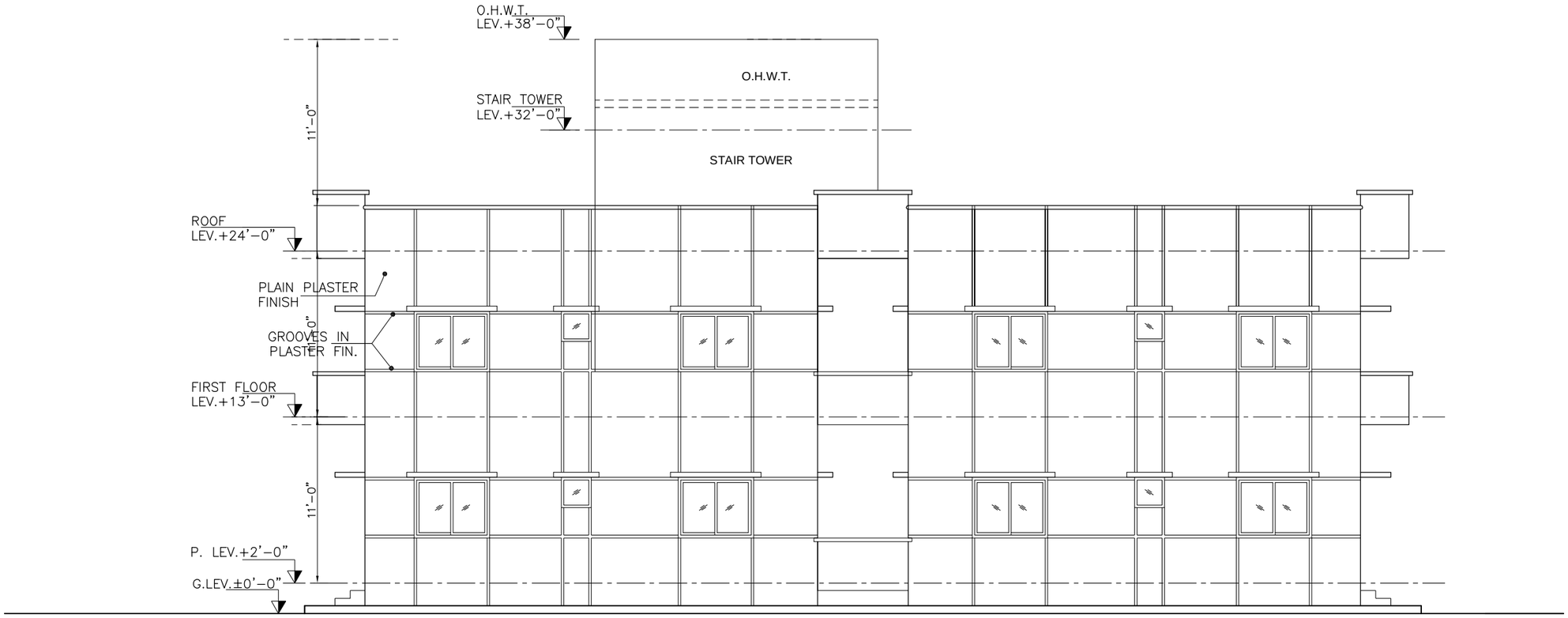
RIGHT SIDE ELEVATION

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12--2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : RIGHT SIDE ELEVATION
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO : 303 / 11	
DRG. NO. : 303 / 11 AR-06	
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE :1/10"=1'-0"	DATE : 09-12--2025



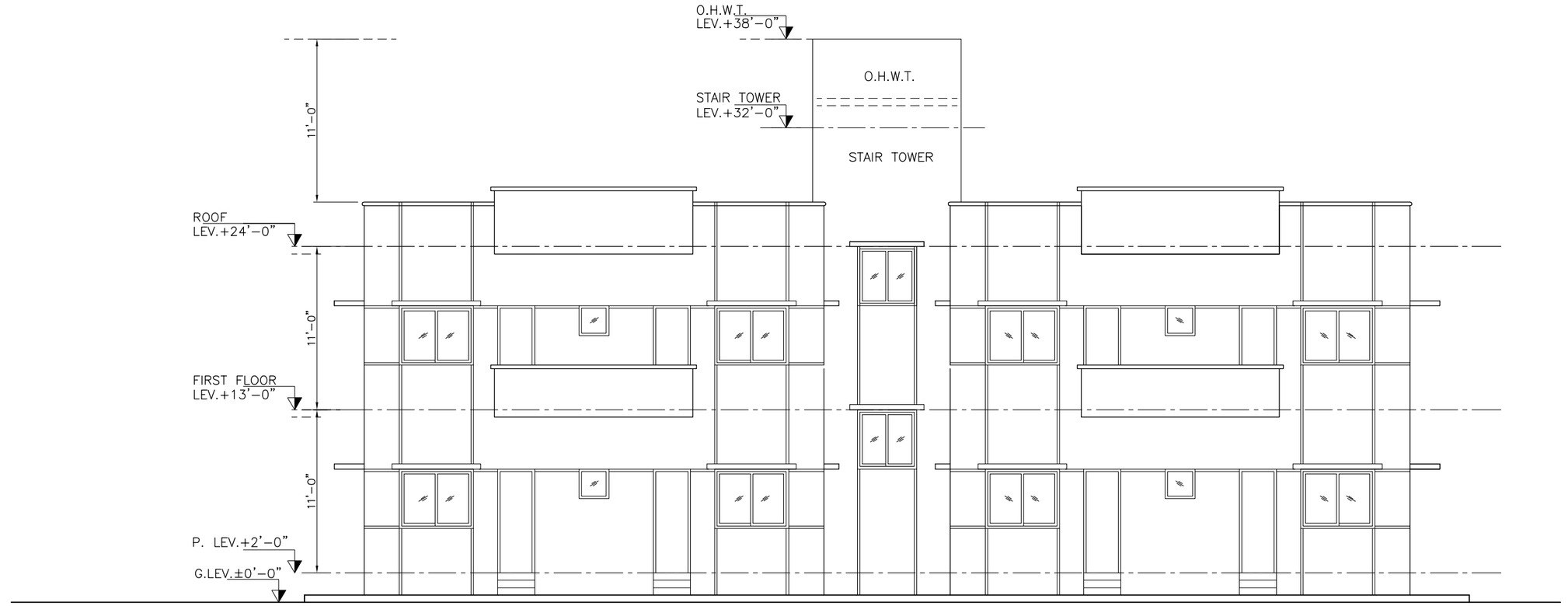
LEFT SIDE ELEVATION

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12--2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : LEFT SIDE ELEVATION
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

YOUNG ASSOCIATES
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FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO : 303 / 11	
DRG. NO. : 303 / 11 AR-07	
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE :1/10"=1'-0"	DATE : 09-12--2025



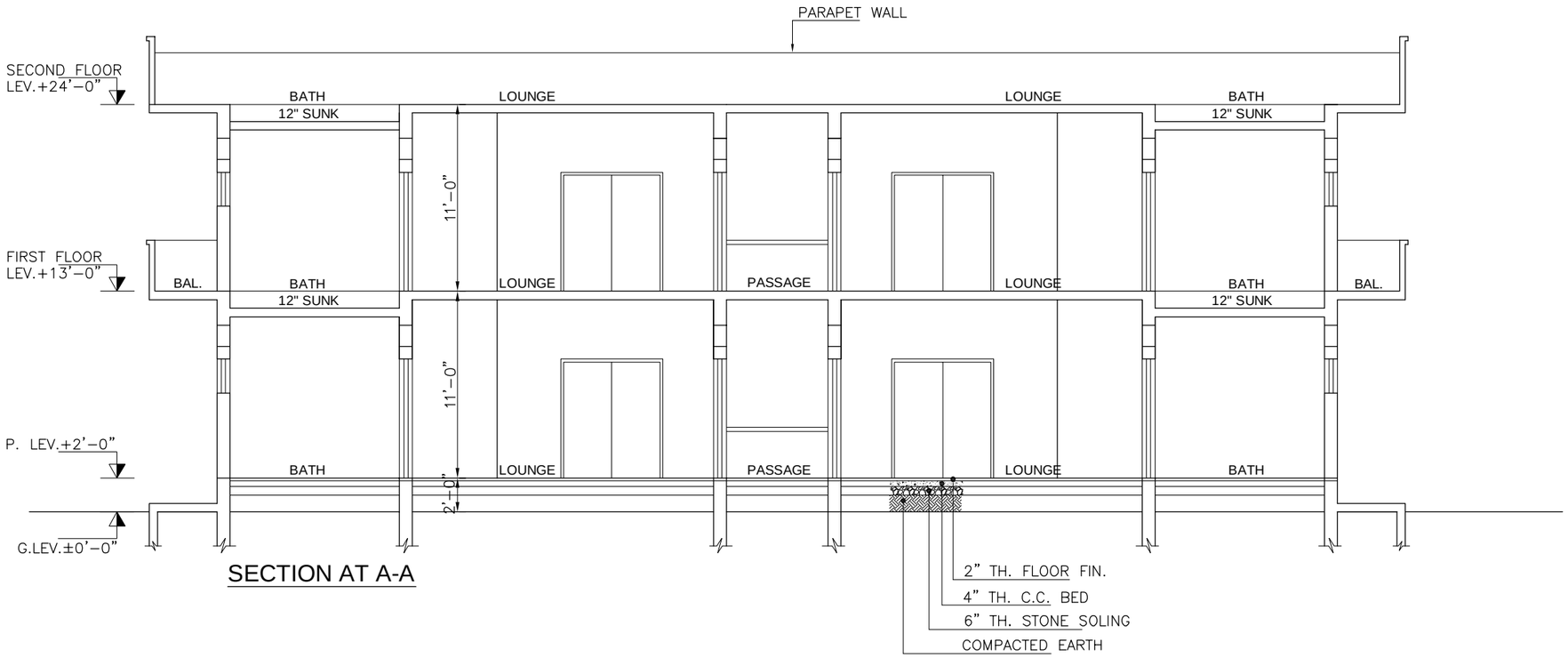
REAR SIDE ELEVATION

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12--2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : REAR SIDE ELEVATION
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

YOUNG ASSOCIATES
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E-mail: info@youngassociates.com.pk

JOB NO :	303 / 11
DRG. NO. :	303 / 11 AR-08
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE :1/10"=1'-0"	DATE : 09-12--2025



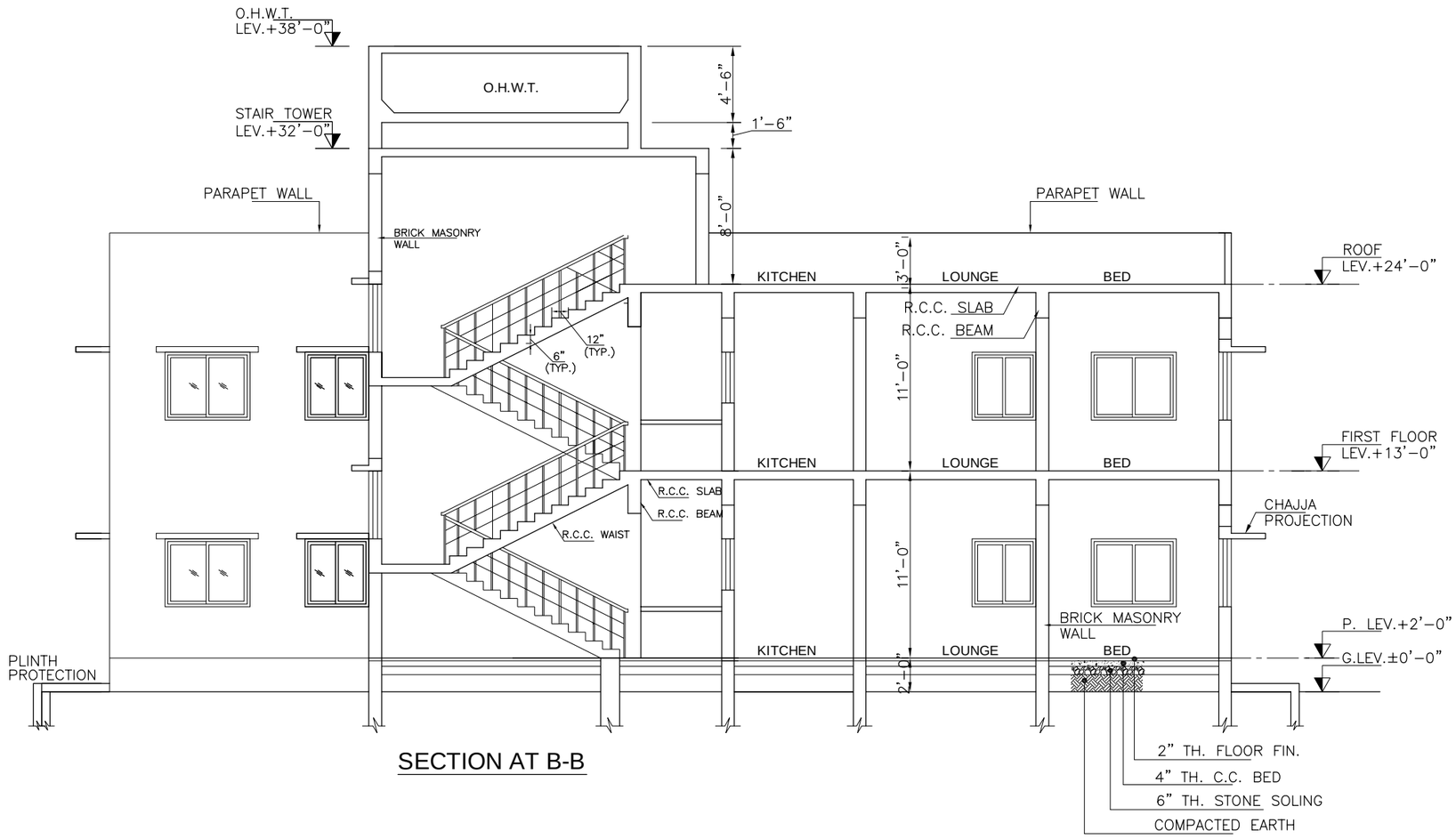
SECTION AT A-A

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12--2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : SECTION AT A-A
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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FAX: 021-35883106
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JOB NO : 268 / 21	
DRG. NO. : 303 / 11 AR-09	
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE :1/10"=1'-0"	DATE : 09-12--2025



SECTION AT B-B

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12--2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : SECTION AT B-B
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

YOUNG ASSOCIATES
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Tel :021-35396444, 021-35312244
FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO :	303 / 11
DRG. NO. :	303 / 11 AR-10
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE :1/10"=1'-0"	DATE : 09-12--2025

STRUCTURAL DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
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GENERAL NOTES

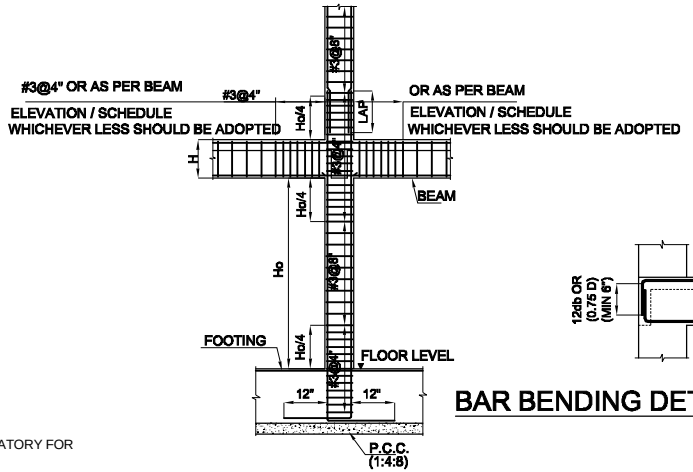
1. REINFORCED CONCRETE DESIGN IS BASED ON BUILDING CODE REQUIREMENT FOR REINFORCED CONCRETE UBC -97 AND ACI 318-08
2. FOUNDATION DESIGN IS BASED UPON A SAFE SOIL BEARING CAPACITY OF 0.65 T / SQ.FT. AT 6'-6" BELOW EXISTING GROUND LEVEL AS PER SOIL REPORT.
3. COORDINATE STRUCTURAL DRAWINGS WITH ARCHITECTURAL DRAWINGS IN CASE OF DISCREPANCY REFER TO ENGINEER IN CHARGE
4. ALL DIMENSIONS ARE IN FEET/INCHES.
5. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSIONS OR REFER TO CONSULTANT
6. THE CONTRACTOR IS TO CHECK AND VERIFY ALL DIMENSIONS AND LEVELS BEFORE EXECUTION
7. ALL ERRORS AND OMISSIONS TO BE REFERED TO THE CONSULTANT / ENGINEER PRIOR TO EXECUTION OF WORK
8. PRIOR TO CASTING CONCRETE REFER TO ARCHITECTURAL, PLUMBING , ELECTRICAL AND HAVC DRAWINGS FOR EMBEDDED ITEMS.
9. ALL MATERIALS SHALL COMPLY TO THE SPECIFICATIONS SHOWN ON THE DRAWINGS IN ABSENCE OF ANY SPECIFICATION ALL ABSENT MATERIALS SHOULD COMPLY TO RELEVANT ACI STANDARDS AND SHALL BE SUBJECTED TO APPROVAL OF THE CONSULTANT.
10. CONCRETE CUBES SHALL BE MADE AVAILABAL AT SITE BY THE CONTRACTOR AND SAMPLE FROM RANDOM BATCHES WILL BE TAKEN DURING CONCRETING.
11. SLUMP CONE SHALL BE MADE AVAILBLE AT SITE BY THE CONTRACTOR AND RANDOM SAMPLES WILL BE CHECKED DURING CONCRETING.
12. THE WATER USED FOR CONCRETE MIXING AND CURING SHOULD BE OF POTABLE QUALITY AND WITHOUT ANY IMPURITIES. A SAMPLE SHOULD BE TESTED IN LABORATORY FOR SULPHATE AND CHLORIDE CONTENTS.
13. FINE AND COARSE AGGREGATES SHOULD BE FREE FROM CLAY, LOAMS OR ANY OTHER ORGANIC IMPURITIES. A TEST SHOULD BE CARRIED OUT BEFORE USE.
14. ATMOSPHERIC TEMPERATURE SHOULD BE BETWEEN 32 C TO 35 C, AT THE TIME OF CONCRETE POURING.
15. R.C.C.CONCRETE (STANDARD CYLINDRICAL) STRENGTHS (fc IN PSI) AT 28 DAYS FOR VARIOUS STRUCTURAL MEMBERS SHALL BE.

    FOUNDATION/ BEAMS/ SLAB (fc' = 3000 psi)
    COLUMNS (fc' = 3000 psi)
    LEAN CONCRETE (fc' = 1500 psi)

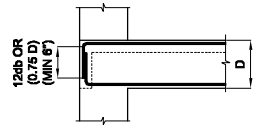
16. ALL R.C.C. SPACE WORKS SHALL BE CONTINUOUSLY MOIST CURED FOR AT LEAST 14 DAYS OR CURED BY CURING COMPOUND.
17. FORM WORK SUPPORTING R.C.C. MEMBERS SHALL NOT BE REMOVED PRIOR TO 14 DAYS. AFTER POURING.
18. ALL R.C.C. SPACE WORKS SHALL BE INTERNALLY VIBRATED WITH ELECTRO MECHANICAL VIBRATOR.
19. MINIMUM CLEAR CONCRETE COVER TO REINFORCEMENT SHALL BE AS FOLLOWS.

    FOUNDATION.....3"
    BEAMS .....1 1/2"
    COLUMNS/WALLS .....1 1/2" / 1"
    SLAB..... 3/4"
    WATER RETAINING STRUCTURES..... 2"

20. BEAMS AND SLABS SHOULD BE CASTED MONOLITHICALLY.
21. PRIOR TO PLACING CONCRETE ALL REINFORCING SHALL BE FREE OF LOOSE RUST AND SCALE OR ANY FOREIGN MATERIALS.
22. SPLICE LENGTH SHALL BE 60 TIMES DIA OF BAR
23. ALL INTERNAL & EXTERNAL PLASTER ON R.C.C. MEMBERS TO BE OF RATIO 1:4 AND THICKNESS SHOULD NOT EXCEED 3/4".

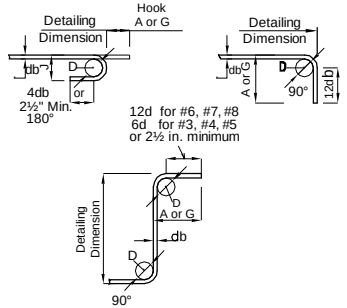


SEISMIC BEAM/COLUMN JOINT DETAIL



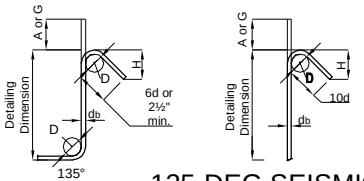
BAR BENDING DETAIL AT BEAM END

RECOMENDED END HOOKS, ALL GRADES				
Bar Size	Finished bend diameter D,in.	180-deg hooks		90-deg hooks
		A or G, in.	J, in.	A or G, in.
#3	2¼	5	3	6
#4	3	6	4	8
#5	3¾	7	5	10
#6	4½	8	6	12
#7	5¼	10	7	14
#8	6	11	8	16
#9	9½	15	11¾	19
#10	10¾	17	13¼	20
#11	12	19	14¾	24
#14	18¼	27	21¾	31
#18	24	36	28½	41



STIRRUP AND TIE HOOKS

Bar Size	D (in.)	135 deg Stirrup-tie hook dimensions, in.	
		135-deg hooks	
		A or G, in.	H approx
#3	1½	5	3½
#4	2	6½	4½
#6	4½	10¾	6½



135-DEG SEISMIC STIRRUP/TIE HOOKS

3rd Revision :	----------	Date : ---------
2nd Revision :	----------	Date : ---------
1st Revision :	----------	Date : ---------
ISSUED FOR	TENDER DRAWING	Date : 09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : GENERAL NOTES
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO :	303 /11
DRG. NO.:	303 /11GN-01
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 3/32"=1'-0"	DATE : 09-12-2025

LIST OF STRUCTURAL DRAWINGS

S.NO.	DWG. NO.	DESCRIPTION
1	GN.-01	GENERAL NOTES
2	ST.00	LIST OF DRAWING
3	ST.01	COLUMN LAYOUT PLAN
4	ST.02	RAFT SECTION X-X & COLUMN REINFORCEMENT DETAIL
5	ST.03	RAFT PLAN & TOP / BOTTOM REINFORCEMENT DETAIL
6	ST.04	RAFT BOTTOM EXTRA REINFORCEMENT PLAN
7	ST.05	PLINTH BEAM PLAN & REINFORCEMENT DETAIL
8	ST.06	FIRST FLOOR FRAMING PLAN & REINFORCEMENT DETAIL
9	ST.07	ROOF FRAMING PLAN & REINFORCEMENT DETAIL
10	ST.08	SCHEDULE OF BEAM & ELEVATION & SECTION
11	ST.09	STAIR CASE SECTION & REINFORCEMENT DETAIL
12	ST.10	STAIR TOWER FRAMING / REINF.PLAN BEAM SECTION,O.H.W.T REINF. PLAN & SECTION 1-1

3rd Revision : ---------- Date : Date : ---------

2nd Revision : ---------- Date : Date : ---------

1st Revision : ---------- Date : Date : ---------

ISSUED FOR TENDER DRAWING Date : 09-12-2025

CLIENT: CADET COLLEGE SANGHAR

JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)

DESCRIPTION : LIST OF DRAWING

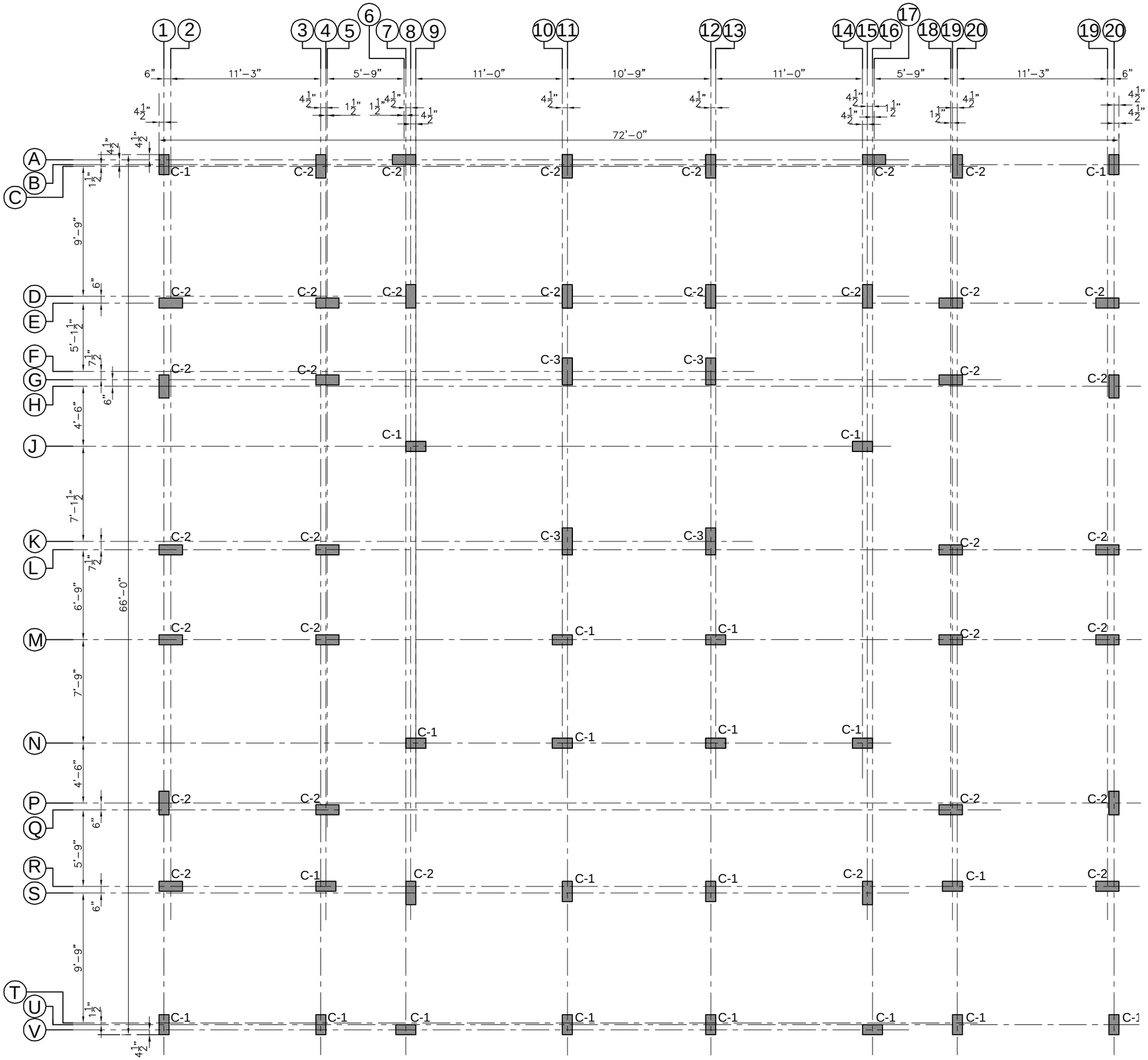
YOUNG ASSOCIATES
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JOB NO : 303 /11

DRG. NO. : 303 / 11 ST.01

DRAWN BY : AAMIR | CHECKED BY : MUNEER

SCALE : 3/32"=1'-0" | DATE : 09-12-2025



COLUMN LAYOUT PLAN

NOTE:

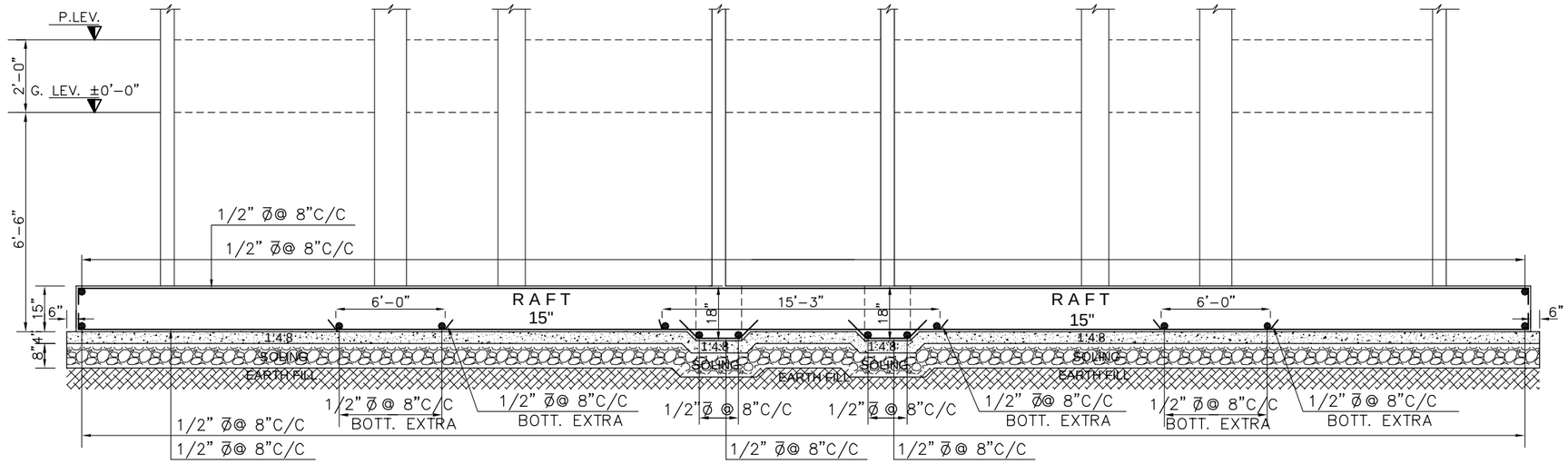
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3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : COLUMN LAYOUT PLAN
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

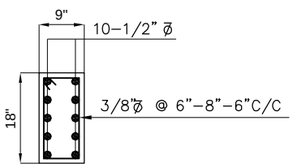
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JOB NO : 303 /11	
DRG. NO. : 303 /11 ST.01	
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"=1'-0"	DATE 09-12-2025



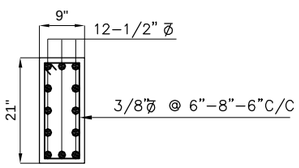
SECTION X-X

SCALE:1/8"=1'-0"



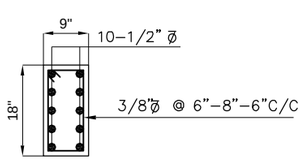
TYP.COLUMN C-1

SCALE:3/8"=1'-0"



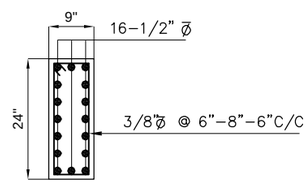
COLUMN C-2
BASE TO 2ND. FLOOR

SCALE:3/8"=1'-0"



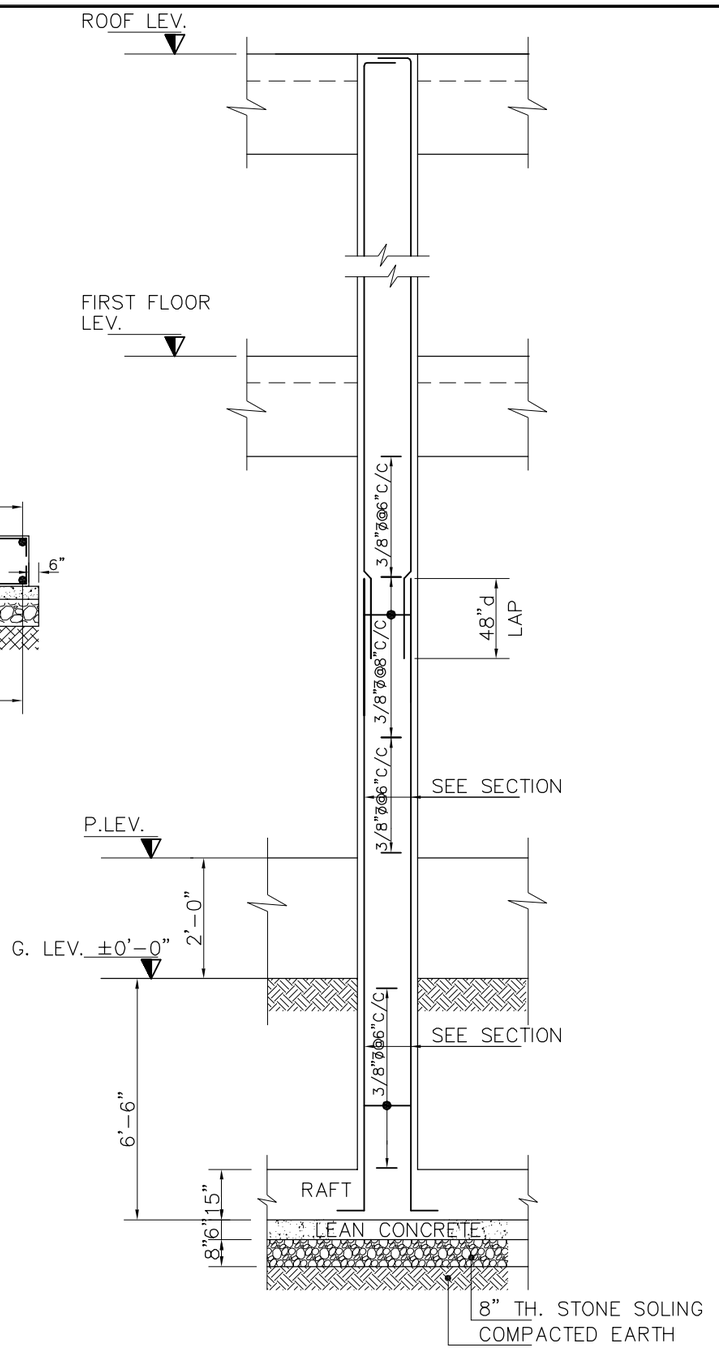
COLUMN C-2
2ND. FOOR TO ROOF

SCALE:3/8"=1'-0"



TYP. COLUMN C-3

SCALE:3/8"=1'-0"



TYP. ELEVATION OF COLUMN

SCALE : 1/4"=1'-0"

NOTE:

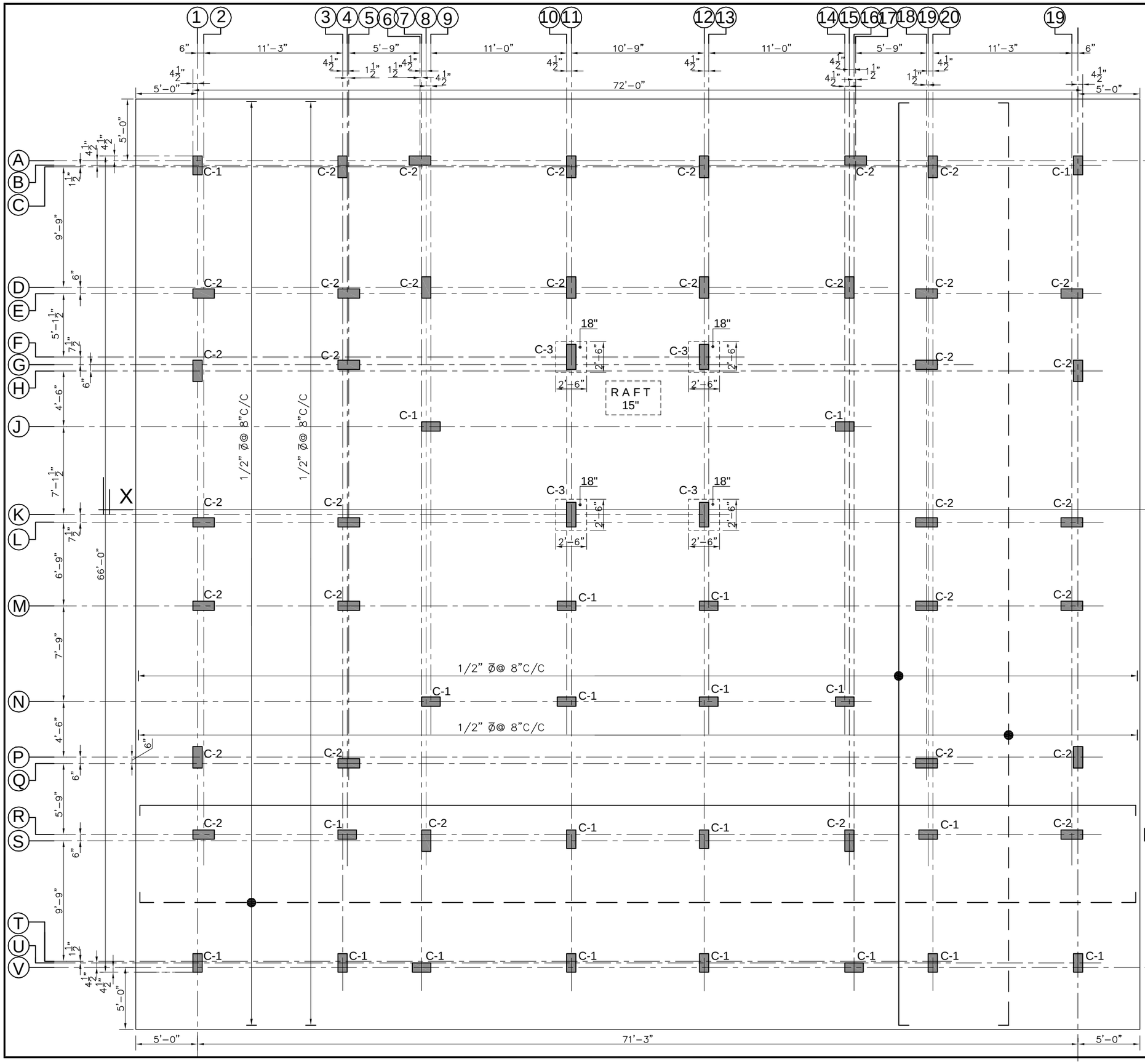
1: FOR GENERAL NOTES REFER DWG. NO.303/ 11 GN.01

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2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : RAFT SECTION X-X & COLUMN REINFROCEMENT DETAIL
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO :	303 /11
DRG. NO. :	303 /11 ST.02
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"=1'-0"	DATE 09-12-2025



RAFT TOP & BOTTOM REINFORCEMENT PLAN

NOTE:

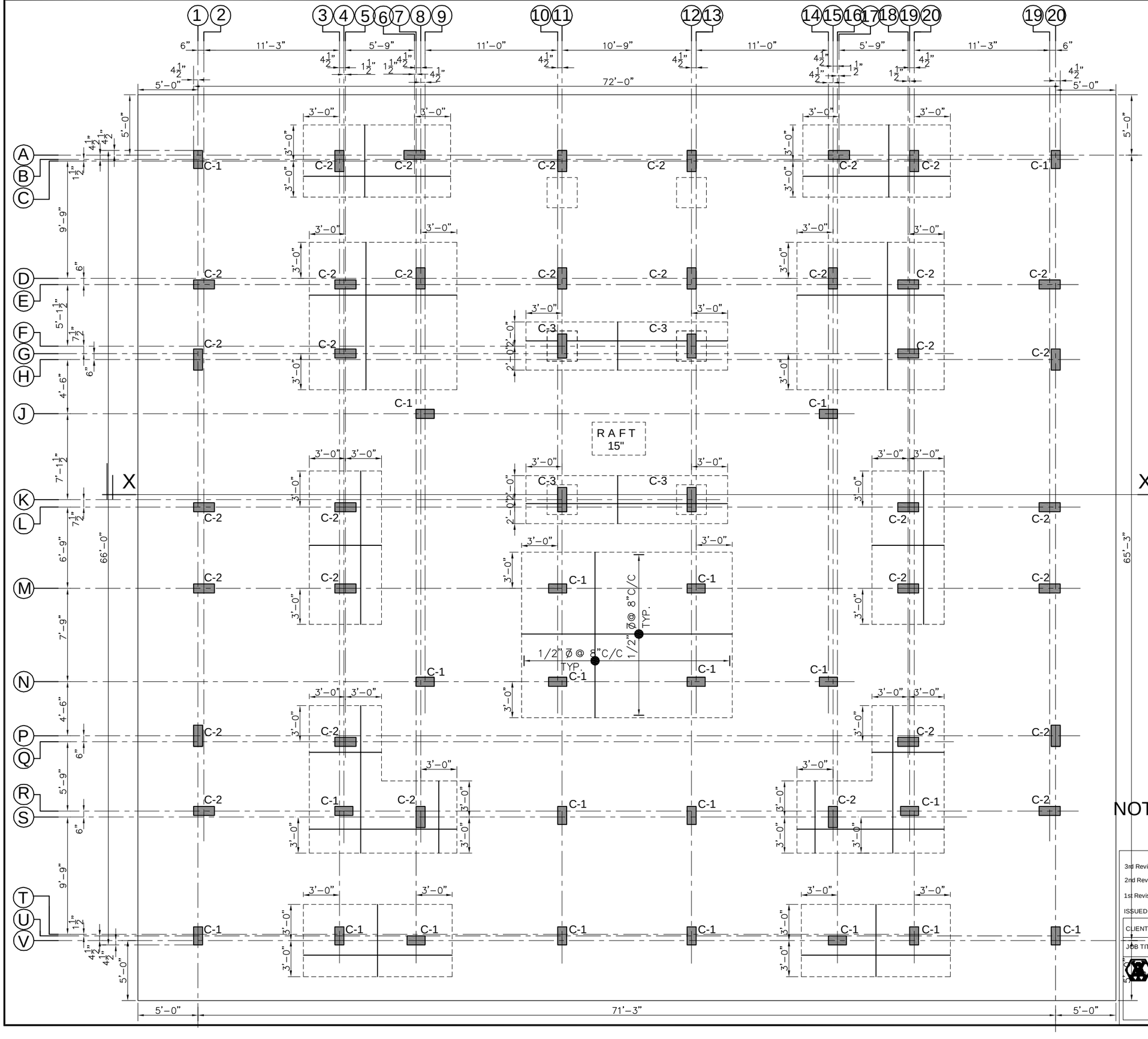
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2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	FRAT PLAN & TOP / BOTTOM REINFORCEMENT DETAIL
JOB TITLE :	STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)		

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JOB NO :	303 /11
DRG. NO. :	303 /11 ST.03
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"=1'-0"	DATE 09-12-2025



RAFT BOTTOM EXTRA REINFORCEMENT PLAN

NOTE:

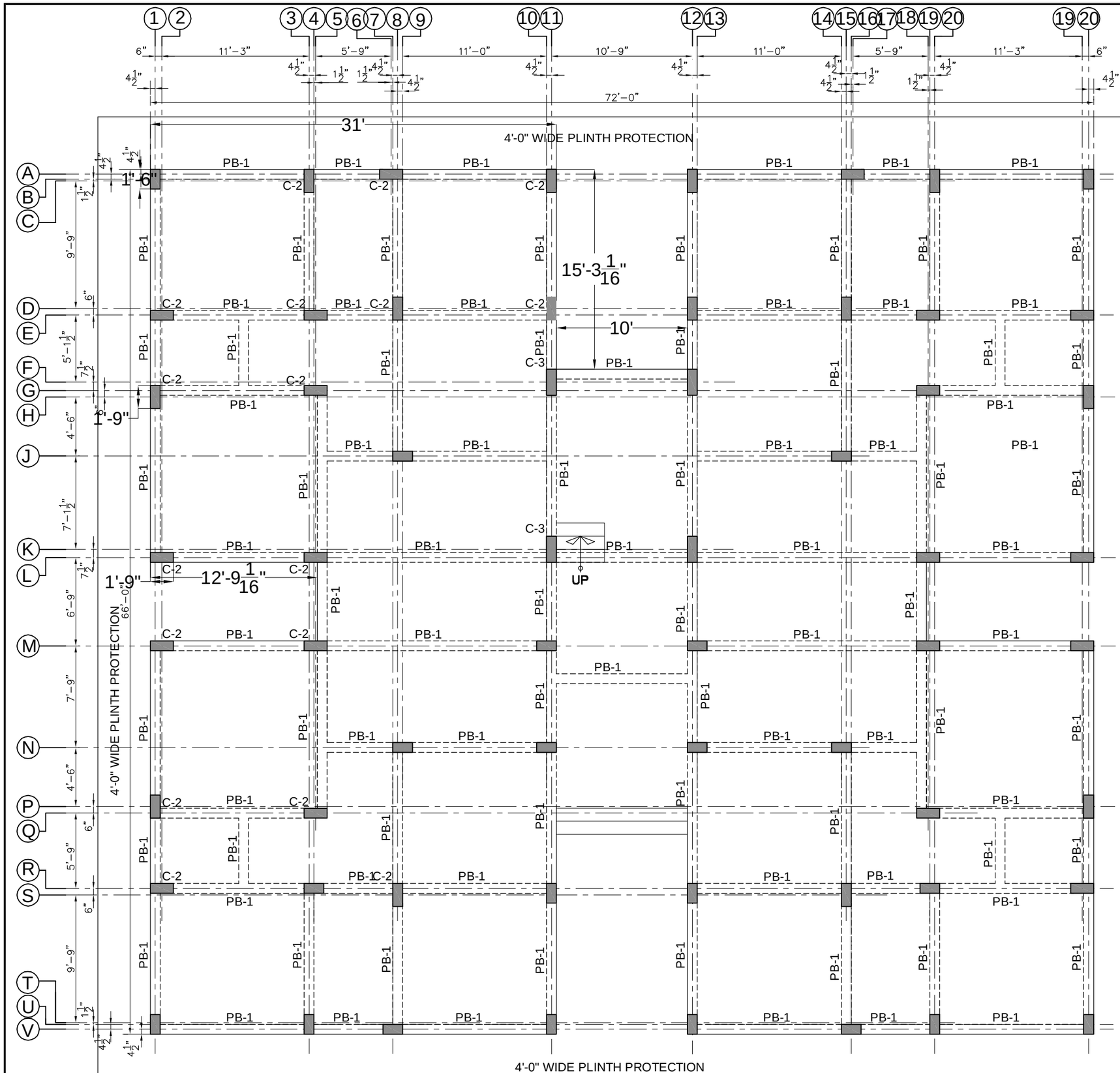
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1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

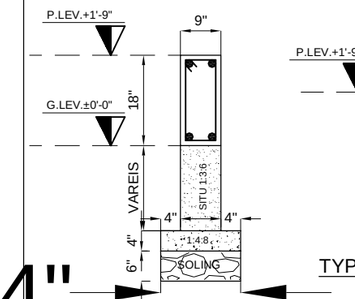
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : RAFT BOTTOM EXTRA REINFORCEMENT PLAN
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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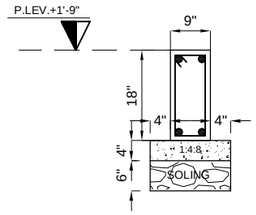
JOB NO :	303 /11
DRG. NO. :	303 /11 ST.04
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"=1'-0"	DATE 09-12-2025



PLINTH BEAM PLAN @ LEV.+2'-0"



4" TYP. EXTERNAL PLINTH BEAM SECTION
SCALE:3/8"=1'-0"



TYP. INTERNAL PLINTH BEAM BEAM SECTION
SCALE:3/8"=1'-0"

TYP. PLINTH PROTECTION DETAIL
SCALE:3/8"=1'-0"

NOTE:

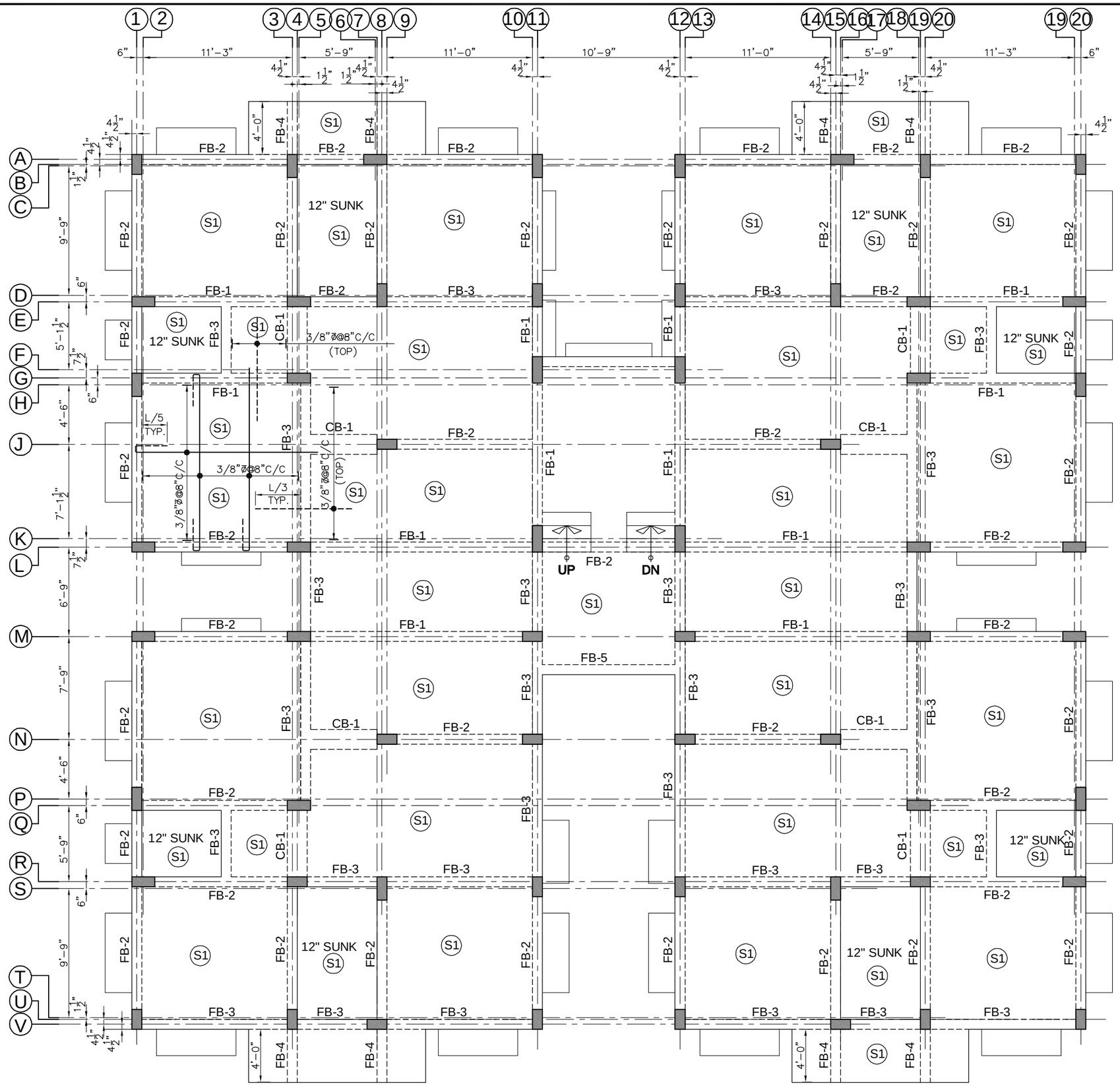
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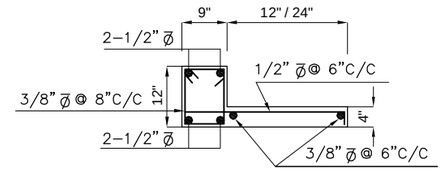
3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE MITHI	DESCRIPTION : PLINTH BEAM PLAN & REINFORCEMENT DETAIL
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO : 303 /11	
DRG. NO. : 303 /11 ST.05	
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"=1'-0"	DATE 09-12-2025





TYP. DETAIL OF LINTEL & CHAJJA PROJECTION

SCALE:3/8"=1'-0"

FIRST FLOOR FRAMING PLAN @ LEV.+12'-9"

ALL SLABS ARE 5" THICK U.N.O

NOTE:

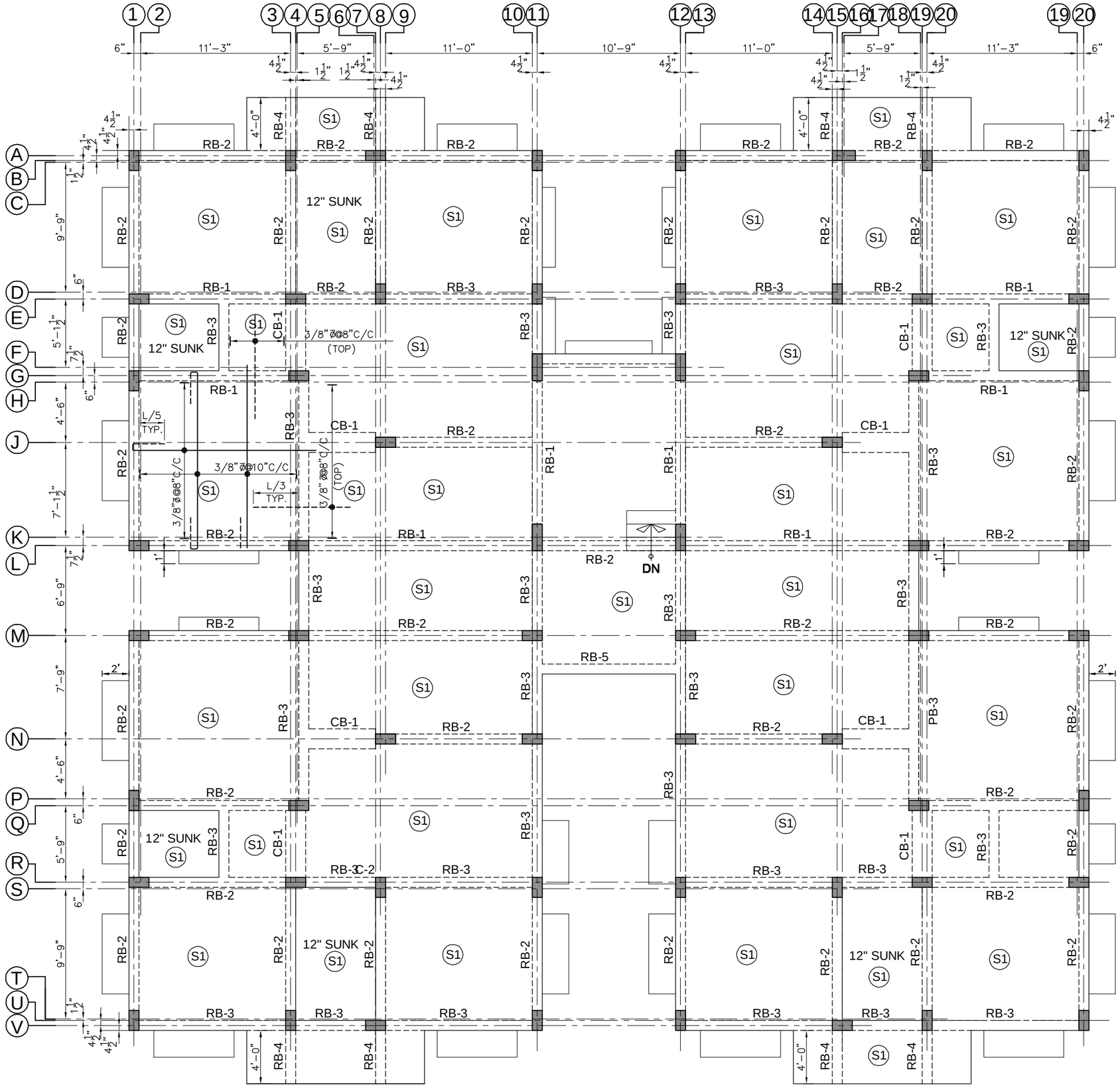
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3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FIRST FLOOR FRAMING PLAN & REINFORCEMENT DETAIL
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

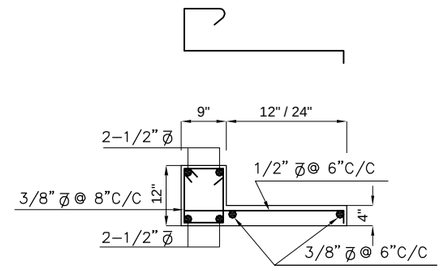
YOUNG ASSOCIATES
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JOB NO :	303 /11
DRG. NO. :	303 /11 ST.06
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"=1'-0"	DATE 09-12-2025



ROOF FRAMING PLAN @ LEV.+23'-9"

ALL SLABS ARE 5" THICK U.N.O



TYP. DETAIL OF LINTEL & CHAJJA PROJECTION

SCALE:3/8"=1'-0"

NOTE:

1: FOR GENERAL NOTES REFER DWG. NO.303/ 11 GN.01

3rd Revision :	----------	Date :	---------
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ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : ROOR FRAMING PLAN & REINFORCEMENT DETAIL
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO :	303 /11
DRG. NO. :	303 /11 ST.07
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"=1'-0"	DATE 09-12-2025

SCHEDULE OF PLINTH BEAMS

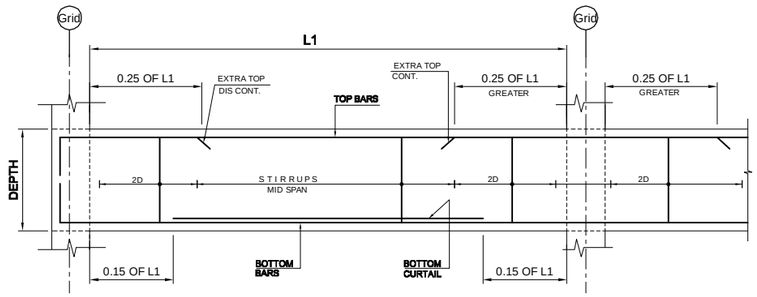
NOTATION	BEAM SIZE	BOTTOM STEEL	TOP STEEL			RINGS @ L/4	RINGS @ CENTER	REMAKS
		BOTTOM STEEL	TOP STEEL	TOP EXTRA				
				CONT.	DIS CONT.			
PB-1	9" X 18"	2-1/2"ø	2-1/2" ø	1-1/2" ø	1-1/2" ø	3/8" ø @6"C/C	3/8" ø @8"C/C	———

SCHEDULE OF FIRST FLOOR BEAMS

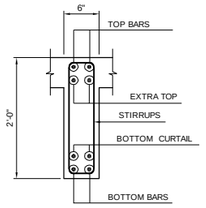
NOTATION	BEAM SIZE	BOTTOM STEEL	TOP STEEL			RINGS @ L/4	RINGS @ CENTER	REMAKS
		BOTTOM STEEL	TOP STEEL	TOP EXTRA				
				CONT.	DIS CONT.			
FB-1	9" X 24"	3-1/2"ø	3-1/2" ø	2-1/2" ø	2-1/2" ø	3/8" ø @6"C/C	3/8" ø @8"C/C	———
FB-2	9" X 24"	3-1/2"ø	3-1/2" ø	1-1/2" ø	1-1/2" ø	3/8" ø @6"C/C	3/8" ø @8"C/C	———
FB-3	9" X 24"	3-1/2"ø	2-1/2" ø	1-1/2" ø	1-1/2" ø	3/8" ø @6"C/C	3/8" ø @8"C/C	———
FB-4	9" X 24"	2-1/2"ø	4-1/2" ø	———	———	3/8" ø @6"C/C	3/8" ø @8"C/C	———
FB-5	9" X 24"	2-1/2"ø	2-1/2" ø	———	———	3/8" ø @6"C/C	3/8" ø @8"C/C	———
CB-1	18" X 5"	5-1/2"ø	5-1/2" ø	———	———	3/8" ø @6"C/C	3/8" ø @8"C/C	———

SCHEDULE OF ROOF FLOOR BEAMS

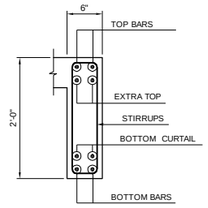
NOTATION	BEAM SIZE	BOTTOM STEEL	TOP STEEL			RINGS @ L/4	RINGS @ CENTER	REMAKS
		BOTTOM STEEL	TOP STEEL	TOP EXTRA				
				CONT.	DIS CONT.			
RB-1	9" X 18"	3-1/2"ø	3-1/2" ø	2-1/2" ø	2-1/2" ø	3/8" ø @6"C/C	3/8" ø @8"C/C	———
RB-2	9" X 18"	3-1/2"ø	3-1/2" ø	1-1/2" ø	1-1/2" ø	3/8" ø @6"C/C	3/8" ø @8"C/C	———
RB-3	9" X 18"	3-1/2"ø	2-1/2" ø	2-1/2" ø	2-1/2" ø	3/8" ø @6"C/C	3/8" ø @8"C/C	———
RB-4	9" X 18"	2-1/2"ø	4-1/2" ø	———	———	3/8" ø @6"C/C	3/8" ø @8"C/C	———
RB-5	9" X 18"	2-1/2"ø	2-1/2" ø	———	———	3/8" ø @6"C/C	3/8" ø @8"C/C	———
CB-1	18" X 5"	5-1/2"ø	5-1/2" ø	———	———	3/8" ø @6"C/C	3/8" ø @8"C/C	———



TYPICAL ELEVATION OF BEAM



TYPICAL SECTION OF BEAM
SCALE 3/8"



TYPICAL SECTION OF BEAM
SCALE 3/8"

NOTE:

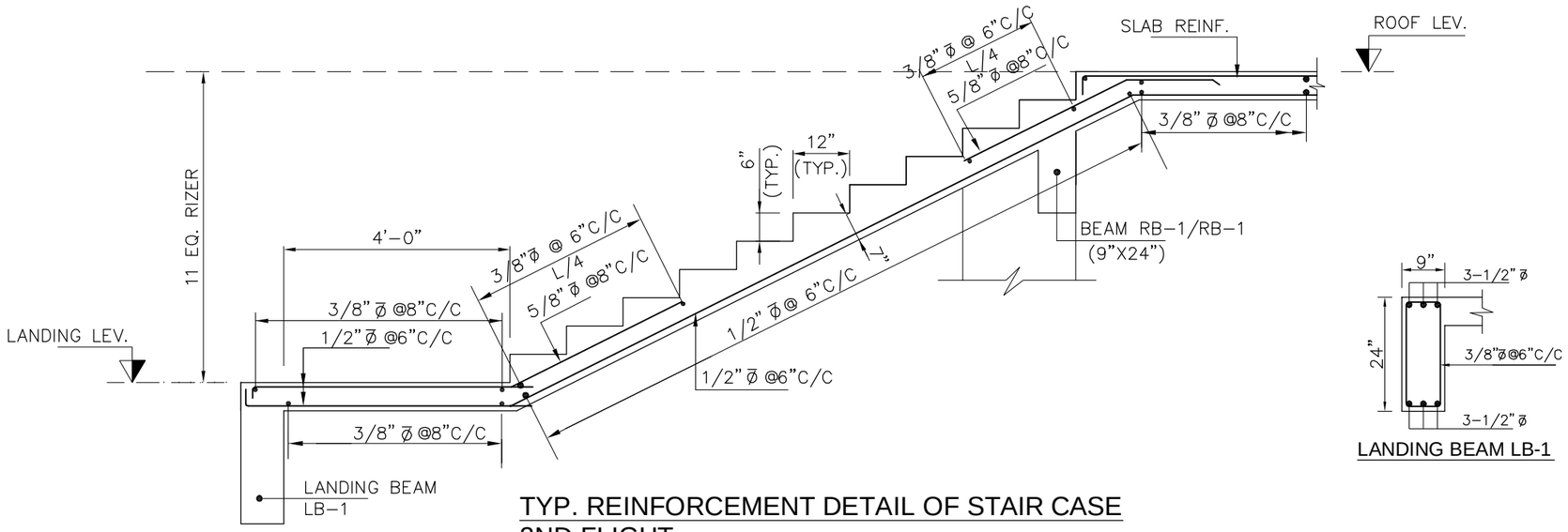
1: FOR GENERAL NOTES REFER DWG. NO.303/ 11 GN.01

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : SCHEDULE OF BEAM
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

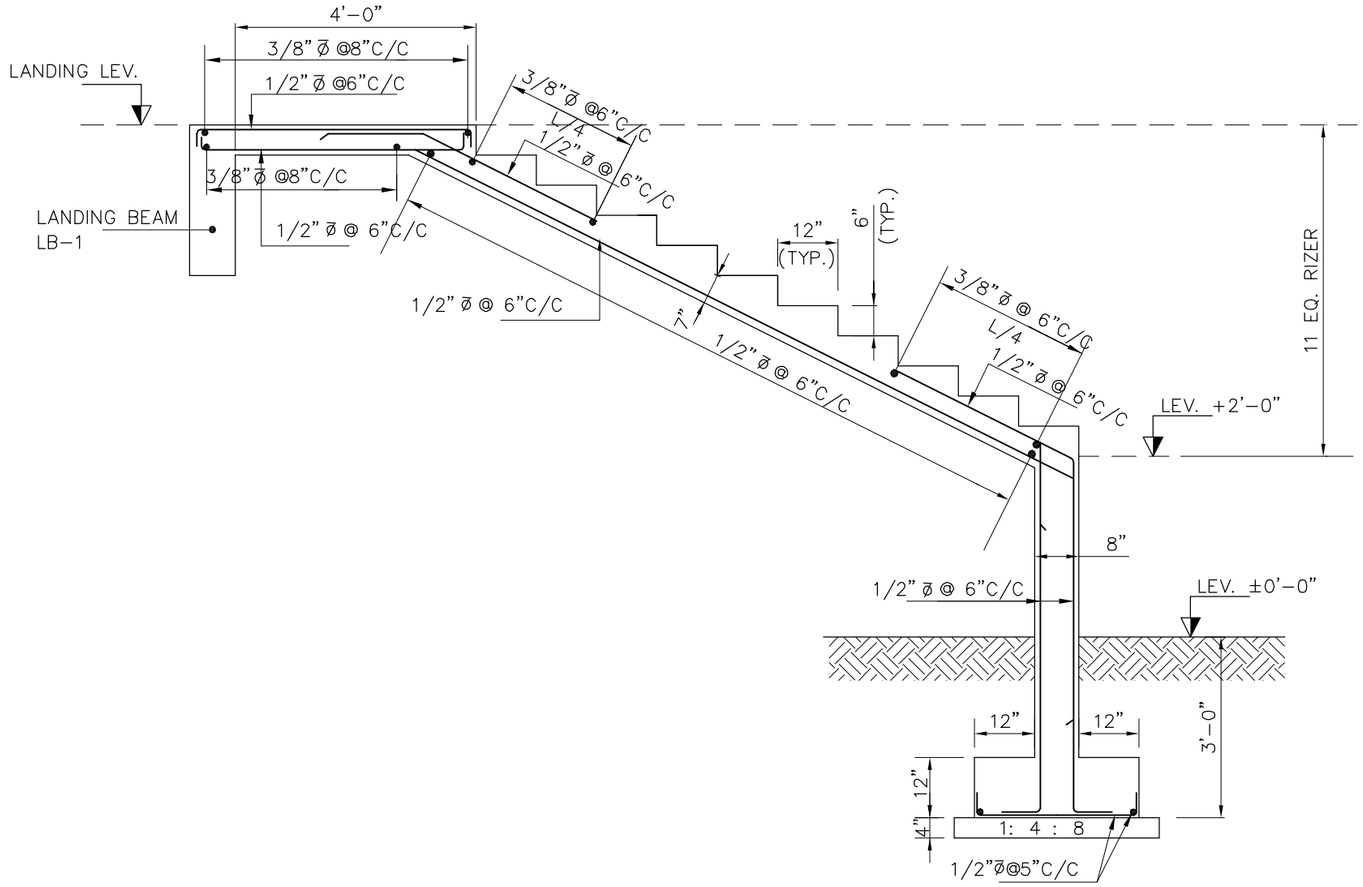
YOUNG ASSOCIATES
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Defence Housing Authority, Karachi-75500
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JOB NO :	303 /11
DRG. NO. :	303 /11 ST.08
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"='-0"	DATE 09-12-2025



TYP. REINFORCEMENT DETAIL OF STAIR CASE
2ND FLIGHT

LANDING BEAM LB-1



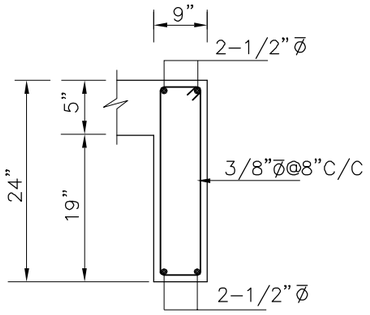
TYP. REINFORCEMENT DETAIL OF STAIR CASE
1ST FLIGHT
SCALE:- 3/8"=1'-0"

NOTE:

1: FOR GENERAL NOTES REFER DWG. NO.303/ 11 GN.01

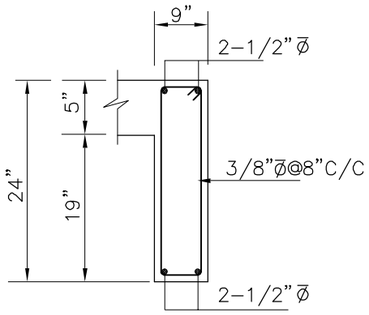
3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	STAIR CASE SECTION & REINFORCEMENT DETAIL
JOB TITLE :	STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)		
YOUNG ASSOCIATES CONSULTING ENGINEERS & ARCHITECTS 9-C 24 th Commercial street, Phase 2 (Extn), Defence Housing Authority, Karachi-75500 Tel :021-35396444, 021-35312244 FAX: 021-35883106 E-mail: info@youngassociates.com.pk		JOB NO :	303 /11
		DRG. NO. :	303 /11 ST.09
		DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
		SCALE :1/8"=1'-0"	DATE : 09-12-2025

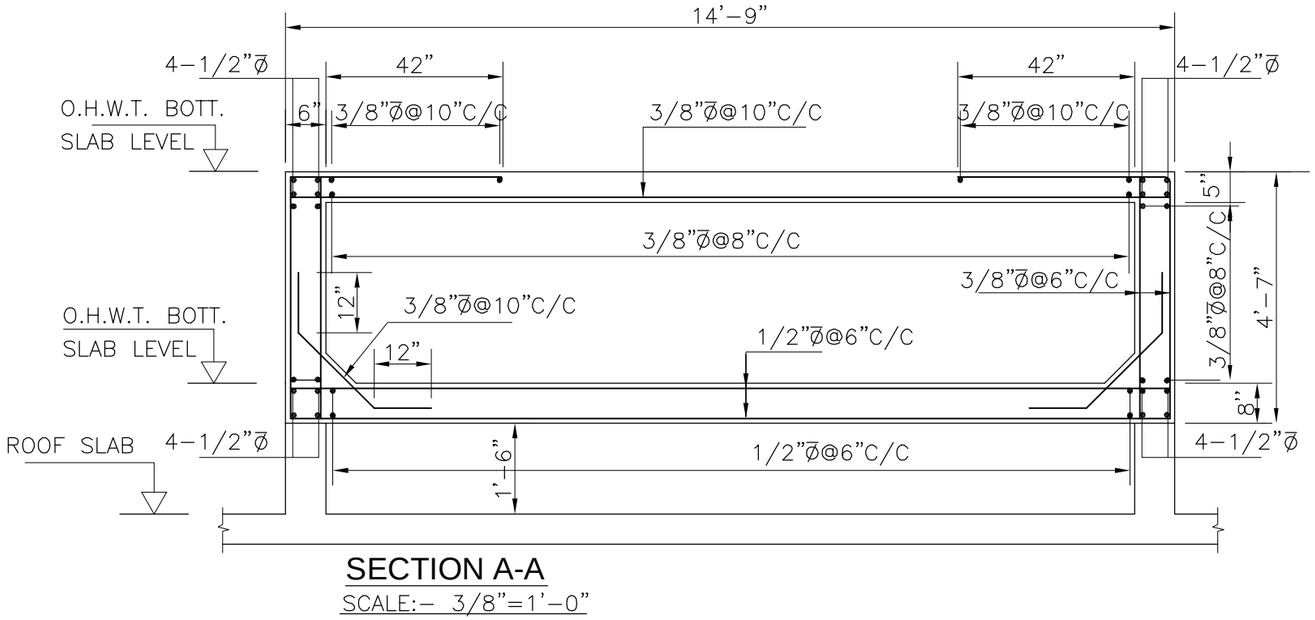


BEAM SRB-1

SCALE:- 1/2"=1'-0"

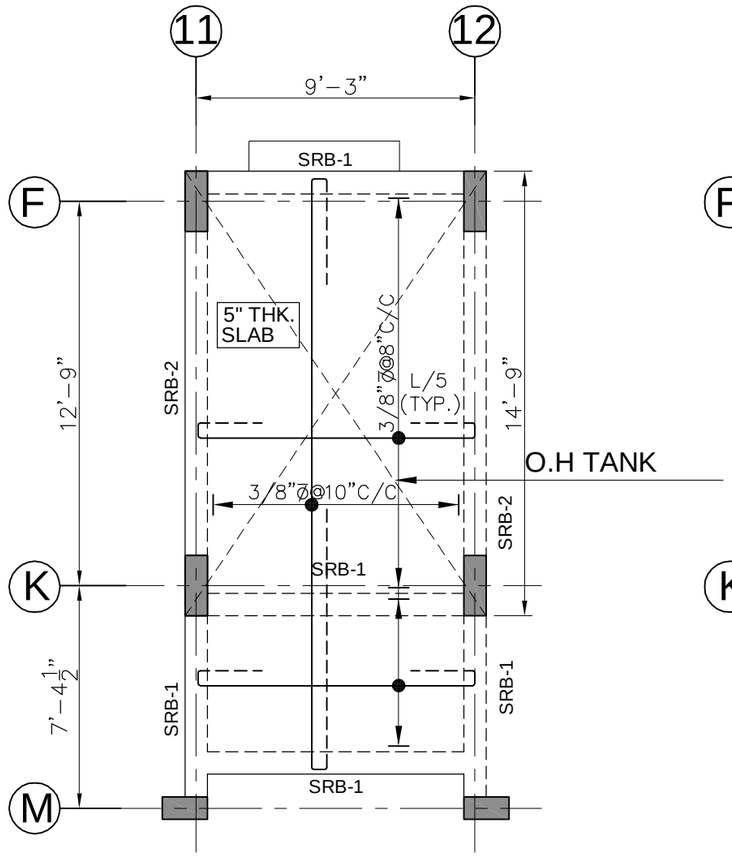


BEAM SRB-2

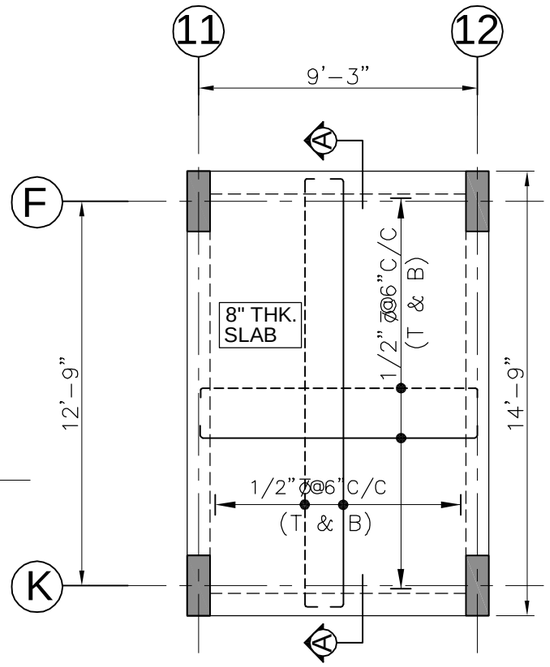


SECTION A-A

SCALE:- 3/8"=1'-0"

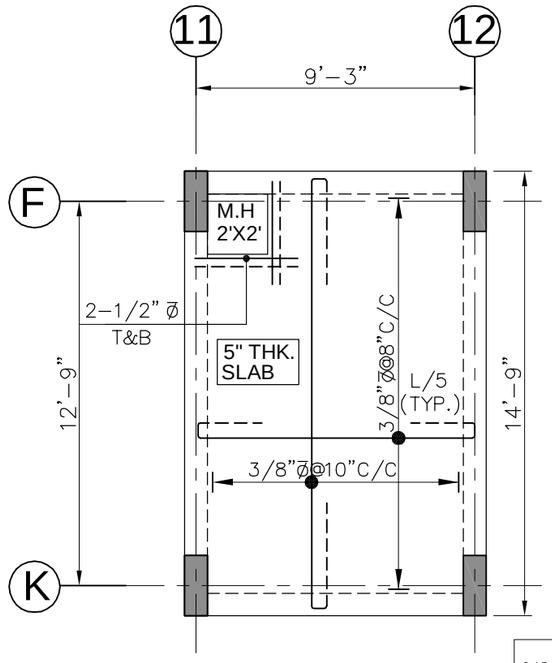


STAIRTOWER FRAMING PLAN @ LEV.+31'-9"



O.H.W.T. BOTTOM SLAB PLAN

SCALE:- 3/16"=1'-0"



O.H.W.T. TOP SLAB PLAN

SCALE:- 3/16"=1'-0"

NOTE:

1: FOR GENERAL NOTES REFER DWG. NO.303/ 11 GN.01

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : STAIR TOWER FRAMING/REINF. PLAN BEAM SECTIONS, O.H.W.T. REINF. PLAN & SECTION AT A-A
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO :	303 /11
DRG. NO. :	303 /11 ST.10
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"=1'-0"	DATE : 09-12-2025

PLUMBING DRAWINGS

PREPARED BY:

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LIST OF PLUMMBING DRAWINGS

S.NO.	DWG. NO.	DESCRIPTION
1	P-00	LIST OF DRAWINGS
2	WS-01	ROOF WATER SUPPLY SYSTEM
3	WS-02	FIRST FLOOR PLAN WATER SUPPLY SYSTEM
4	WS-03	GROUND FLOOR PLAN WATER SUPPLY SYSTEM
5	DS-04	FIRST FLOOR PLAN DRAIN SYSTEM
6	DS-05	GROUND FLOOR PLAN DRAIN SYSTEM

3rd Revision : ---------- Date : --------

2nd Revision : ---------- Date : --------

1st Revision : ---------- Date : --------

ISSUED FOR TENDER DRAWINGS Date : 29-11-2025

CLIENT: CADET COLLEGE SANGHAR

JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)

DESCRIPTION : LIST OF DRAWING

YOUNG ASSOCIATES
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E-mail: info@youngassociates.com.pk

JOB NO : 303 / 11

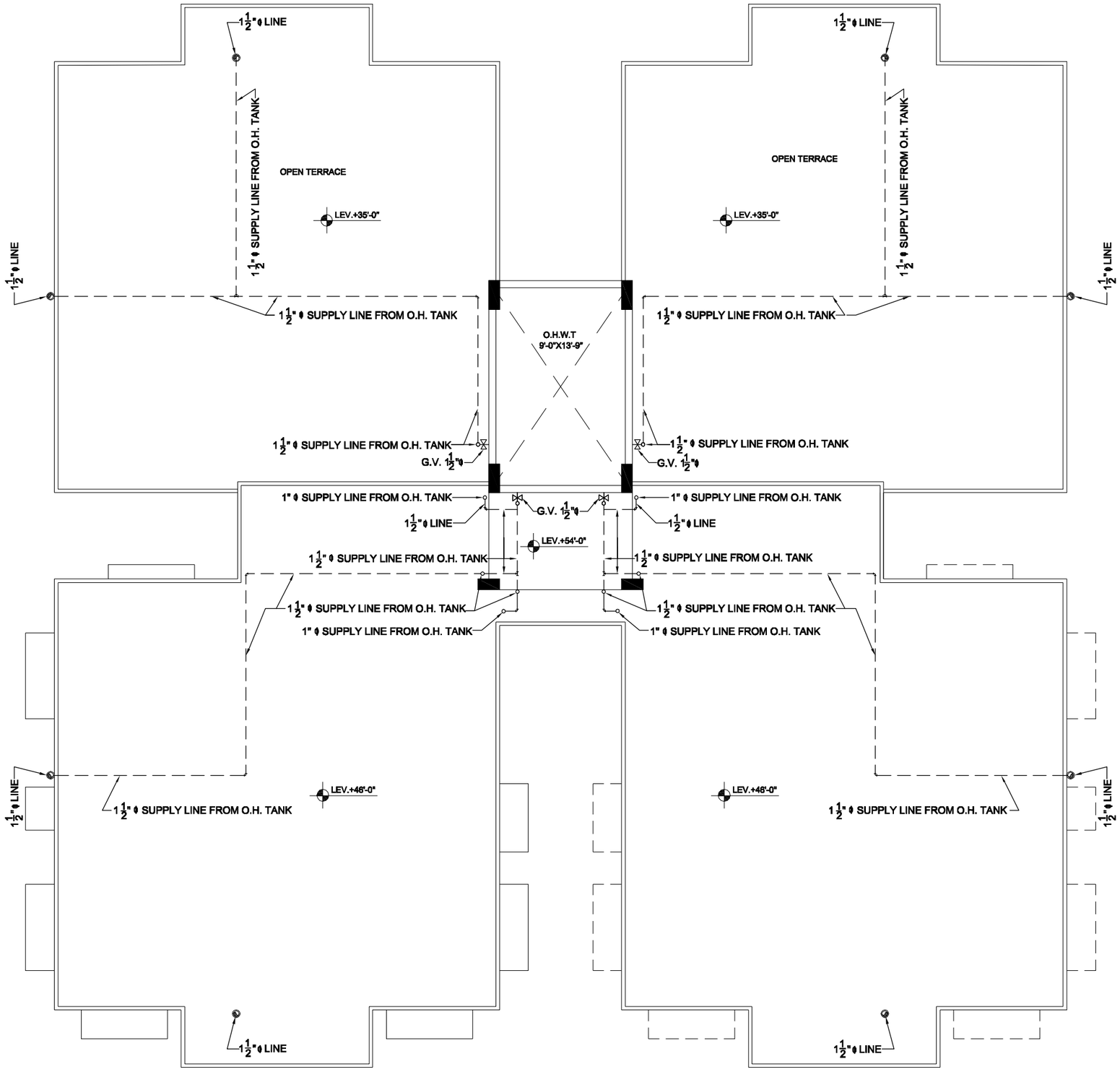
DRG. NO. : 303 / 11 P.00

DRAWN BY : M.K ABBASI

CHECKED BY : ZEESHAN

SCALE :1/8"=1'-0"

DATE : 29-11-2025



ROOF PLAN

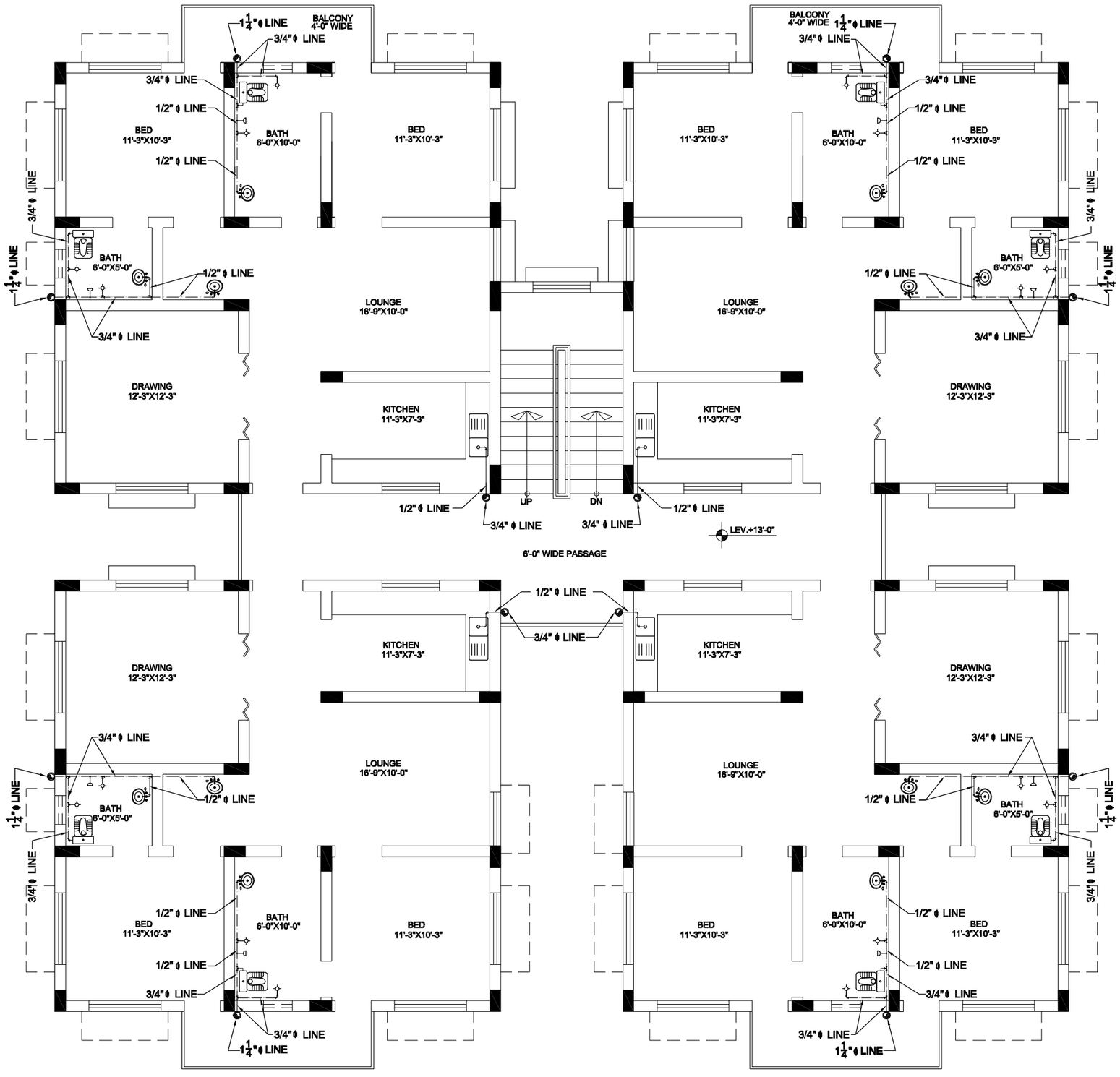
	LEGEND	SYMBOLE
1	2 " ϕPIPE (PPR) W / LINE	
2	1½" ϕ PIPE (PPR) W / LINE	
3	1¼" ϕ PIPE (PPR) W / LINE	
4	1" ϕ PIPE (PPR) W / LINE	
5	3/4" ϕ PIPE (PPR) W / LINE	
6	1/2" ϕ PIPE (PPR) W / LINE	
7	GATE VALVE	GV
8	WASH BASIN	WB
9	WATER CLOSET	W.C
10	COMMODE	
11	SINK	
12	SHOWER	SH.
13	BIB COCK	BC

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWINGS	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : ROOF WATER SUPPLY SYSTEM
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO :	303 / 11
DRG. NO. :	303 / 11 WS.01
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"=1'-0"	DATE : 09-12-2025



FIRST FLOOR PLAN

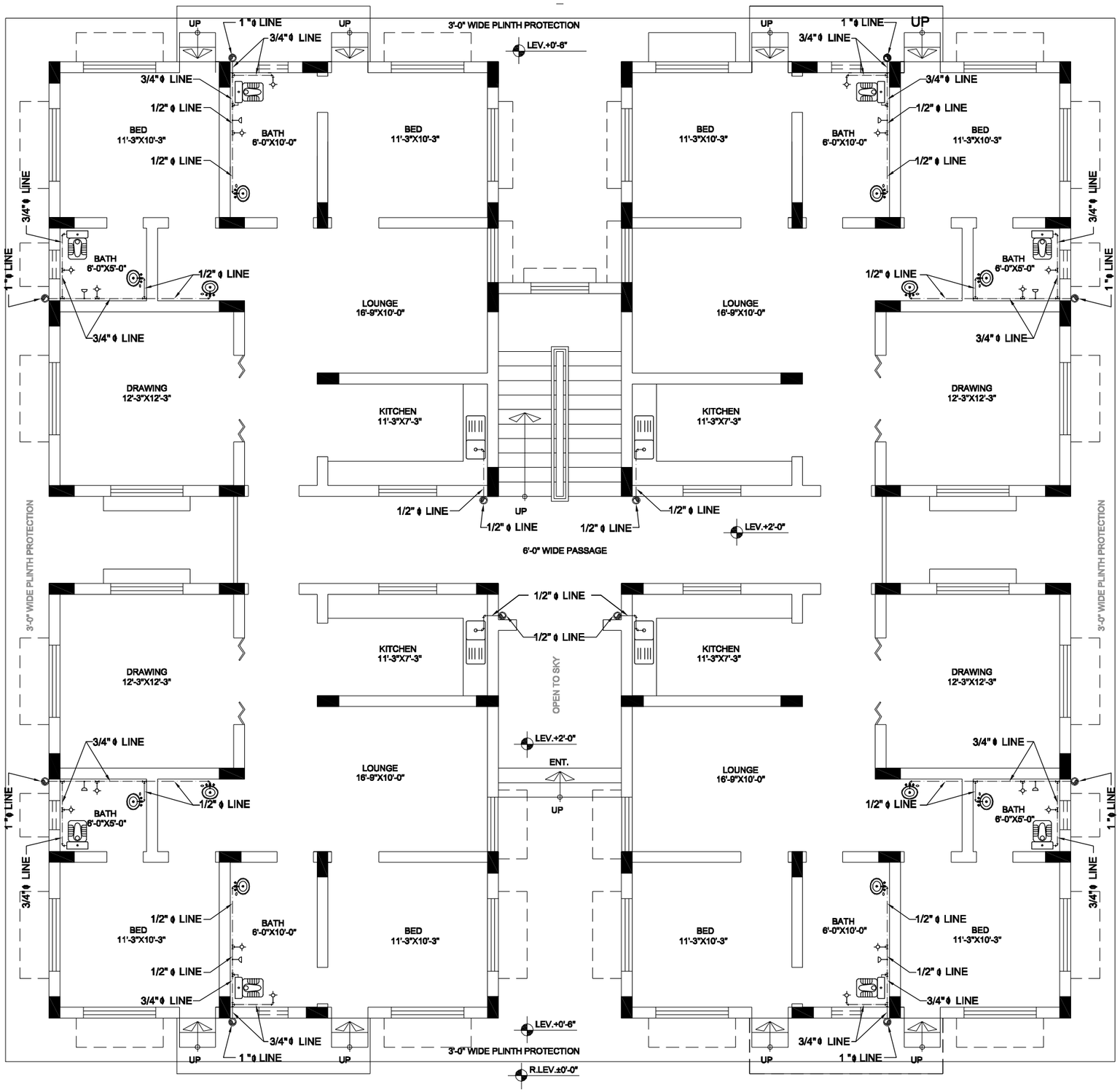
	LEGEND	SYMBOLE
1	2 " ϕPIPE (PPR) W / LINE	
2	1½" ϕ PIPE (PPR) W / LINE	
3	1¼" ϕ PIPE (PPR) W / LINE	
4	1" ϕ PIPE (PPR) W / LINE	
5	3/4" ϕ PIPE (PPR) W / LINE	
6	1/2" ϕ PIPE (PPR) W / LINE	
7	GATE VALVE	GV
8	WASH BASIN	WB
9	WATER CLOSET	W.C
10	COMMODE	
11	SINK	
12	SHOWER	SH.
13	BIB COCK	BC

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWINGS	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FIRST FLOOR PLAN WATER SUPPLY SYSTEM
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO : 303 / 11	
DRG. NO. : 303 / 11 WS.02	
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"=1'-0"	DATE : 09-12-2025



GROUND FLOOR PLAN

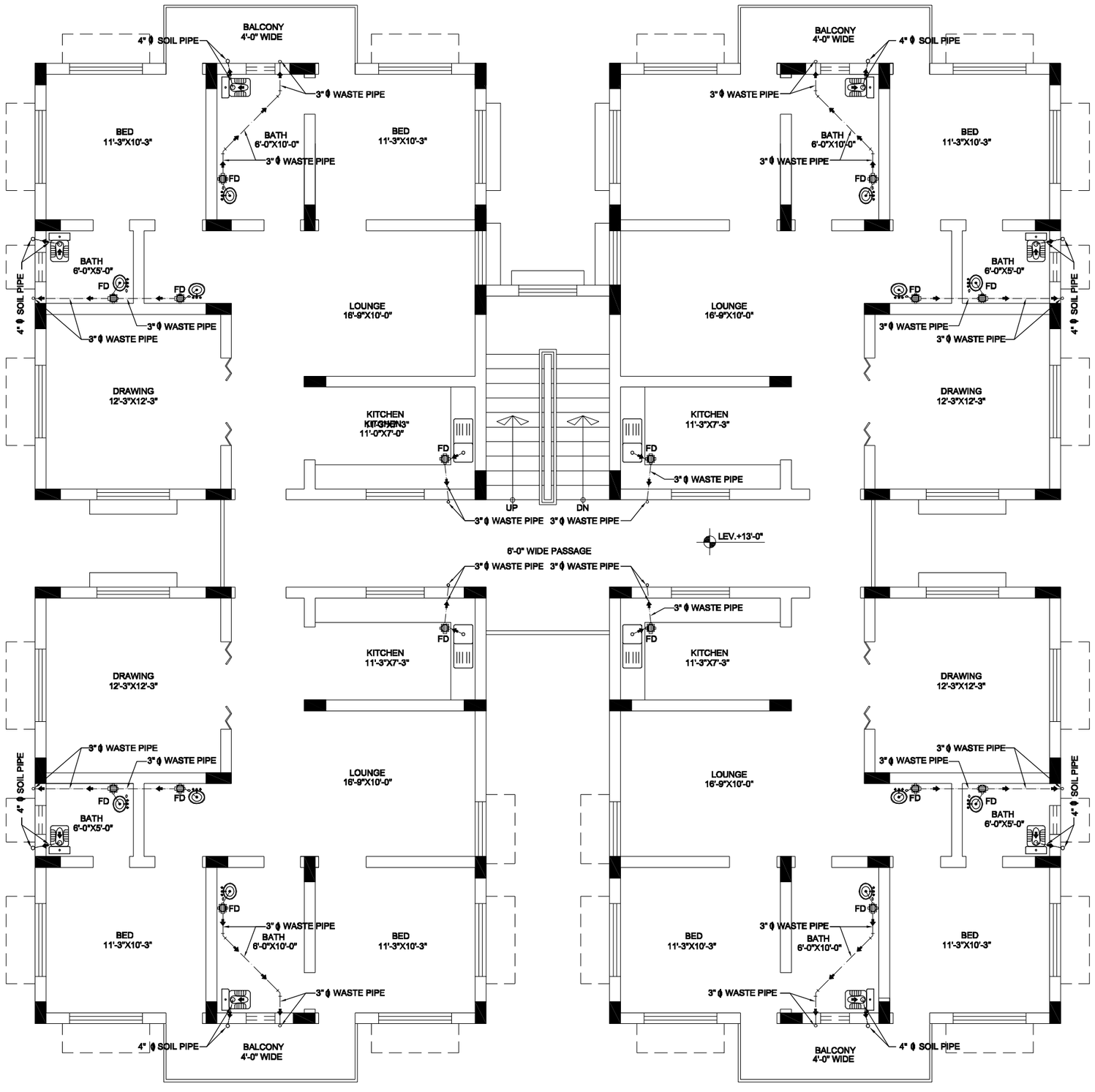
	LEGEND	SYMBOLE
1	2 " ϕPIPE (PPR) W / LINE	
2	1½" ϕ PIPE (PPR) W / LINE	
3	1¼" ϕ PIPE (PPR) W / LINE	
4	1" ϕ PIPE (PPR) W / LINE	
5	3/4" ϕ PIPE (PPR) W / LINE	
6	1/2" ϕ PIPE (PPR) W / LINE	
7	GATE VALVE	GV
8	WASH BASIN	WB
9	WATER CLOSET	W.C
10	COMMODE	
11	SINK	
12	SHOWER	SH.
13	BIB COCK	BC

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWINGS	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : GROUND FLOOR PLAN WATER SUPPLY SYSTEM
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO :	303 / 11
DRG. NO. :	303 / 11 WS.03
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"=1'-0"	DATE : 09-12-2025



FIRST FLOOR PLAN

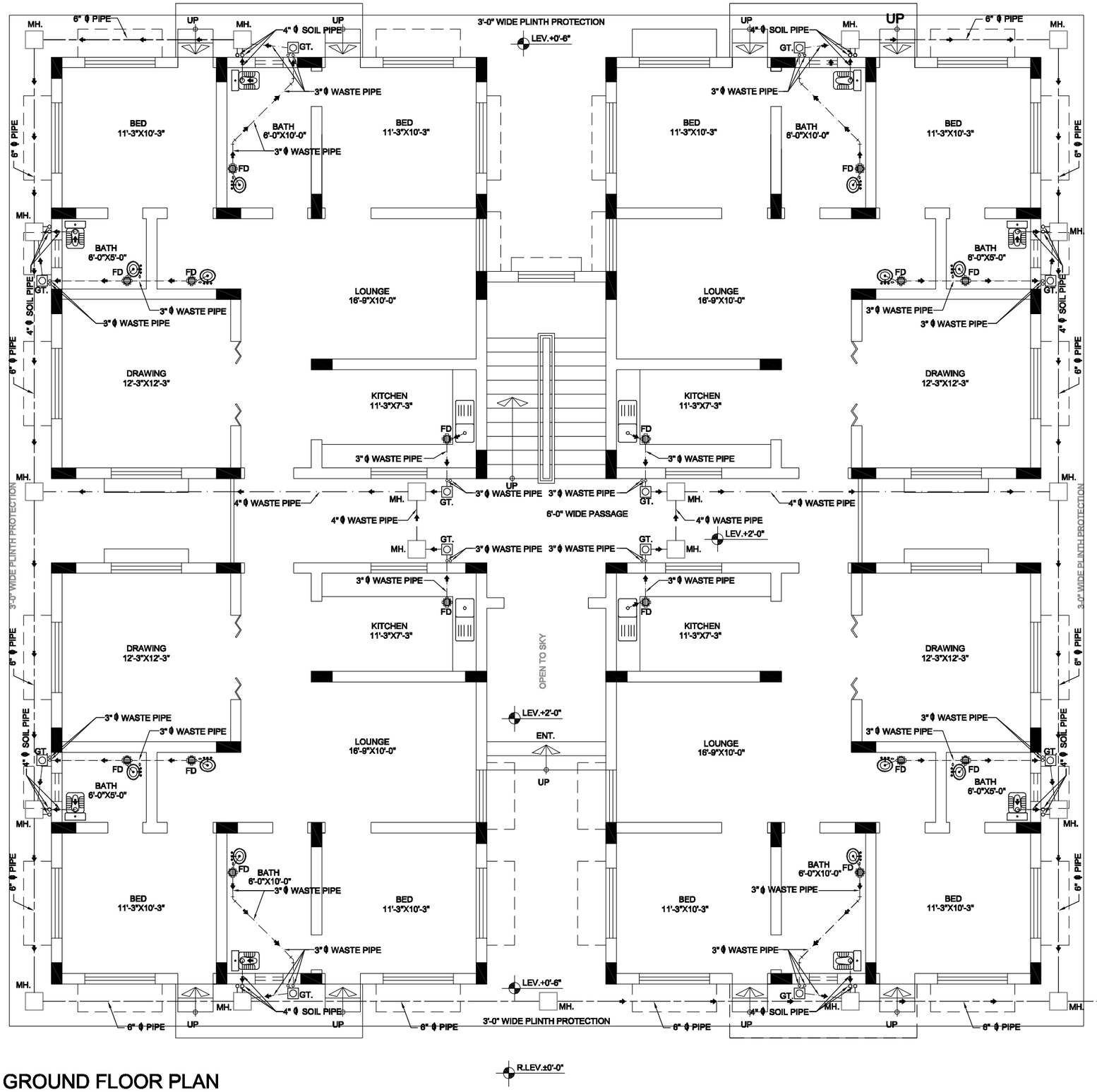
	LEGEND	SYMBOLE
1	WASH BASIN	WB
2	WATER CLOSET	W.C
3	COMMODE	
4	MAN HOLE	
5	GULLY TRAP	
6	FLOOR DRAIN	
7	6"ϕ PIPE P.V.C SEWER LINE	
8	4"ϕ PIPE P.V.C SEWER LINE	
9	3"ϕ PIPE P.V.C SEWER LINE	

3rd Revision :	----------	Date : ---------
2nd Revision :	----------	Date : ---------
1st Revision :	----------	Date : ---------
ISSUED FOR	TENDER DRAWINGS	Date : 29-11-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FIRST FLOOR PLAN DRAIN SYSTEM
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO : 303 / 11	
DRG. NO. : 303 / 11 DS.01	
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"=1'-0"	DATE : 09-12-2025



GROUND FLOOR PLAN

	LEGEND	SYMBOLE
1	WASH BASIN	WB
2	WATER CLOSET	W.C
3	COMMODE	
4	MAN HOLE	
5	GULLY TRAP	
6	FLOOR DRAIN	
7	6"ϕ PIPE P.V.C SEWER LINE	
8	4"ϕ PIPE P.V.C SEWER LINE	
9	3"ϕ PIPE P.V.C SEWER LINE	

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWINGS	Date :	29-11-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	GROUND FLOOR PLAN DRAIN SYSTEM
JOB TITLE :	STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)		

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JOB NO :	303 / 11
DRG. NO. :	303 / 11 DS.02
DRAWN BY : M.K ABBASI	CHECKED BY : ZEESHAN
SCALE :1/8"=1'-0"	DATE : 09-12-2025

ELECTRICAL DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
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LIST OF DRAWINGS

DWG NO.	DRAWING TITLE
EL–01	LIST OF DRAWINGS, LEGENDS & EARTHING DETAIL
EL–02	GENERAL NOTES
EL–03	SINGLE LINE DIAGRAM
EL–04	GROUND FLOOR PLAN LIGHTING LAYOUT
EL–05	FIRST FLOOR PLAN LIGHTING LAYOUT
EL–06	GROUND FLOOR PLAN POWER LAYOUT
EL–07	FIRSTL FLOOR PLAN POWER LAYOUT

LEGEND FOR LIGHTING FIXTURE

SYMBOLS	DESCRIPTION
	UV SHIELD POLY CARBONATE LIGHT (40W)
○	DOWN LIGHT (FLUSHED)
⊗	DOWN LIGHT (SURFACE)
	WALL BRACKET LIGHT
	WALL BRACKET LIGHT
	FLOOD LIGHT 50W

NOTE: THE ABOVE DETAILS ARE SHOWN FOR REFERENCE ONLY, LIGHTING FIXTURE SHALL BE AS PER CLIENT/ARCHITECT APPROVAL.

LEGEND

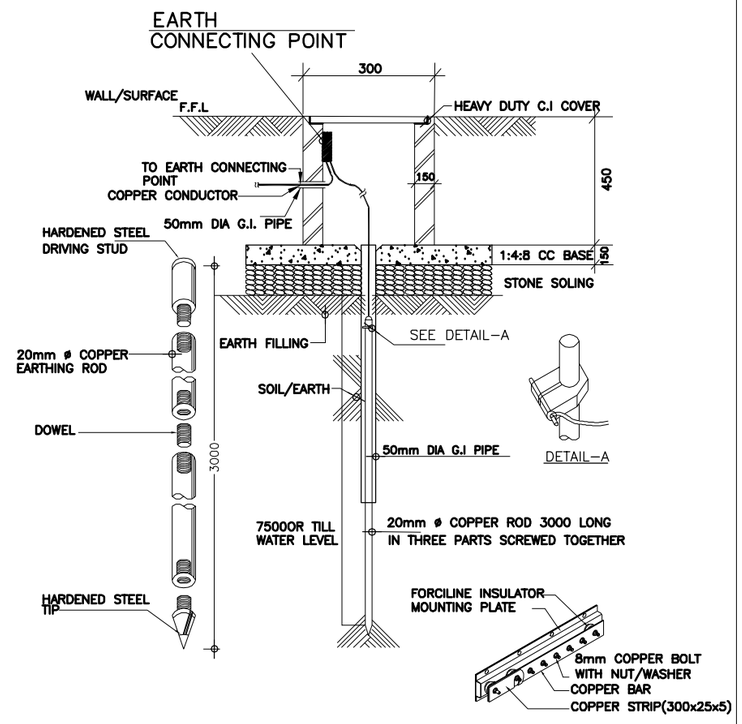
SYMBOL	DESCRIPTION
	LIGHT SWITCH
D	FAN DIMMER
	13 AMP UNIVERSAL SWITCH SOCKET OUTLET
	13 AMP SWITCH SOCKET OUTLET
	15 AMP SWITCH SOCKET OUTLET
	VIVACE ROCKER 20A DP 1 GANG SWITCH WITH NEON & EARTH
◀	RJ–45 DATA OUTLET
◁	RJ–11 VOICE OUTLET
	18U DATA RACK
	SUB MAIN DISTRIBUTION BOARD (SMDB)
	DISTRIBUTION BOARD (DB)
	WALL BRACKET FAN
	CEILING FAN
	EXHAUST / FRESH AIR FAN
----------	WIRING FOR SMALL POWER
-·-·-·-·-·-	WIRING FOR FIRE ALARM
————	WIRING FOR TELEPHONE & DATA
	ROAD CROSSING SLEEVES
	MANHOLE 600mmx600mmx900mm
-·-·-·-·-	50mm Ø UPVC CLASS "D" PIPE

MOUNTING HEIGHTS

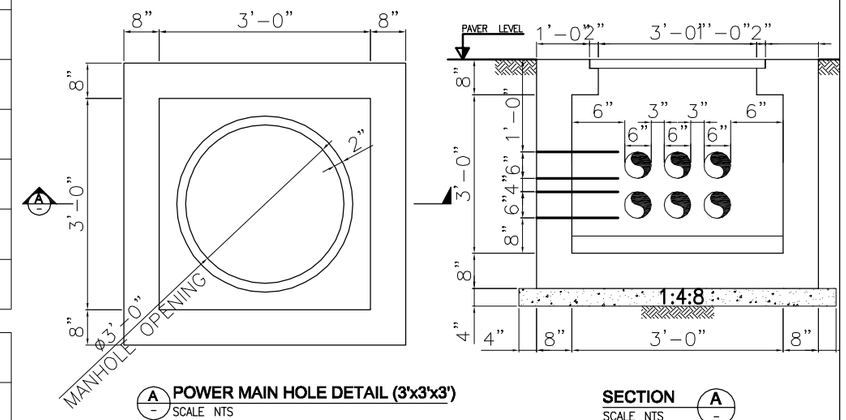
1	LIGHT SWITCH	4'–0" BOTTOM FROM F.F.L.
2	SOCKETS , TELEPHONE, DATA OUTLETS. a.LOW LEVEL b.HIGH LEVEL	 =0'–8" BOTTOM FROM F.F.L. =3'–3" BOTTOM F.F.L.
3	DB HEIGHT.	=6'–0" TOP FROM F.F.L.
4	BELL	=7'–0" MID FROM F.F.L.

NOTE: THE ABOVE DETAILS ARE SHOWN FOR REFERENCE ONLY, THE HEIGHT SHALL BE AS PER ARCHITECT.

EARTHING DETAILS



NOTE:
ALL DIMENSIONS IN mm



A POWER MAIN HOLE DETAIL (3'x3'x3')
SCALE NTS

SECTION A–A
SCALE NTS

HEAVY DUTY
CI COVER (3'–4" ø)

MANHOLE DETAIL (TYPICAL

3rd Revision :	----------	Date : ---------
2nd Revision :	----------	Date : ---------
1st Revision :	----------	Date : ---------
ISSUED FOR	TENDER DRAWINGS	Date : 09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : LIST OF DRAWINGS, LEGENDS & EARTHING DETAILS
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO : 303 / 11	
DRG. NO. : 303 / 11	EL-01
DRAWN BY : Z.N	CHECKED BY : A.H
SCALE : N.T.S	DATE : 09-12-2025

POWER OUTLETS

1. COLOUR FOR ALL SWITCHES, SWITCH SOCKET OUTLETS SHALL BE AS PER CLIENT / CONSULTANT SELECTION.
2. THE ELECTRICAL CONTRACTOR SHALL NOTE THAT THE POSITIONS OF ELECTRICAL POINTS, LUMINAIRES, LIGHTING SWITCHES, SWITCH SOCKET OUTLETS ETC. ARE INDICATIVE AND APPROXIMATE AS SHOWN ON DRAWINGS. THE ACTUAL POSITIONS SHALL BE BASED ON THE ARCHITECT'S DRAWING. THE CONTRACTOR IS DEEMED TO HAVE ALLOWED IN HIS TENDER PRICE FOR ALL NECESSARY SITE ADJUSTMENT TO SUIT THE FINAL POSITIONS.
3. LOCATIONS FOR ELECTRICAL DISTRIBUTION BOARDS AND SHOWN IN THE PLANS ARE INDICATIVE ONLY. ELECTRICAL CONTRACTOR SHALL VERIFY ON SITE AND PROPOSE THEIR ACTUAL LOCATIONS ON THE SHOP DRAWING FOR CLEARANCE.

CABLES AND ANCILLARY PRODUCTS

1. ALL PVC CABLES FOR FINAL SUB-CIRCUIT WIRINGS SHALL BE MULTI-STRAND COPPER CONDUCTORS & INSULATION COLOUR OF THE CABLES SHALL BE AS FOLLOWS :-
   LIVE WIRES – RED OR YELLOW OR BLUE FOR SINGLE-PHASE CIRCUIT.
   (TO CORRESPOND TO THE PHASE OF THE SUPPLY)
   RED, YELLOW, BLUE FOR THREE PHASE CIRCUIT
   NEUTRAL WIRES – BLACK
   EARTH WIRE – GREEN & YELLOW
2. SPACE FACTOR OF CONDUIT & TRUNKING SHALL COMPLY WITH BS 7671 CODE OF PRACTICE FOR WIRING OF ELECTRICAL EQUIPMENT.
3. ALL SUB-MAINS CIRCUITS TO BE COMPLETE WITH CIRCUIT PROTECTIVE CONDUCTOR(CPC) COMPLYING TO BS 7671 CODE OF PRACTICE.
4. NEUTRAL & EARTH CABLES FOR EACH DIFFERENT CIRCUIT SHALL BE BROUGHT BACK TO THE SOURCE PANEL AND SHALL NOT BE LOOPED TOGETHER OUTSIDE THE PANEL.

CO-ORDINATION AND INSTALLATION

1. THE ELECTRICAL CONTRACTOR SHALL OBTAIN APPROVAL FROM STRUCTURAL ENGINEERS & ARCHITECT FOR PENETRATION THROUGH STRUCTURE AND FLOOR SLABS PRIOR TO CONSTRUCTION.
2. ALL MATERIALS/ CABLES USED AND INSTALLATION METHOD SHALL COMPLY WITH THE TECHNICAL SPECIFICATION, STANDARDS, CODE OF PRACTICE AND AUTHORITY REQUIREMENT.
3. ALL CABLES/ UNDERGROUND PIPE ROUTES SHOWN ON THE DRAWINGS ARE INDICATIVE ONLY. ELECTRICAL CONTRACTOR SHALL CHECK AND VERIFY THEM ON SITE.
4. THE CONTRACTOR IS REQUIRED TO SUBMIT DETAILS OF FINAL ARRANGEMENT AND DIMENSIONAL LAYOUT OF ALL ITEMS OF EQUIPMENT IN RESPECTIVE ROOMS TO SUIT SITE CONDITIONS, ETC. FOR REVIEW BY THE ARCHITECT BEFORE COMMENCEMENT OF INSTALLATION.
5. THE TENDERER IS REQUIRED TO CKECK AND HIGHLIGHT IN THEIR TENDER SUBMISSION IF ANY OF THE SWITCHBOARDS, ELECTRICAL EQUIPMENTS, ETC. AS PROVIDED ON THE SPECIFICATION DRAWINGS ARE NOT ADEQUATE TO ACCOMMODATE ALL THE EQUIPMENT TO BE SUPPLIED UNDER THIS CONTRACT.

GENERAL NOTES

1. ALL ELECTRICAL WORKS CARRIED OUT SHALL COMPLY WITH THE LATEST STANDARD.
2. EARTHING INSTALLATION SYSTEM SHALL COMPLY WITH THE LATEST STANDARD ALL WIRING SHALL BE IN CONCEALED CONDUIT/TRUNKING UNLESS OTHERWISE APPROVED BY CONSULTING ENGINEERS.
3. THE POSITIONING OF ALL LIGHTING LIMINAIRES, SWITCH SOCKET OUTLETS, DISTRIBUTION BOARDS ETC. AS SHOWN IN THE DRAWINGS ARE APPROXIMATE ONLY. THE EXACT POSITIONS SHALL BE DETERMINED ON SITE.
4. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE ELECTRICAL LOAD BALANCING AND LABELING OF ALL EQUIPMENT AND SWITCHBOARDS THROUGHOUT THE INSTALLATION.
5. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE TO LIAISE WITH ELECTRIC INSPECTOR FOR ALL CLEARANCE, CABLE JOINTING, TESTING AND ELECTRICITY METERING FOR THE INSTALLATION. (IF REQUIRED)
6. THE OVERALL RESISTANCE FOR THE EARTHING SYSTEM (ELECTRICAL) SHALL COMPLY WITH LATEST CODES / STANDARDS REQUIREMENTS.
7. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR SEALING OF ALL CABLE PENETRATION OPENINGS BETWEEN FLOOR SLAB, MANHOLE AND WALLS ETC. WITH APPROVED FIRE RATING MATERIAL/CONSULTING ENGINEER'S APPROVAL.
8. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR SEALING OF ALL CABLE PENETRATION OPENINGS THROUGH ROOF STRUCTURE WALL WITH APPROVED WATER-PROOF MATERIALS AFTER THE INSTALLATION OF CABLES.
9. THE ELECTRICAL CONTRACTOR SHALL BACKFILL WITH SAND THE MANHOLES AND DRAWPITS TO COMPLY TO TECHNICAL SPECIFICATIONS.
10. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE EQUIPOTENTIAL EARTHING BONDING TO ALL METAL PARTS COMPLETED BY THE OTHER TRADES TO THE NEARBY ELECTRICAL PANEL IN ACCORDANCE WITH STANDARD.
11. ALL WIRING TO LIGHTING LUMINAIRES SHALL COMPRISE OF APPROVED CEILING ROSE FOR INDOOR INSTALLATION AND WEATHERPROOF JUNCTION BOX FOR OUTDOOR INSTALLATION. CONNECTION TO LIGHT FIXTURE SHALL BE BY MEANS OF PVC SHEATHED FLEXIBLE CABLE FOR NORMAL SUPPLY, FR CABLE FOR EMERGENCY SUPPLY.
12. OUTDOOR INSTALLATION SHALL BE IN HEAVY DUTY UPVC PIPES.
13. THE ELECTRICAL CONTRACTOR SHALL FURNISH ALL NECESSARY LABOUR, MATERIALS AND EQUIPMENTS FOR SATISFACTORY COMPLETION OF THE ENTIRE ELECTRICAL INSTALLATION AS GENERALLY DESCRIBED IN THE SPECIFICATION AND/OR SHOWN ON DRAWINGS.
14. ALL LOCATIONS OF EQUIPMENT AND CABLE ROUTES SHOWN ON THE DRAWING ARE APPROXIMATE. THE EXACT LOCATIONS MUST BE CO-ORDINATED ON SITE BEFORE INSTALLATION. FULLY CO-ORDINATED SHOP DRAWINGS MUST BE SUBMITTED TO THE CONSULTANT FOR APPROVAL BEFORE COMMENCEMENT OF WORK.
15. ALL SWITCHBOARDS AND DISTRIBUTION BOARDS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST STANDARD AND TO THE APPROVAL OF CONSULTANT. THEY SHALL BE PAINTED WITH A COAT OF ANTI-RUST PAINT AND TWO COATS OF SEMI-GLOSS TEAK PAINT OF BEST QUALITY TO THE APPROVAL OF THE CONSULTANT.
16. ALL CONDUITS SHALL COMPLY WITH THE LATEST STANDARD AND MINIMUM SIZE SHALL NOT BE LESS THAN 25mm. ALL THREADS IN CONDUITS SHALL BE TREATED WITH ALUMINIUM PAINT OR SIMILAR ANTI-RUST PAINT TO PREVENT CORROSION AT JOINTS AND TERMINATIONS. CONNECTION SHALL BE BY MEANS OF BUSH & COUPLER.
17. PHASE SEGREGATION SHALL COMPLY WITH THE LATEST REQUIREMENTS OF THE IEE WIRING REGULATIONS. SEPARATE CONDUITS SHALL BE USED FOR CABLES OF DIFFERENT CIRCUIT CATEGORIES. FOR 3 PHASE FINAL CIRCUITS, SEPARATE CONDUITS SHALL BE USED FOR DIFFERENT CIRCUITS.
18. ALL LIGHTING POINTS SHALL BE PROVIDED WITH CIRCUIT PROTECTIVE CONDUCTORS AND ALL METAL PARTS SHALL BE CONTINUOUSLY EARTHED THROUGHOUT.
19. THE ELECTRICAL CONTRACTOR SHALL SUPPLY AND INSTALL ALL LIGHT LIMINAIRES AS SHOWN ON THE DRAWINGS. EACH FITTING SHALL HAVE ITS OWN INDEPENDENT SUPPORT REGARDLESS OF SURFACE, RECESSED OR SUSPENDED MOUNTING.
20. EACH CIRCUIT SHALL BE TESTED FOR GROUNDS AND SHORTS BY MEANS OF A MEGGER INSULATION RESISTANCE TESTING INSTRUMENT APPLYING A VOLTAGE OF NOT LESS THAN 500V D.C. UPON CIRCUIT UNDER TEST.
21. ALL EARTH TESTS SHALL BE CARRIED OUT WITH A 1000V MEGGER TEST INSTRUMENT AND IN ACCORDANCE WITH THE LATEST REQUIREMENTS OF THE IEE WIRING REGULATIONS.

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWINGS	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : GENERAL NOTES
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

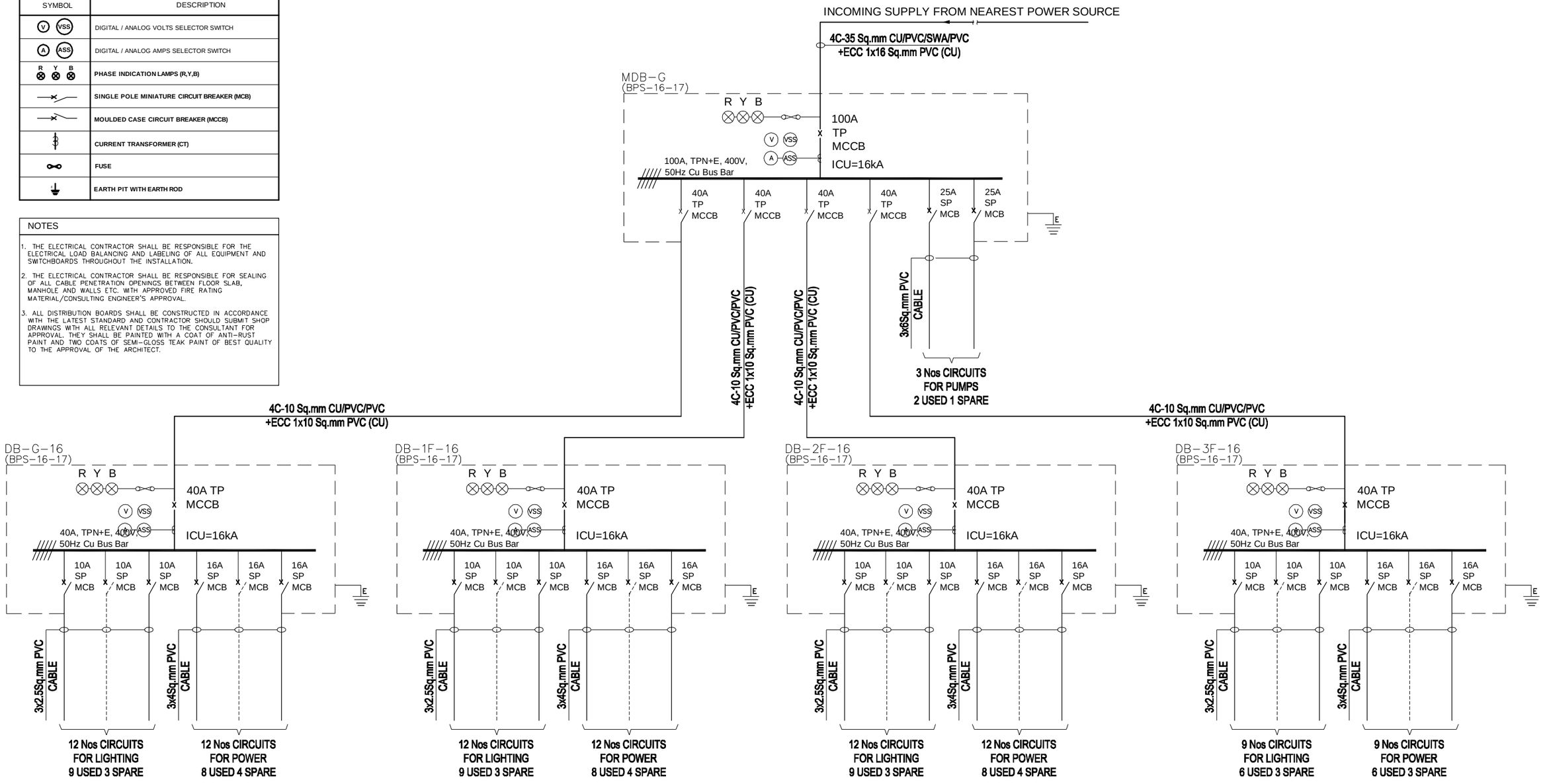
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JOB NO : 303 / 11	
DRG. NO. : 303 / 11 EL-02	
DRAWN BY : Z.N	CHECKED BY : A.H
SCALE : N.T.S	DATE : 09-12-2025

LEGENDS	
SYMBOL	DESCRIPTION
V VSS	DIGITAL / ANALOG VOLTS SELECTOR SWITCH
A ASS	DIGITAL / ANALOG AMPS SELECTOR SWITCH
R Y B	PHASE INDICATION LAMPS (R,Y,B)
	SINGLE POLE MINIATURE CIRCUIT BREAKER (MCB)
	MOULDED CASE CIRCUIT BREAKER (MCCB)
	CURRENT TRANSFORMER (CT)
	FUSE
	EARTH PIT WITH EARTH ROD

NOTES

1. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE ELECTRICAL LOAD BALANCING AND LABELING OF ALL EQUIPMENT AND SWITCHBOARDS THROUGHOUT THE INSTALLATION.
2. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR SEALING OF ALL CABLE PENETRATION OPENINGS BETWEEN FLOOR SLAB, MANHOLE AND WALLS ETC. WITH APPROVED FIRE RATING MATERIAL/CONSULTING ENGINEER'S APPROVAL.
3. ALL DISTRIBUTION BOARDS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST STANDARD AND CONTRACTOR SHOULD SUBMIT SHOP DRAWINGS WITH ALL RELEVANT DETAILS TO THE CONSULTANT FOR APPROVAL. THEY SHALL BE PAINTED WITH A COAT OF ANTI-RUST PAINT AND TWO COATS OF SEMI-GLOSS TEAK PAINT OF BEST QUALITY TO THE APPROVAL OF THE ARCHITECT.

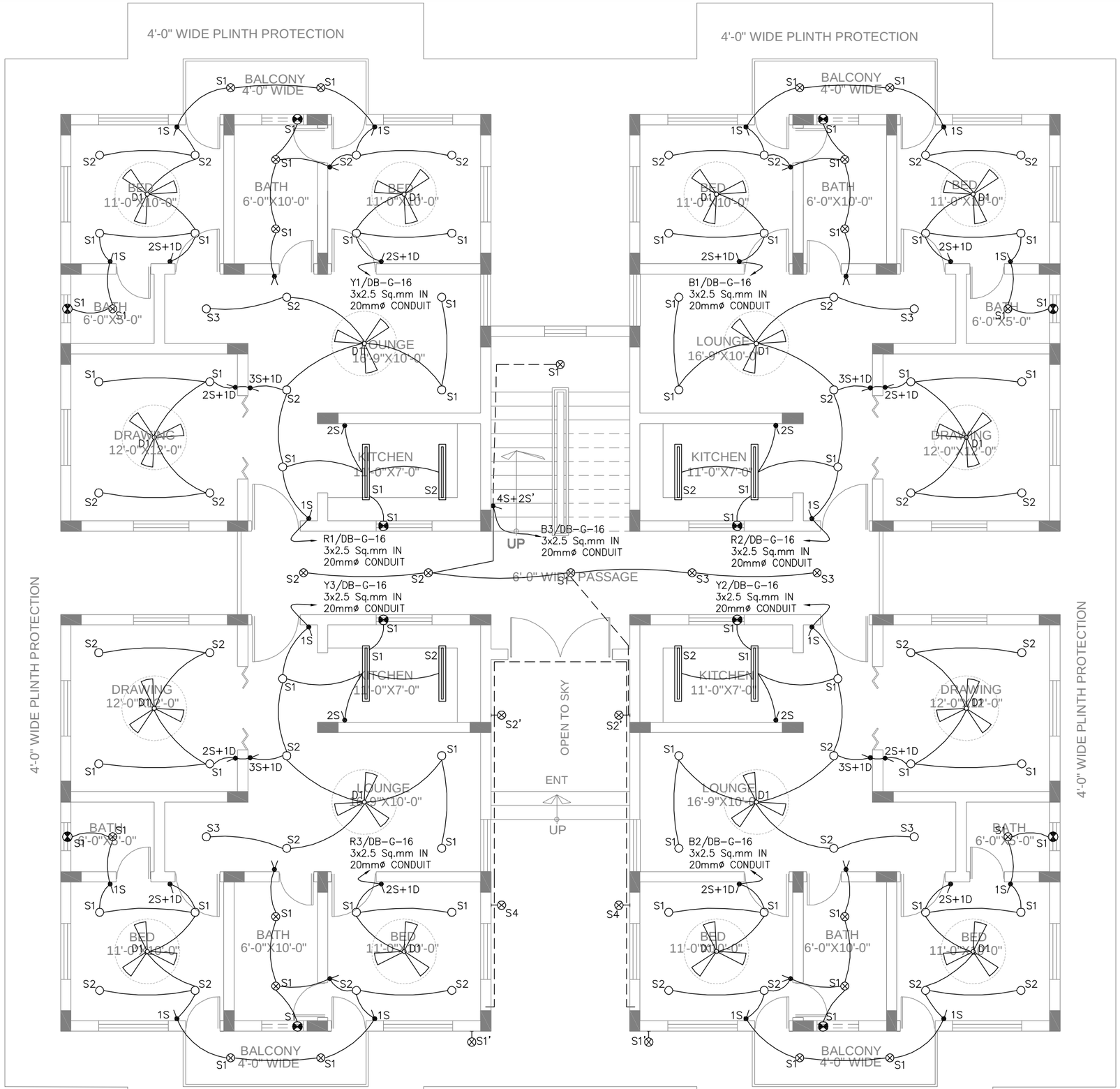


3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWINGS	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : SINGLE LINE DIAGRAM
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO :	303 / 11
DRG. NO. :	303 / 11 EL-03
DRAWN BY : Z.N	CHECKED BY : A.H
SCALE : N.T.S	DATE : 09-12-2025



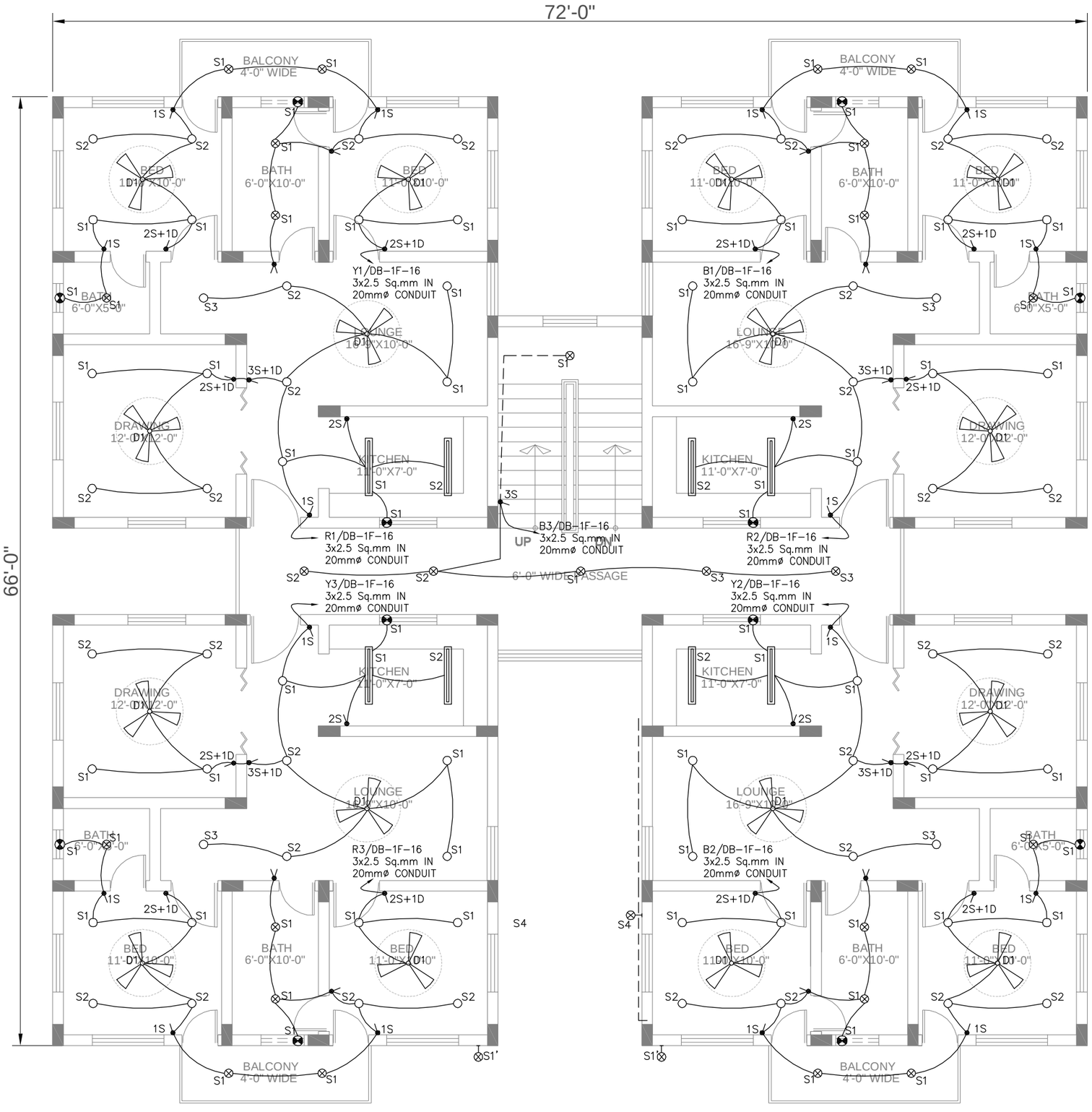
GROUND FLOOR PLAN
COVERED AREA = 4179.00 SQ.FT.

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWINGS	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	GROUND FLOOR PLAN LIGHTING LAYOUT
JOB TITLE :	STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)		

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JOB NO :	303 / 11		
DRG. NO. :	303 / 11 EL-04		
DRAWN BY :	Z.N	CHECKED BY :	A.H
SCALE :	1/8"=1'-0"	DATE :	09-12-2025



(FIRST FLOOR)

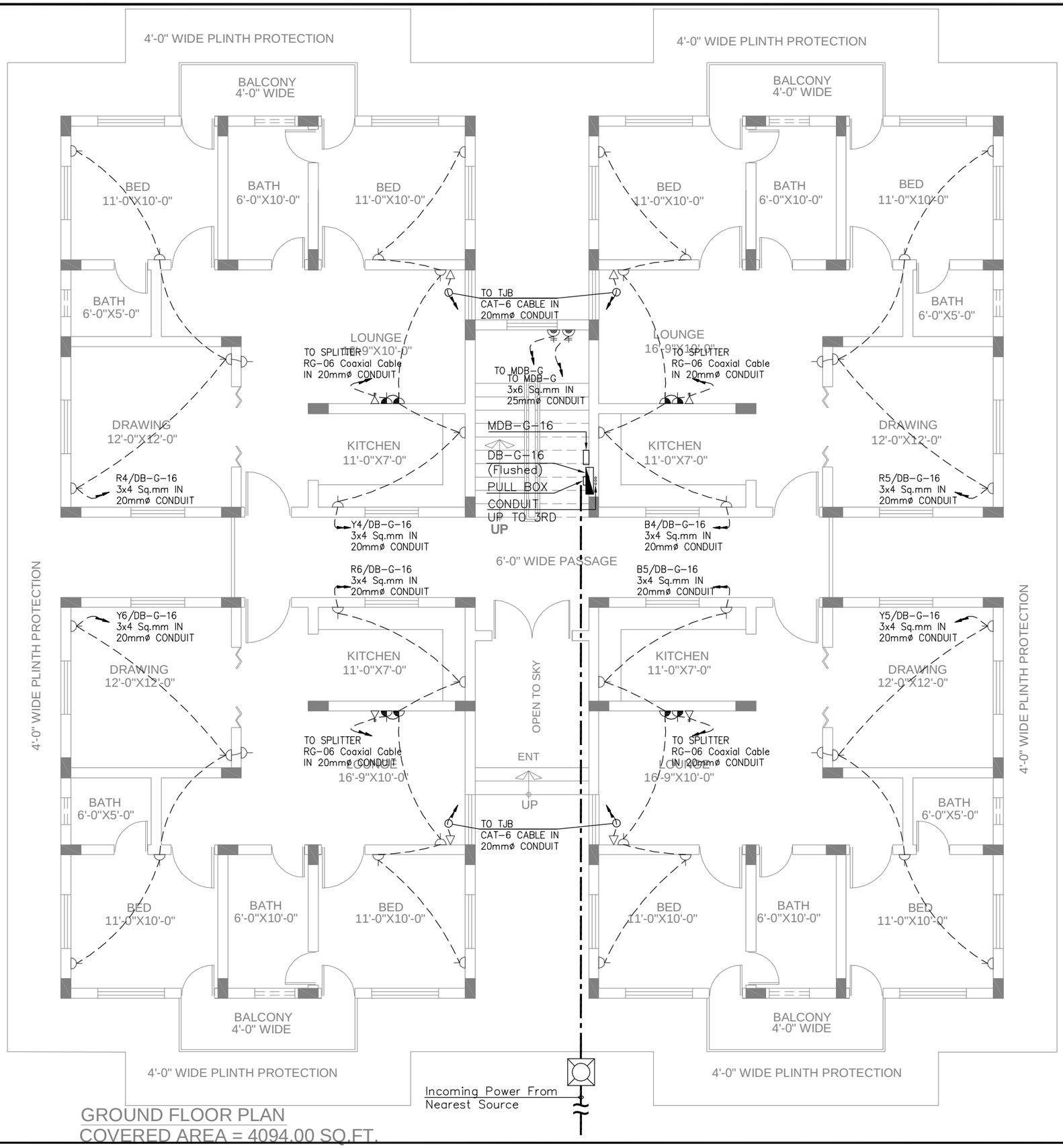
COVERED AREA = 4179.00 SQ.FT.

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWINGS	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FIRST FLOOR PLAN LIGHTING LAYOUT
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO :	303 / 11
DRG. NO. :	303 / 11 EL-05
DRAWN BY : Z.N	CHECKED BY : A.H
SCALE : 1/8"=1'-0"	DATE : 09-12-2025



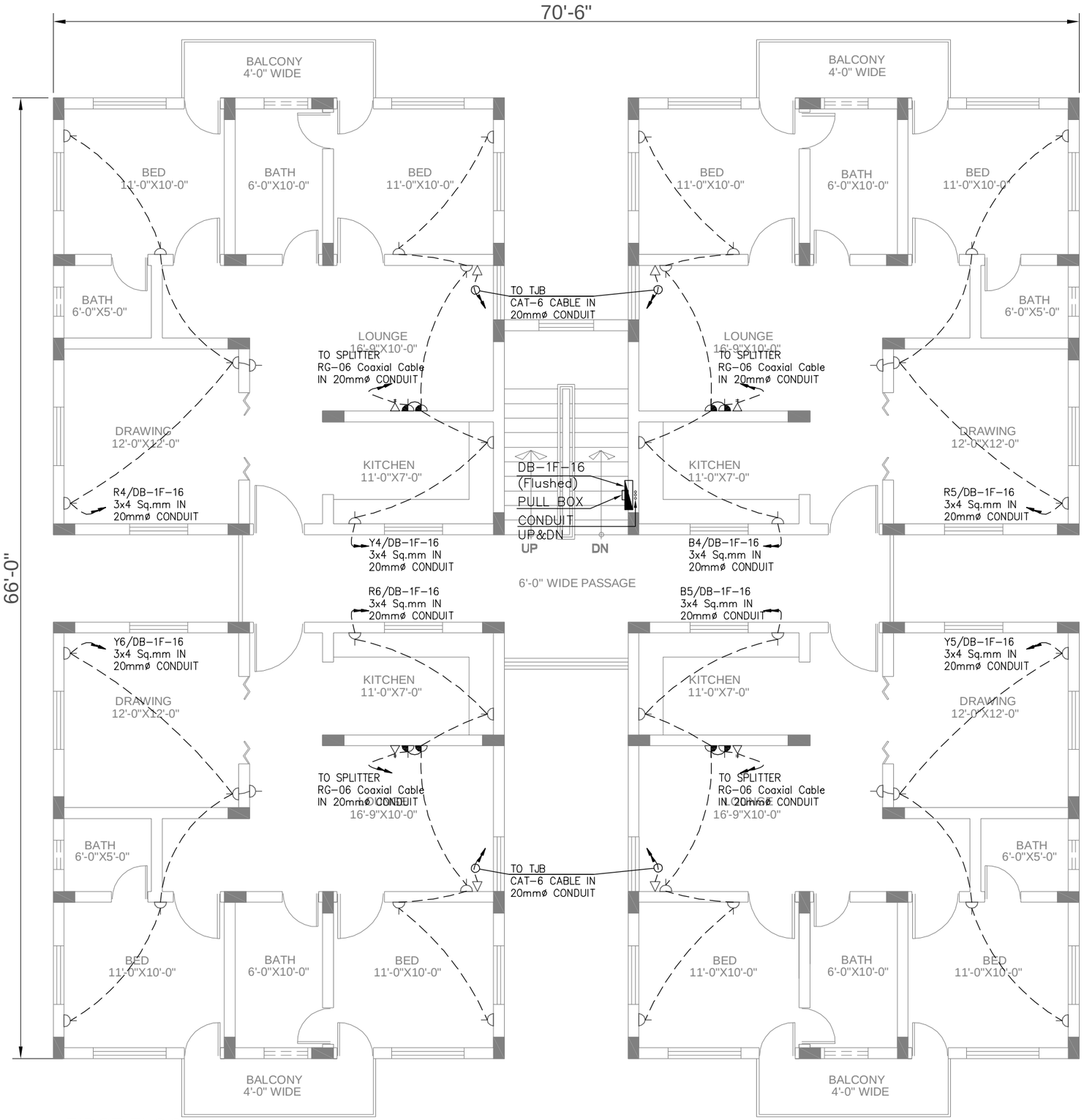
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COVERED AREA = 4094.00 SQ.FT.

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWINGS	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : GROUND FLOOR PLAN POWER LAYOUT
JOB TITLE : STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)	

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JOB NO :	303 / 11
DRG. NO. :	303 / 11 EL-06
DRAWN BY : Z.N	CHECKED BY : A.H
SCALE :1/8"=1'-0"	DATE : 09-12-2025



FIRST FLOOR PLAN

COVERED AREA = 4094.00 SQ.FT.

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWINGS	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	FIRST FLOOR PLAN POWER LAYOUT
JOB TITLE :	STAFF FAMILY QUARTERS / FLATS CAT-IV (OFFICERS COLONY)		

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JOB NO :	303 / 11		
DRG. NO. :	303 / 11 EL-07		
DRAWN BY : Z.N		CHECKED BY : A.H	
SCALE : 1/8"=1'-0"		DATE : 09-12-2025	

CADET COLLEGE SANGHAR

LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY-VI

TENDER DRAWINGS

ARCHITECTURAL , STRUCTURAL
ELECTRICAL & PLUMBING DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
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ARCHITECTURAL DRAWINGS

PREPARED BY:

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LIST OF ARCHITECTURAL DRAWINGS

S.NO.	DWG. NO.	DESCRIPTION
1	AR.00	LIST OF DRAWING
2	AR.01	SITE PLAN
3	AR.02	GROUND FLOOR PLAN
4	AR.03	FIRST FLOOR PLAN
5	AR.04	ROOF PLAN
6	AR.05	LEFT SIDE & RIGHT ELEVATION
7	AR.06	FRONT ELEVATION
8	AR.07	REAR ELEVATION
9	AR.08	SECTION AT AA & B-B
10	AR.09	SCHEDULE OF OPENING

3rd Revision : ---------- Date : --------

2nd Revision : ---------- Date : --------

1st Revision : ---------- Date : --------

ISSUED FOR TENDER DRAWING Date : 09-12-2025

CLIENT: CADET COLLEGE SANGHAR

JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-V

DESCRIPTION : LIST OF DRAWINGS

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JOB NO : 303/12

DRG. NO. : 330/12 AR-00

DRAWN BY : AAMIR | CHECKED BY : MUNEER

SCALE : 1"=8'-0" | DATE : 09-12-2025

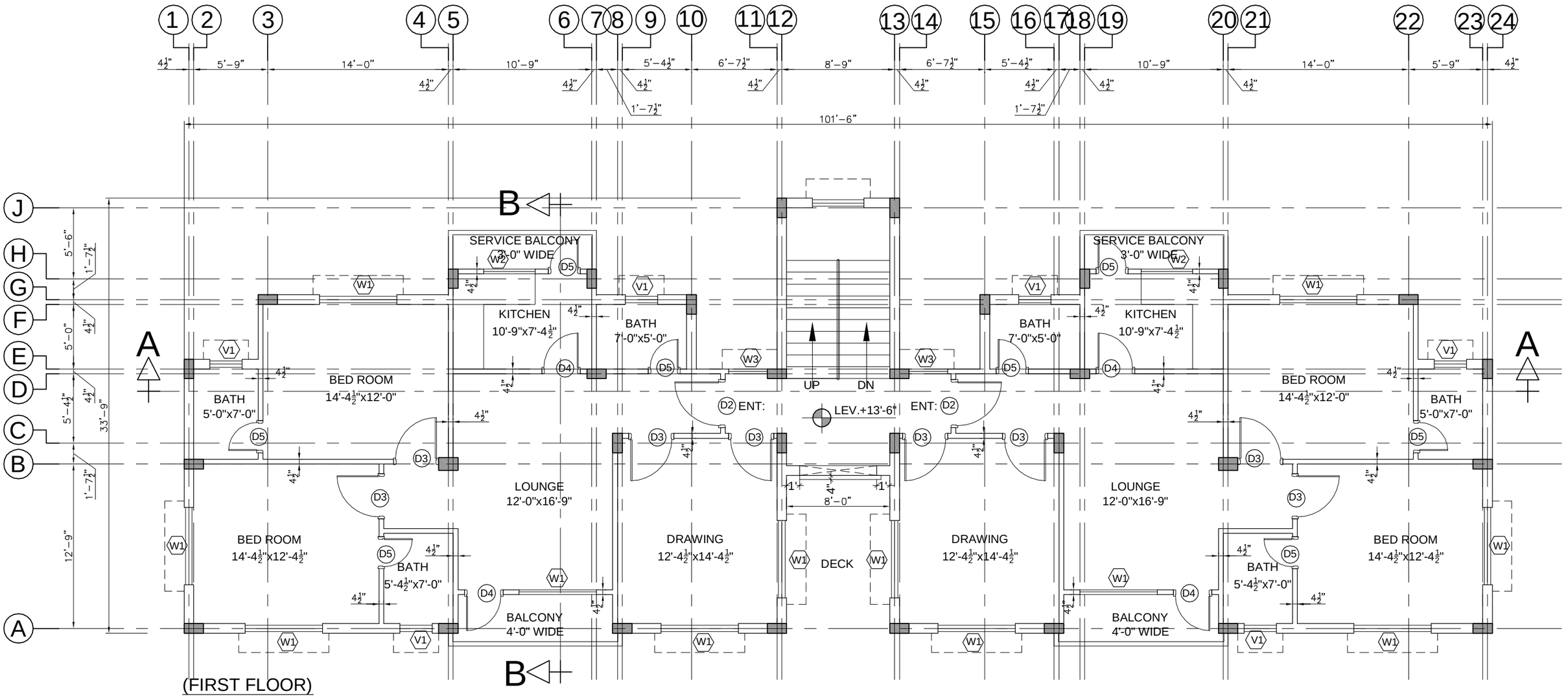


3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	GOOGLE IMAGE
JOB TITLE :	LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-V		

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JOB NO :	303/12		
DRG. NO. :	330/12 AR-01		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1"=8'-0"	DATE :	09-12-2025



(FIRST FLOOR)

FLATS FOR CAT-V

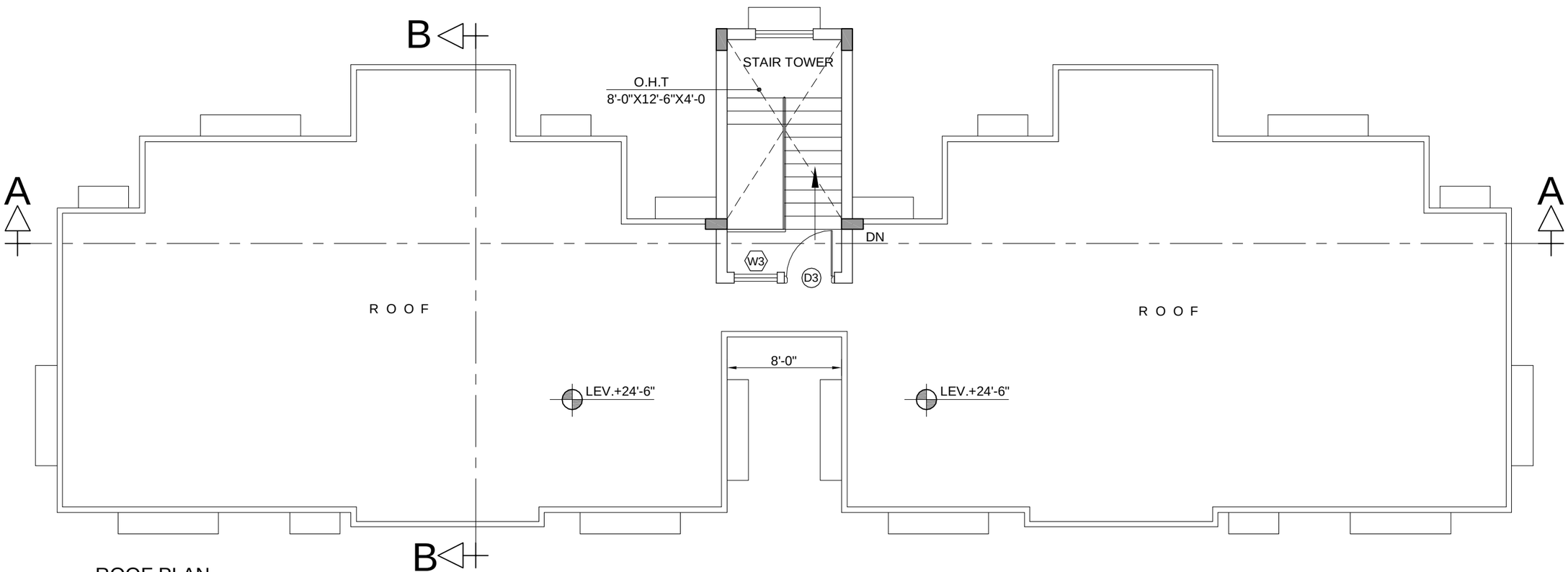
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3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	FIRST FLOOR PLAN
JOB TITLE :	LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-V		

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JOB NO :	303/12		
DRG. NO. :	330/12 AR-03		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1"=8'-0"	DATE :	09-12-2025



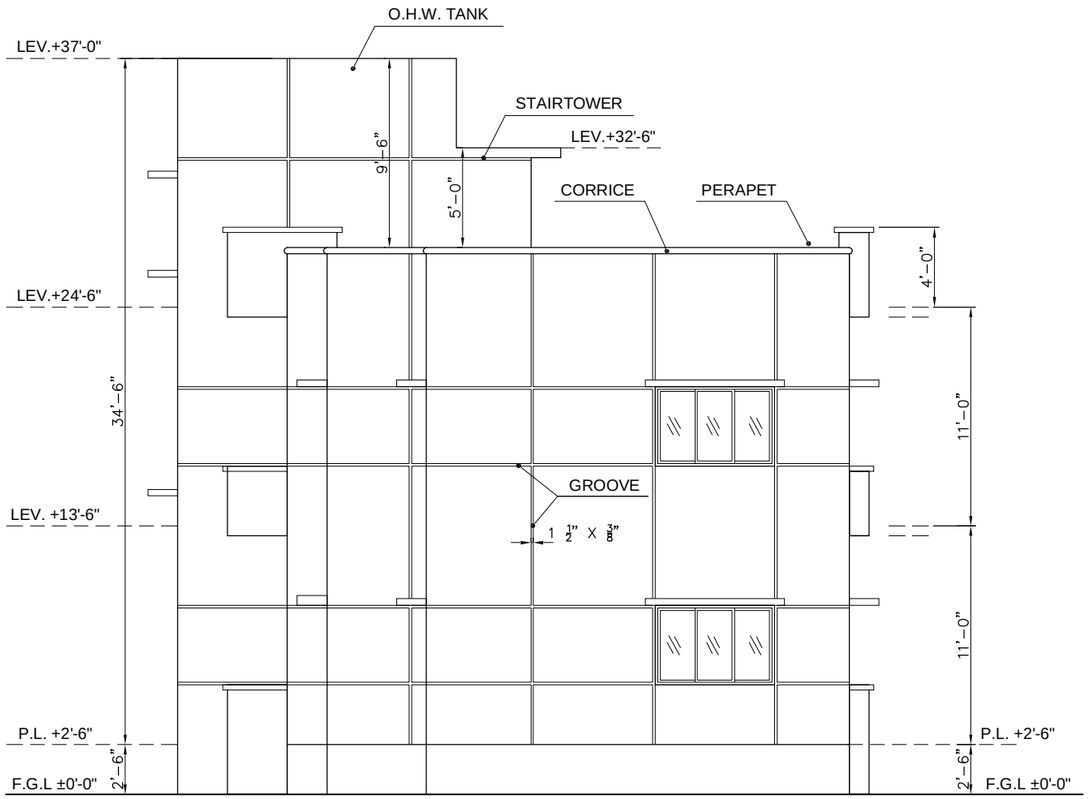
ROOF PLAN

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

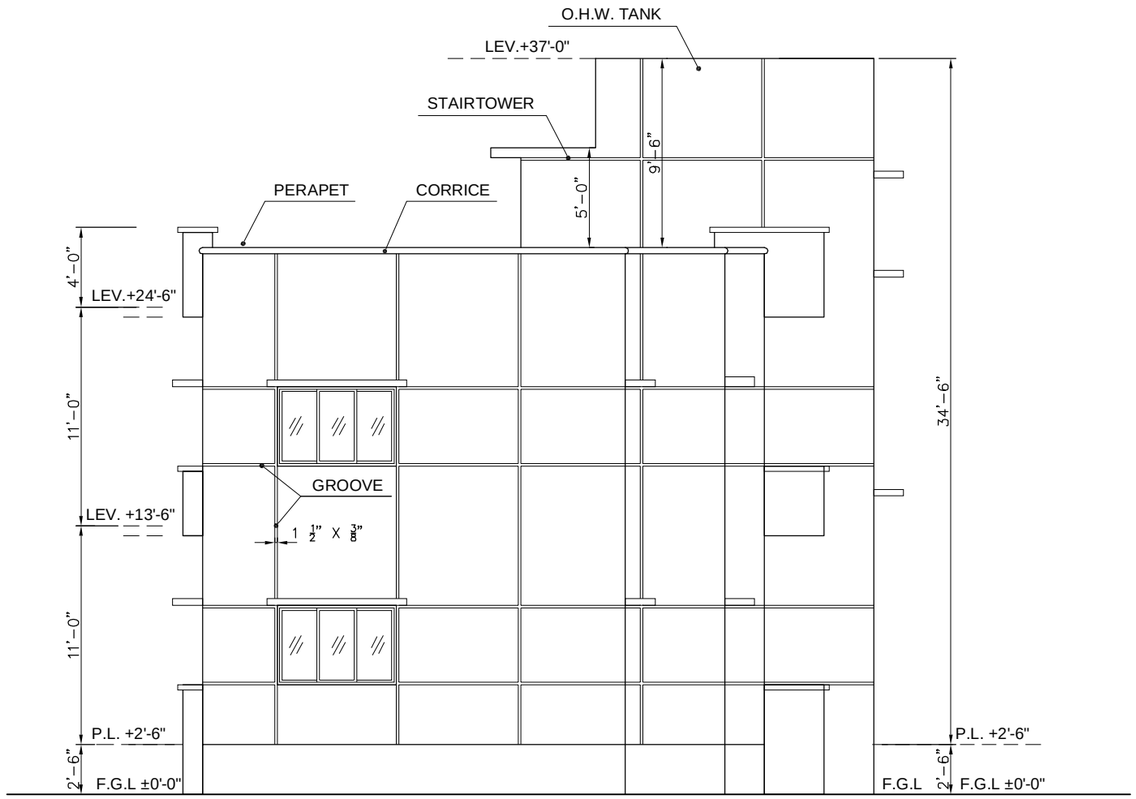
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : ROOF PLAN
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-V	

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JOB NO : 303/12	
DRG. NO. : 330/12 AR-04	
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=8'-0"	DATE : 09-12-2025



LEFT SIDE ELEVATION



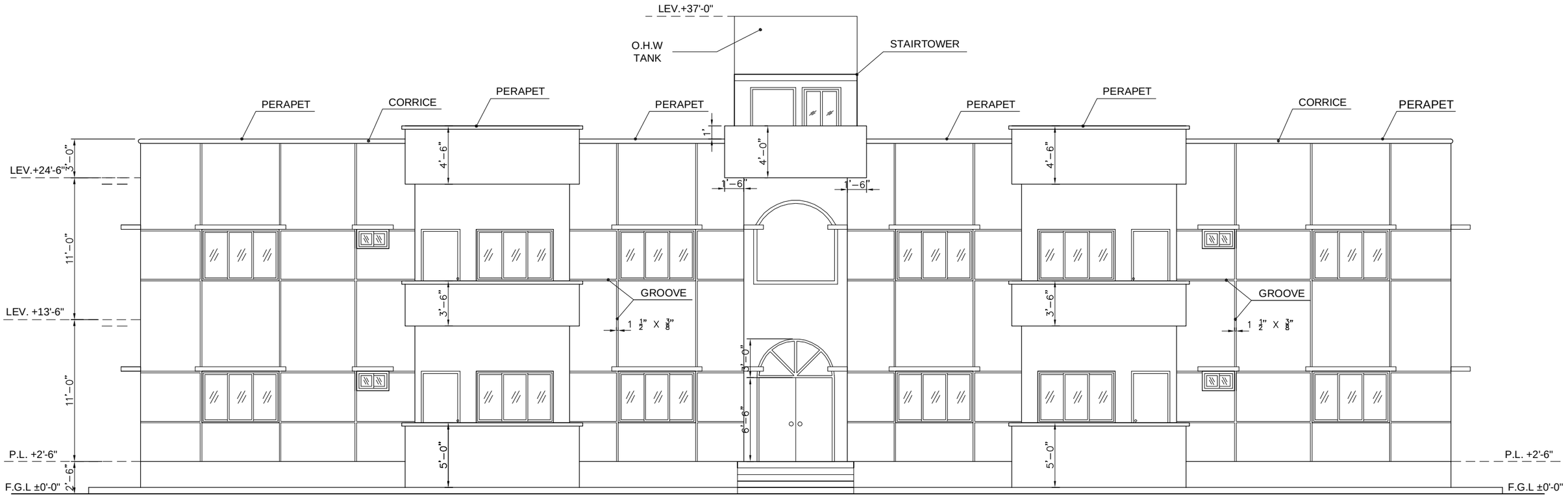
RIGHT SIDE ELEVATION

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	LEFT SIDE & RIGHT SIDE ELEVATION
JOB TITLE :	LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-V		

YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 th Commercial street, Phase 2 (Extn),
Defence Housing Authority, Karachi-75500
Tel :021-35396444, 021-35312244
FAX: 021-35883106
E-mail: info@youngassociates.com.pk

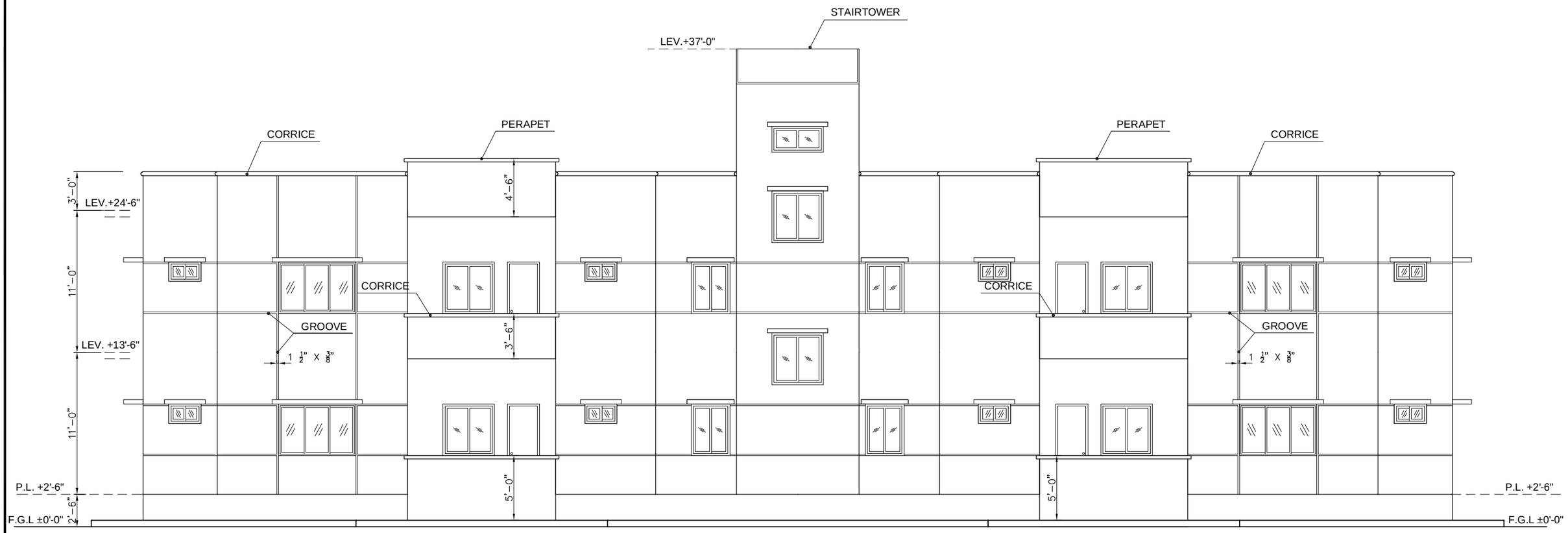
JOB NO :	303/12		
DRG. NO. :	330/12 AR-05		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1"=8'-0"	DATE :	09-12-2025



FRONT ELEVATION

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	FORNT ELEVATION
JOB TITLE :	LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-V		
YOUNG ASSOCIATES CONSULTING ENGINEERS & ARCHITECTS 9-C 24 th Commercial street, Phase 2 (Extn), Defence Housing Authority, Karachi-75500 Tel :021-35396444, 021-35312244 FAX: 021-35883106 E-mail: info@youngassociates.com.pk		JOB NO :	303/12
		DRG. NO. :	330/12 AR-06
		DRAWN BY : AAMIR	CHECKED BY : MUNEER
		SCALE : 1"=8'-0"	DATE : 09-12-2025



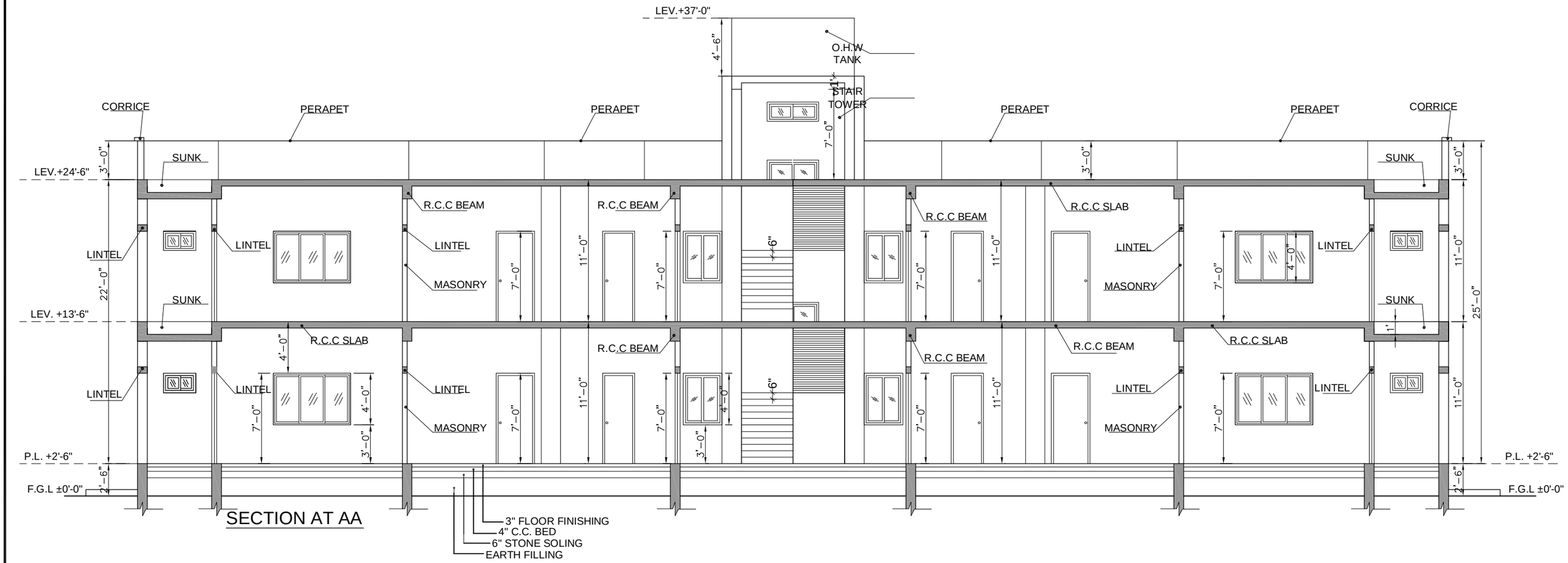
REAR ELEVATION

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

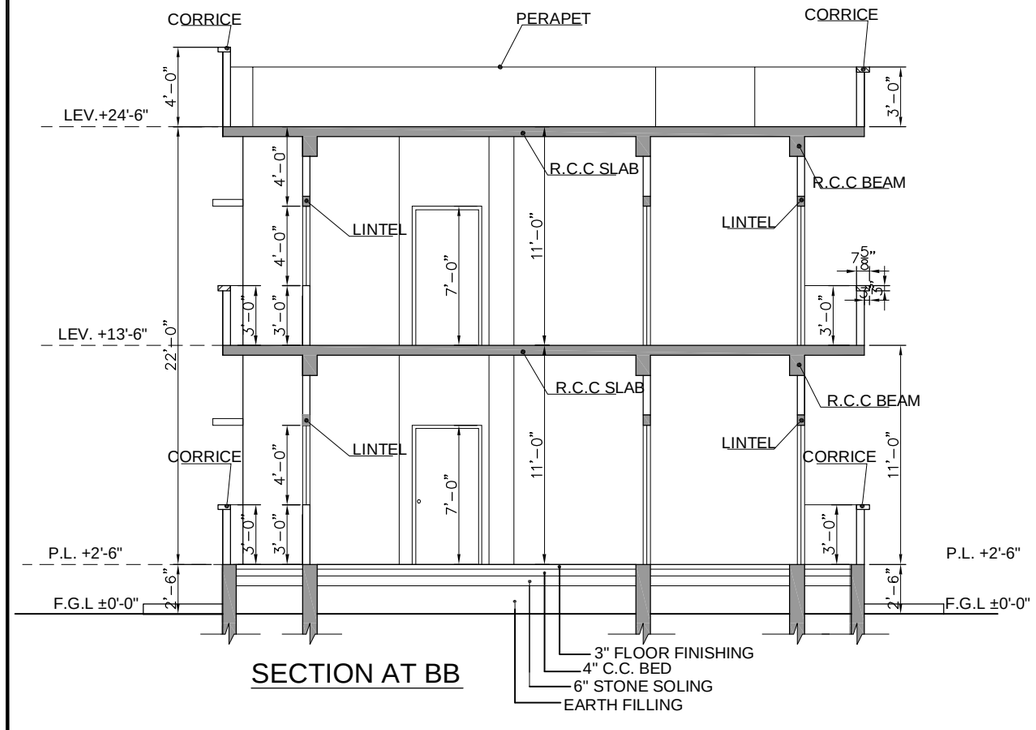
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : REAR ELEVATION
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-V	

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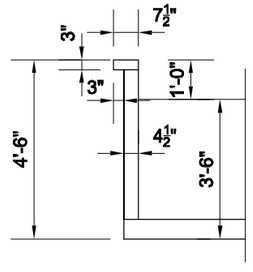
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SCALE : 1"=8'-0"	DATE : 09-12-2025



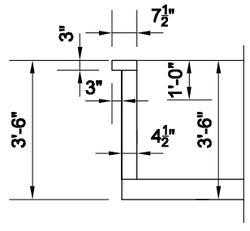
SECTION AT AA



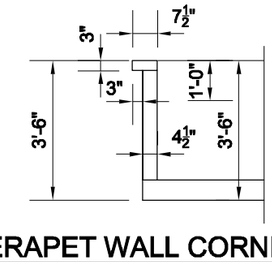
SECTION AT BB



TYP. PERAPET WALL CORNICE AT ROOF



TYP. PERAPET WALL CORNICE AT ROOF



TYP. PERAPET WALL CORNICE AT BALCONY

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	SECTION AT AA & BB
JOB TITLE :	LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-V		
	YOUNG ASSOCIATES CONSULTING ENGINEERS & ARCHITECTS 9-C 24 th Commercial street, Phase 2 (Extn), Defence Housing Authority, Karachi-75500 Tel :021-35396444, 021-35312244 FAX: 021-35883106 E-mail: info@youngassociates.com.pk	JOB NO :	303/12
		DRG. NO. :	330/12 AR-08
		DRAWN BY : AAMIR	CHECKED BY : MUNEER
		SCALE : 1"=8'-0"	DATE : 09-12-2025

DOORS & WINDOWS VENTILATORS SCHEDULE

S.N O	DESCRIPTION	SIZE	REMARKS
	DOORS		
D1	DOOR DOUBLE LEAF	6'-0" X 9'-6"	WOODE PANELLED DOOR
D2	DOOR SINGLE LEAF	3'-6" X 7'-0"	" " " "
D3	DOOR SINGLE LEAF	3'-6" X 7'-0"	" " " "
D4	DOOR SINGLE LEAF	3'-0" X 7'-0"	" " " "
D5	DOOR SINGLE LEAF	2'-6" X 7'-0"	" " " "
	WINDOWS		
W1	WINDOW FULL GLAZED	6'-0" X 4'-0"	WOODEN GLAZED SHUTTER WITH FLY PROOF
W2	WINDOW FULL GLAZED	4'-0" X 4'-0"	" " " "
W3	WINDOW FULL GLAZED	3'-0" X 6'-0"	" " " "
	VENT.		
V1	VENT. FULL GLAZED	2'-6" X 1'-6"	WOODEN GLAZED SHUTTER WITH FLY PROOF

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : SCHEDULE OF OPENING
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-V	

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JOB NO :	303/12
DRG. NO. :	330/12 AR-09
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=8'-0"	DATE : 09-12-2025

STRUCTURAL DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
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Tel :021-35396444, 021-35312244, FAX : 021-35883106
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LIST OF STRUCTURAL DRAWINGS

S.NO.	DWG. NO.	DESCRIPTION
1	GN.-01	GENERAL NOTES
2	ST.00	LIST OF DRAWING
3	ST.01	FOUNDATION & COLUMN LAYOUT PLAN
4	ST.02	FOUNDATION REINFORCEMENT DETAILS
5	ST.03	PLINTH BEAM LAYOUT & REINFORCEMENT DETAILS
6	ST.04	STAIR CASE SECTION & REINFORCEMENT DETAILS
7	ST.05	1ST. SLAB BEAMS & REINFORCEMENT DETAILS
8	ST.06	ROOF SLAB BEAMS & REINFORCEMENT DETAILS
9	ST.07	TOWER & O.H. TANK REINFORCEMENT DETAILS
10	ST.08	TYP. DETAILS OF BRICK WALL

3rd Revision : ---------- Date : ---------

2nd Revision : ---------- Date : ---------

1st Revision : ---------- Date : ---------

ISSUED FOR : TENDER DRAWING Date : 09-12-2025

CLIENT: CADET COLLEGE SANGHAR

JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-V

DESCRIPTION : LIST OF DRAWINGS

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JOB NO : 303/12

DRG. NO. : 303/12 ST-00

DRAWN BY : AAMIR | CHECKED BY : MUNEER

SCALE : 1"=8'-0" | DATE : 09-12-202

GENERAL NOTES

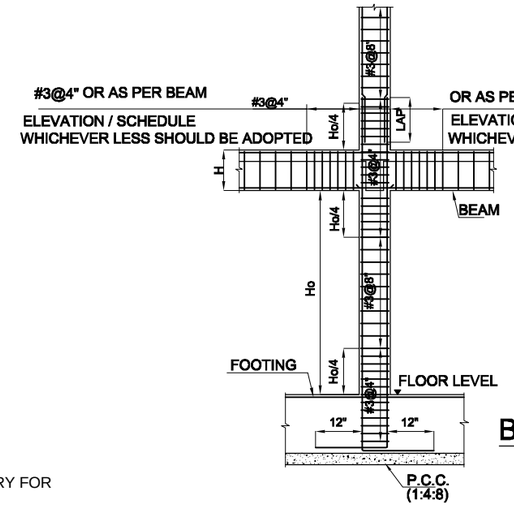
1. REINFORCED CONCRETE DESIGN IS BASED ON BUILDING CODE REQUIREMENT FOR REINFORCED CONCRETE UBC -97 AND ACI 318-08
2. FOUNDATION DESIGN IS BASED UPON A SAFE SOIL BEARING CAPACITY OF 0.65 T / SQ.FT. AT 6'-6" BELOW EXISTING GROUND LEVEL AS PER SOIL REPORT.
3. COORDINATE STRUCTURAL DRAWINGS WITH ARCHITECTURAL DRAWINGS IN CASE OF DISCREPANCY REFER TO ENGINEER IN CHARGE
4. ALL DIMENSIONS ARE IN FEET/INCHES.
5. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSIONS OR REFER TO CONSULTANT
6. THE CONTRACTOR IS TO CHECK AND VERIFY ALL DIMENSIONS AND LEVELS BEFORE EXECUTION
7. ALL ERRORS AND OMISSIONS TO BE REFERED TO THE CONSULTANT / ENGINEER PRIOR TO EXECUTION OF WORK
8. PRIOR TO CASTING CONCRETE REFER TO ARCHITECTURAL, PLUMBING , ELECTRICAL AND HAVC DRAWINGS FOR EMBEDDED ITEMS.
9. ALL MATERIALS SHALL COMPLY TO THE SPECIFICATIONS SHOWN ON THE DRAWINGS IN ABSENCE OF ANY SPECIFICATION ALL ABSENT MATERIALS SHOULD COMPLY TO RELEVANT ACI STANDARDS AND SHALL BE SUBJECTED TO APPROVAL OF THE CONSULTANT.
10. CONCRETE CUBES SHALL BE MADE AVAILABAL AT SITE BY THE CONTRACTOR AND SAMPLE FROM RANDOM BATCHES WILL BE TAKEN DURING CONCRETING.
11. SLUMP CONE SHALL BE MADE AVAILBLE AT SITE BY THE CONTRACTOR AND RANDOM SAMPLES WILL BE CHECKED DURING CONCRETING.
12. THE WATER USED FOR CONCRETE MIXING AND CURING SHOULD BE OF POTABLE QUALITY AND WITHOUT ANY IMPURITIES. A SAMPLE SHOULD BE TESTED IN LABORATORY FOR SULPHATE AND CHLORIDE CONTENTS.
13. FINE AND COARSE AGGREGATES SHOULD BE FREE FROM CLAY, LOAMS OR ANY OTHER ORGANIC IMPURITIES. A TEST SHOULD BE CARRIED OUT BEFORE USE.
14. ATMOSPHERIC TEMPERATURE SHOULD BE BETWEEN 32 C TO 35 C, AT THE TIME OF CONCRETE POURING.
15. R.C.C.CONCRETE (STANDARD CYLINDRICAL) STRENGTHS (fc IN PSI) AT 28 DAYS FOR VARIOUS STRUCTURAL MEMBERS SHALL BE.

    FOUNDATION/ BEAMS/ SLAB (fc' = 3000 psi)
    COLUMNS (fc' = 3000 psi)
    LEAN CONCRETE (fc' = 1500 psi)

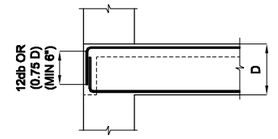
16. ALL R.C.C. SPACE WORKS SHALL BE CONTINUOUSLY MOIST CURED FOR AT LEAST 14 DAYS OR CURED BY CURING COMPOUND.
17. FORM WORK SUPPORTING R.C.C. MEMBERS SHALL NOT BE REMOVED PRIOR TO 14 DAYS. AFTER POURING.
18. ALL R.C.C. SPACE WORKS SHALL BE INTERNALLY VIBRATED WITH ELECTRO MECHANICAL VIBRATOR.
19. MINIMUM CLEAR CONCRETE COVER TO REINFORCEMENT SHALL BE AS FOLLOWS.

    FOUNDATION.....3"
    BEAMS .....1 1/2"
    COLUMNS/WALLS .....1 1/2" / 1"
    SLAB..... 3/4"
    WATER RETAINING STRUCTURES .....2"

20. BEAMS AND SLABS SHOULD BE CASTED MONOLITHICALLY.
21. PRIOR TO PLACING CONCRETE ALL REINFORCING SHALL BE FREE OF LOOSE RUST AND SCALE OR ANY FOREIGN MATERIALS.
22. SPLICE LENGTH SHALL BE 60 TIMES DIA OF BAR
23. ALL INTERNAL & EXTERNAL PLASTER ON R.C.C. MEMBERS TO BE OF RATIO 1:4 AND THICKNESS SHOULD NOT EXCEED 3/4".

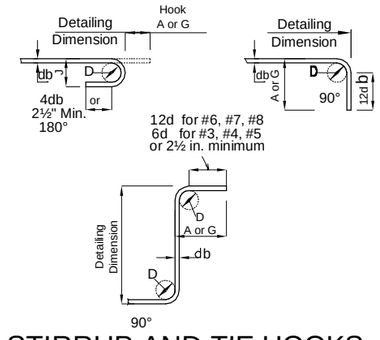


SEISMIC BEAM/COLUMN JOINT DETAIL



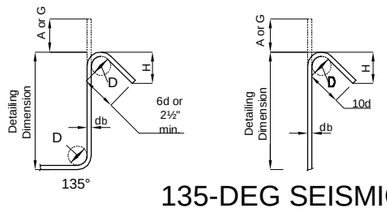
BAR BENDING DETAIL AT BEAM END

RECOMENDED END HOOKS, ALL GRADES				
Bar Size	Finished bend diameter D,in.	180-deg hooks		90-deg hooks
		A or G, in.	J, in.	A or G, in.
#3	2¼	5	3	6
#4	3	6	4	8
#5	3¾	7	5	10
#6	4½	8	6	12
#7	5¼	10	7	14
#8	6	11	8	16
#9	9½	15	11¾	19
#10	10¾	17	13¼	20
#11	12	19	14 ¾	24
#14	18¼	27	21¾	31
#18	24	36	28½	41



STIRRUP AND TIE HOOKS

Bar Size	D (in.)	135 deg Stirrup-tie hook dimensions, in.	
		135-deg hooks	
		A or G, in.	H approx
#3	1½	5	3½
#4	2	6½	4½
#6	4½	10 ¾	6½



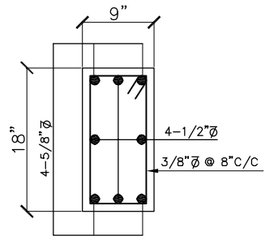
135-DEG SEISMIC STIRRUP/TIE HOOKS

3rd Revision :	----------	Date :	---------
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1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : GENERAL NOTES
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-V	

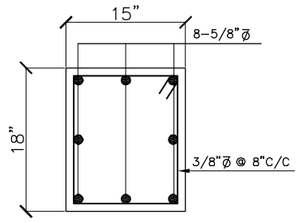
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JOB NO : 303/12	
DRG. NO. : 303/13 GN-01	
DRAWN BY : AAMIR	CHECKED BY : MUNEE
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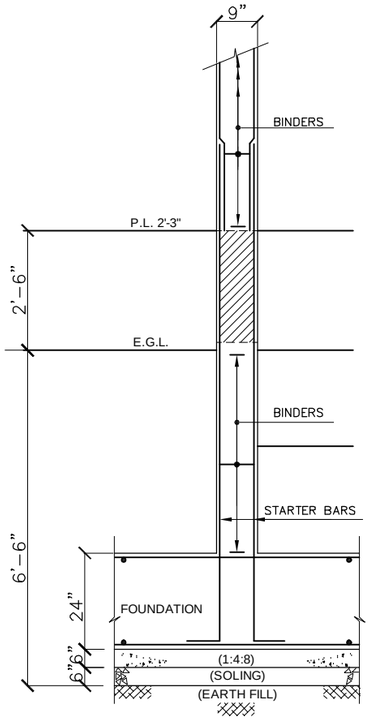
TYP. SEC. OF COLUMN C-1

9” X 18”

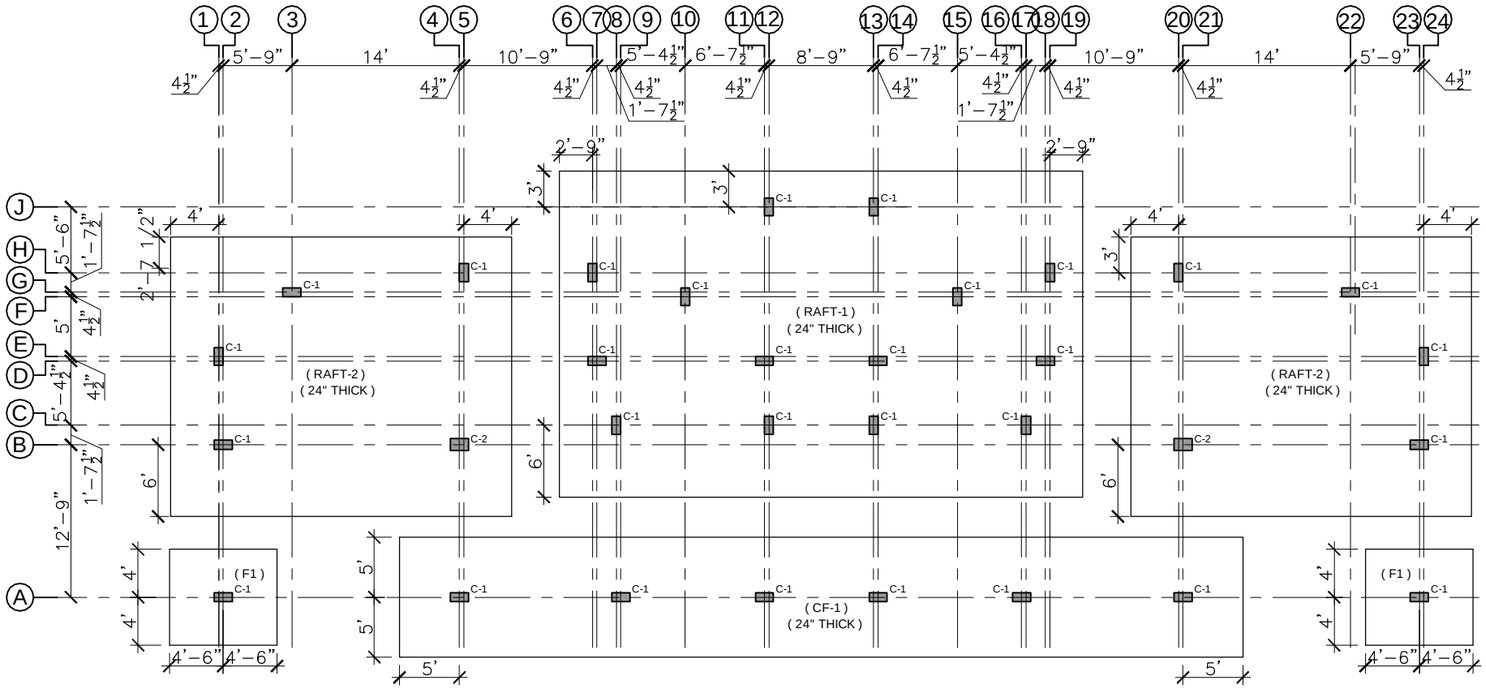


TYP. SEC. OF COLUMN C-2

15” X 18”



TYP.SECTION OF COLUMN



FOUNDATION & COLUMN LAYOUT PLAN

NOTE :

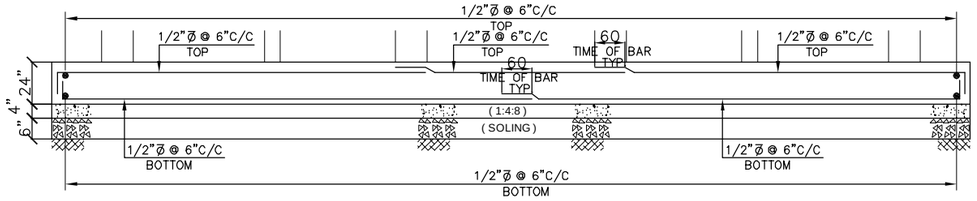
1- FOR GENERAL NOTES REFER DWG. NO. 303/12 GN.01

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1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

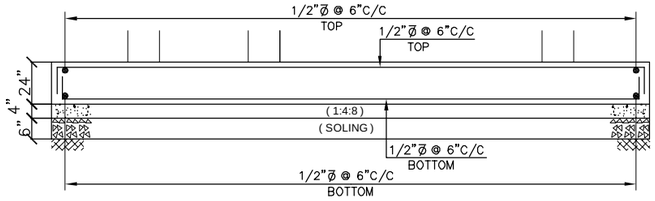
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FOUNDATION & COLUMN LAYOUT PLAN
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-V	

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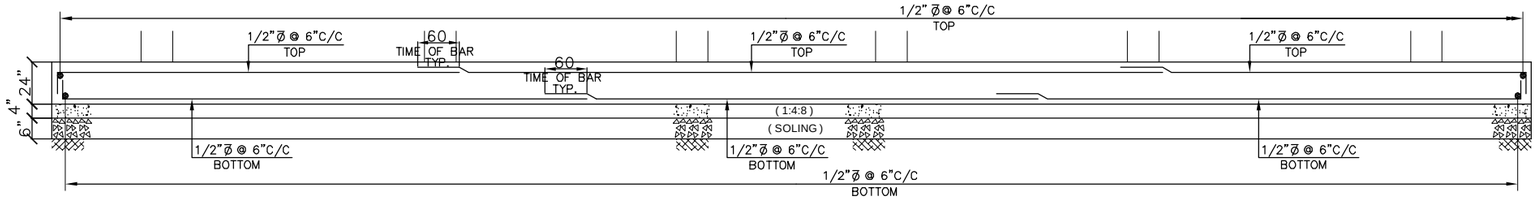
JOB NO : 303/12		
DRG. NO. : 303/12 ST-01		
DRAWN BY : AAMIR	CHECKED BY : MUNEER	
SCALE : 1”=8’-0”	DATE : 09-12-202	



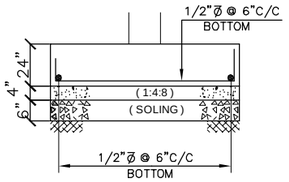
SECTION 1-1
(RAFT-1)



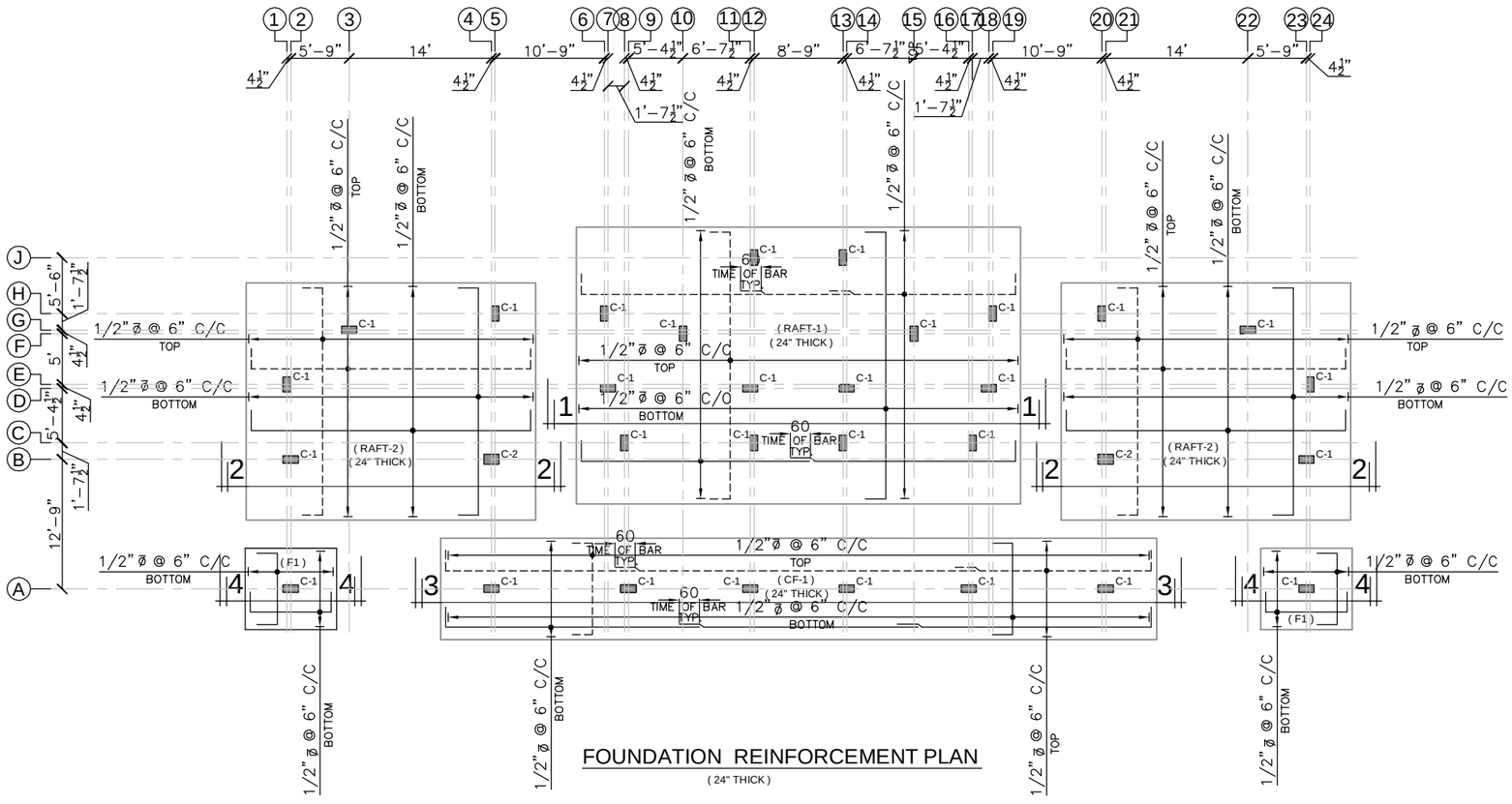
SECTION 2-2
(RAFT-2)



SECTION 3-3
(CF-1)



SECTION 4-4
(F1)



FOUNDATION REINFORCEMENT PLAN
(24" THICK)

NOTE :

1- FOR GENERAL NOTES REFER DWG. NO. 303/12 GN.01

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1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

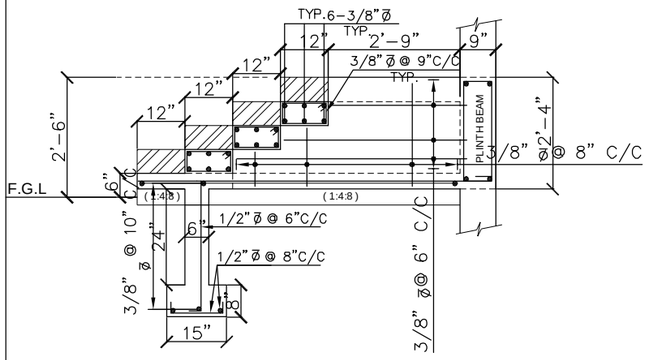
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FOUNDATION REINFORCEMENT DEATILS
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-V	

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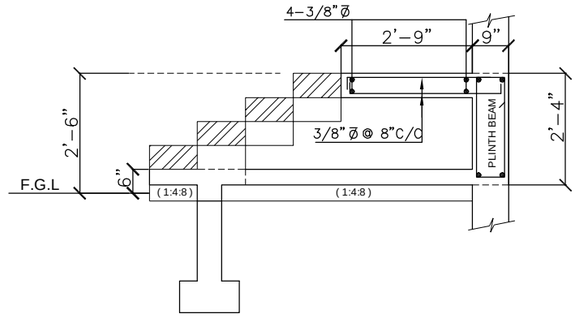
JOB NO : 303/12	
DRG. NO. : 303/12 ST-02	
DRAWN BY : AAMIR	CHECKED BY : MUNEEF
SCALE : 1"=8'-0"	DATE : 09-12-202

SCHEDULE OF PLINTH BEAMS AT LEV. +2'-3"

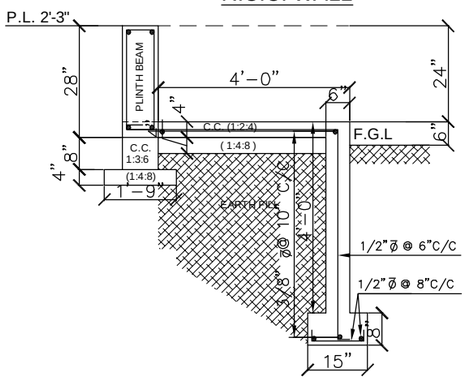
BEAMS NO.S	BEAMS SIZE B X H	TOP STEEL CONT.	MIDDLE BARS	BOTT. STEEL CONT.	EXTRA ON CONT. SUPPORT		EXTRA BOTTOM	RINGS
					L-SUPP.	R-SUPP.		
PB-1	9" X 28"	4–1/2"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-2	9" X 28"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-3	9" X 28"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-4a	9" X 28"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-4b	9" X 28"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-5a	9" X 28"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-5b	9" X 28"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-6	9" X 28"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-7	9" X 28"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-8	9" X 28"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-9	9" X 28"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-10	9" X 28"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-11	9" X 28"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-12	9" X 28"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-13	9" X 28"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-14	9" X 28"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C



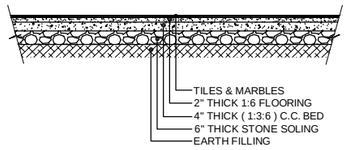
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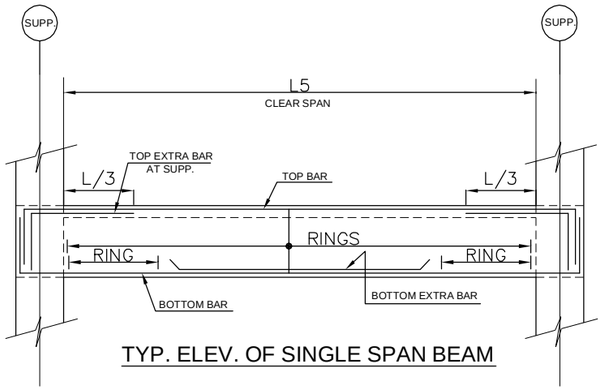
SECTION OF MAIN ENTRANCE R.C.C. SLAB



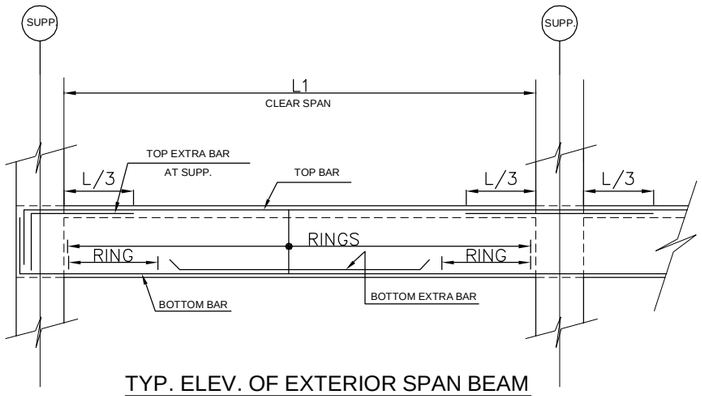
TYP. DETAIL OF PLINTH PROTECTION



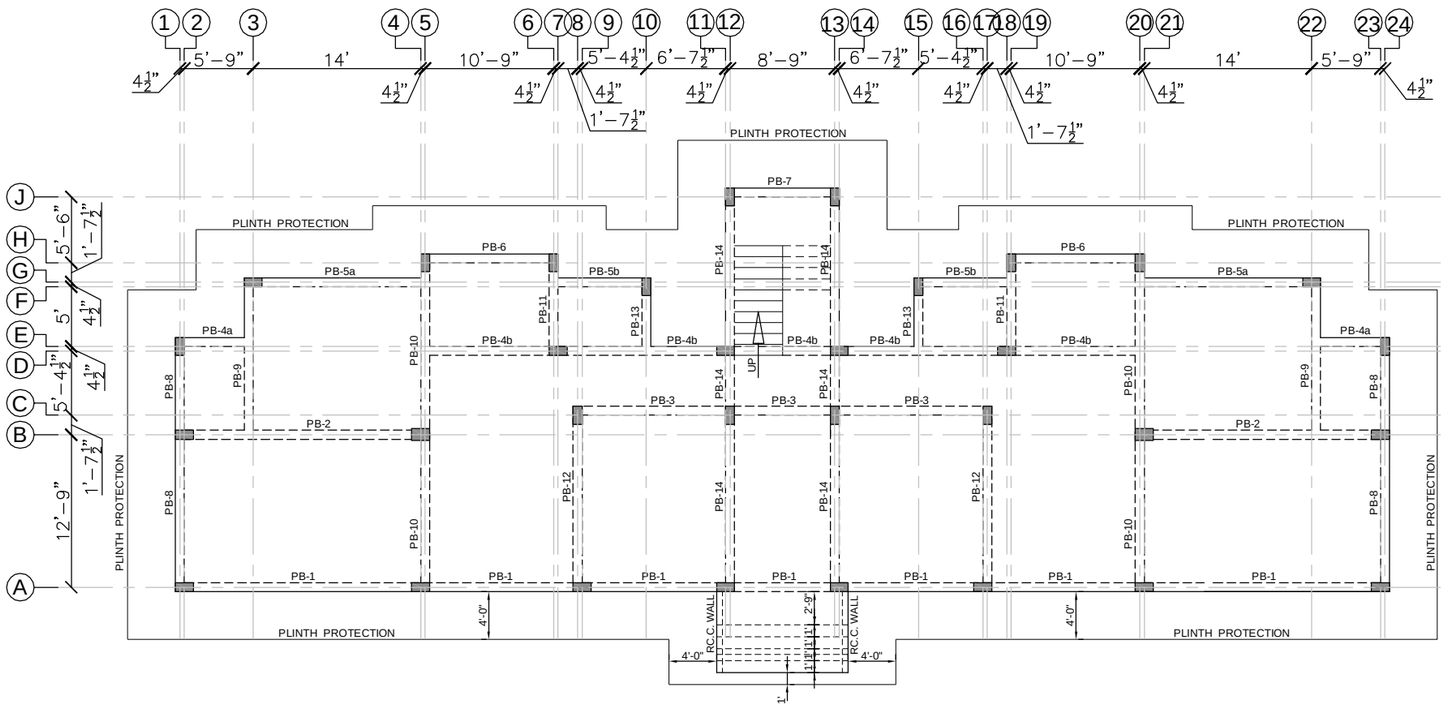
TYP. DETAIL OF FLOORING



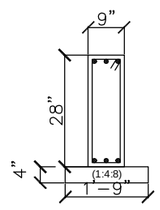
TYP. ELEV. OF SINGLE SPAN BEAM



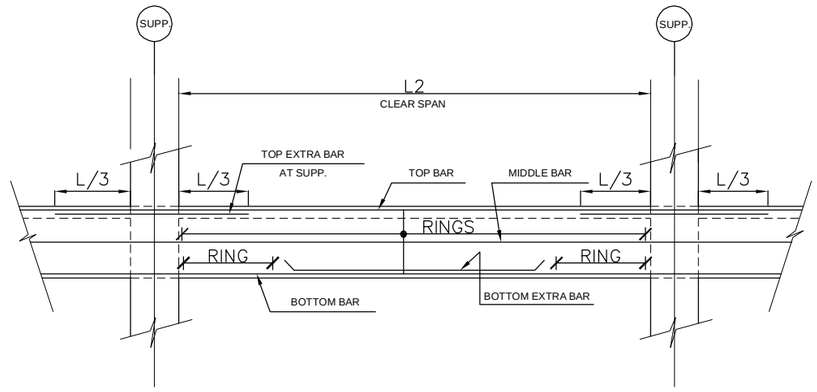
TYP. ELEV. OF EXTERIOR SPAN BEAM



PLINTH BEAM LAYOUT PLAN AT +2'-3"



TYP. SEC. OF INTERNAL PLINTH BEAM
(9" X 28")



TYP. ELEV. OF INTERIOR SPAN BEAM

NOTE :

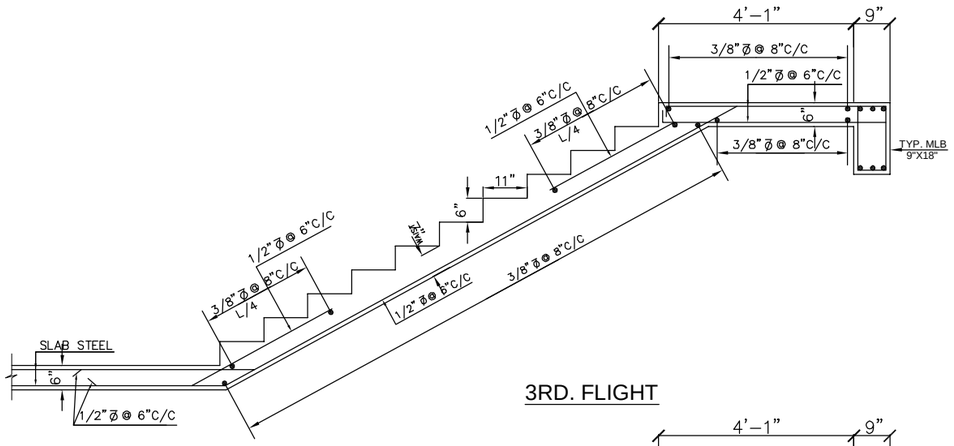
1- FOR GENERAL NOTES REFER DWG. NO. 303/12 GN.01

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

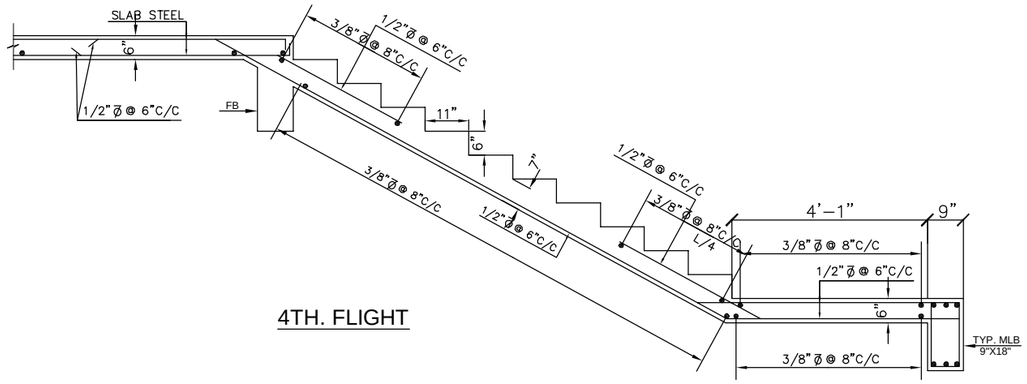
CLIENT: CADET COLLEGE SANGAR	DESCRIPTION : PLINTH BEAM LAYOUT PLAN & REINFORCEMENT DEATILS
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-V	

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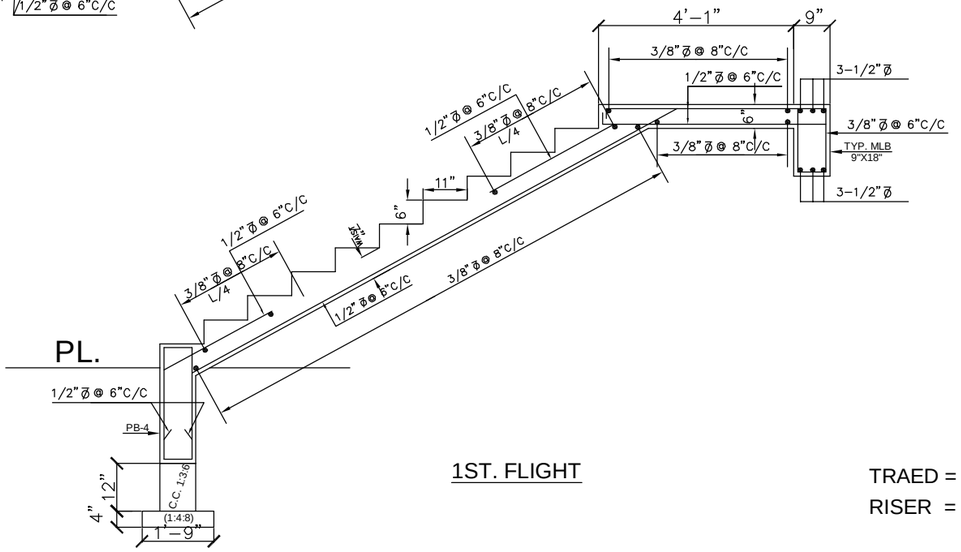
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SCALE : 1"=8'-0"	DATE : 09-12-202



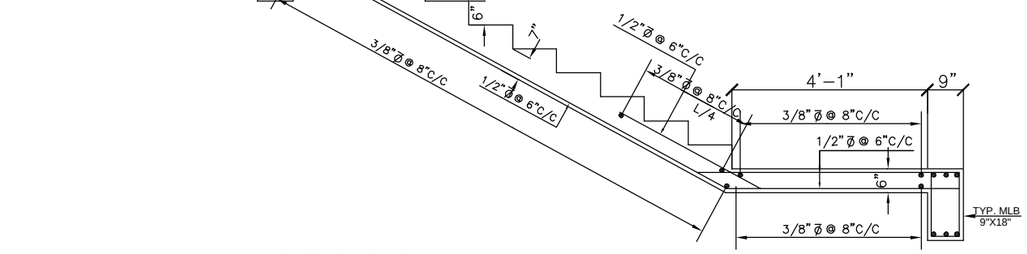
3RD. FLIGHT



4TH. FLIGHT



1ST. FLIGHT



2ND. FLIGHT

TRAED = 11"
RISER = 6"

NOTE :

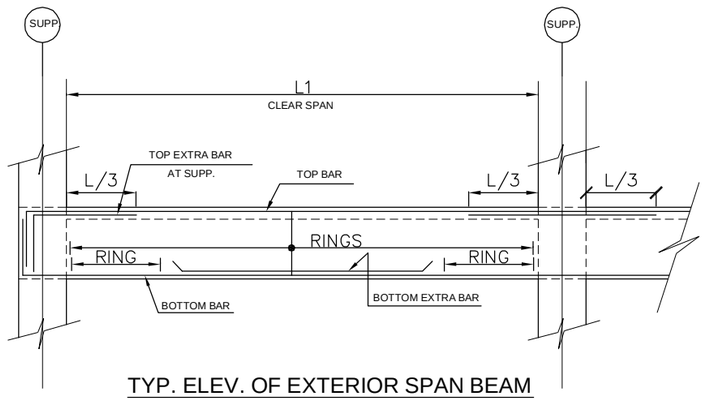
1- FOR GENERAL NOTES REFER DWG. NO. 303/12 GN.01

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : STAIR CASE SECTION & REINFORCEMENT DEATILS
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-V	

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JOB NO : 303/12	
DRG. NO. : 303/12 ST-04	
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SCALE : 1"=8'-0"	DATE : 09-12-202



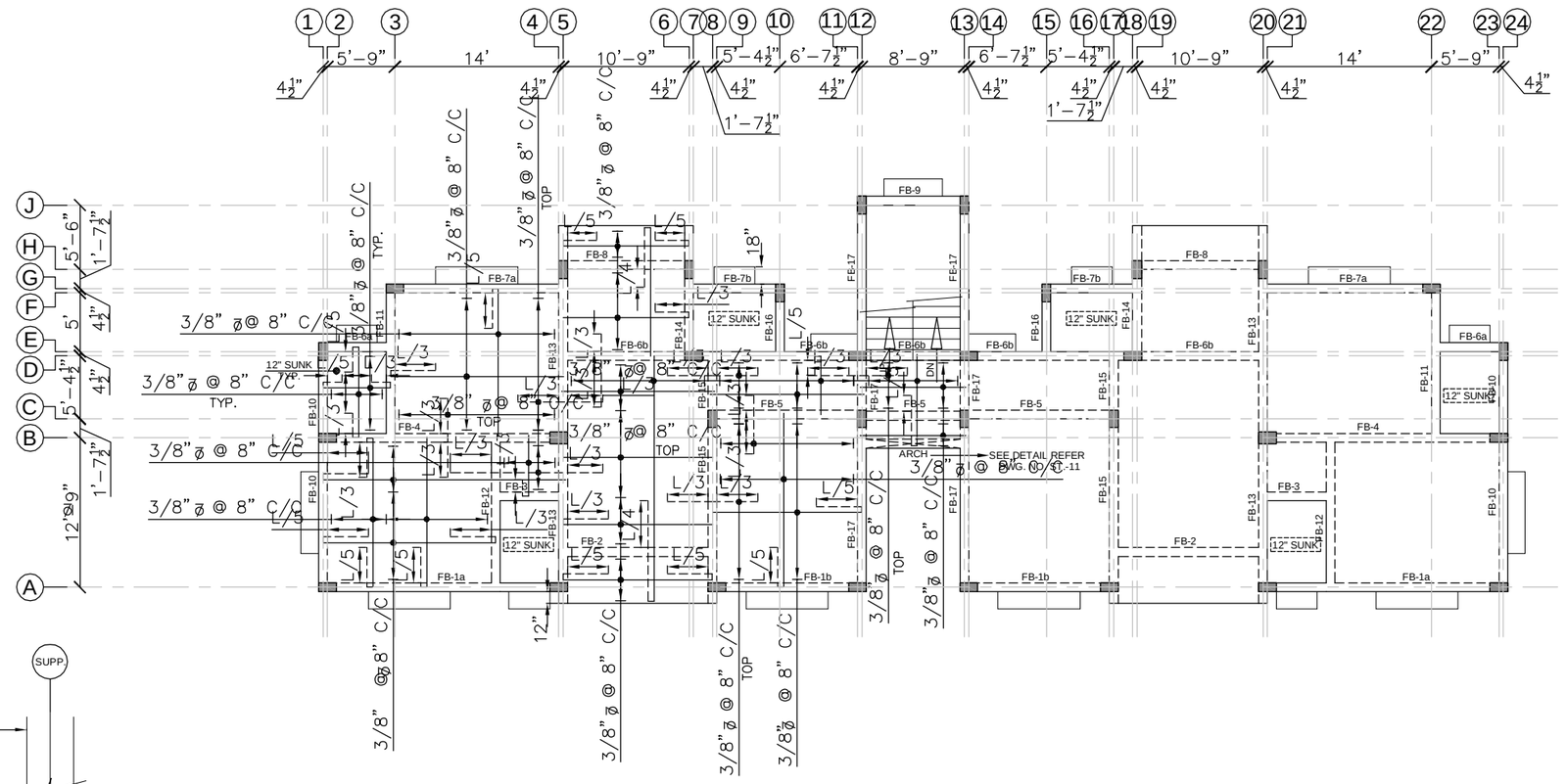
TYP. ELEV. OF EXTERIOR SPAN BEAM

TYP. ELEV. OF SINGLE SPAN BEAM

TYP. ELEV. OF INTERIOR SPAN BEAM

SCHEDULE OF 1st. SLAB'S BEAMS AT LEV.+13'-3"

BEAMS NO.S	BEAMS SIZE B X H	TOP STEEL CONT.	MIDDLE BARS	BOTT. STEEL CONT.	EXTRA ON CONT. SUPPORT		EXTRA BOTTOM	RINGS
					L-SUPP.	R-SUPP.		
FB-1a	9" X 18"	4–5/8"ø	2–1/2" ø	2–5/8"ø+2–1/2"ø	———	———	———	3/8"ø @ 8"C/C
FB-1b	9" X 18"	2–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-2	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-3	9" X 18"	4–1/2" ø	———	4–1/2" ø	2–5/8"ø	2–5/8"ø	———	3/8"ø @ 8"C/C
FB-4	9" X 18"	4–5/8"ø	2–1/2" ø	4–5/8"ø	———	———	———	3/8"ø @5"TO 8"C/C
FB-5	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-6a	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-6b	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-7a	9" X 18"	4–1/2" ø	2–1/2" ø	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-7b	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-8	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-9	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-10	9" X 18"	4–1/2" ø	2–1/2" ø	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-11	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-12	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-13	9" X 18"	4–5/8"ø	2–1/2" ø	2–5/8"ø+2–1/2"ø	———	———	———	3/8"ø @5"TO 8"C/C
FB-14	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-15	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-16	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-17	9" X 18"	4–1/2" ø	2–1/2" ø	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C



1ST. SLAB'S FRAMING PLAN AT LEV. +13'-3"

(ALL SLAB'S 6" THICK)

NOTE :

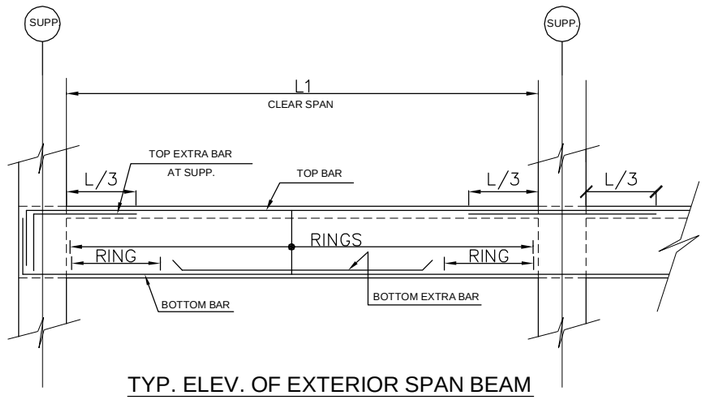
1- FOR GENERAL NOTES REFER DWG. NO. 303/12 GN.01

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2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

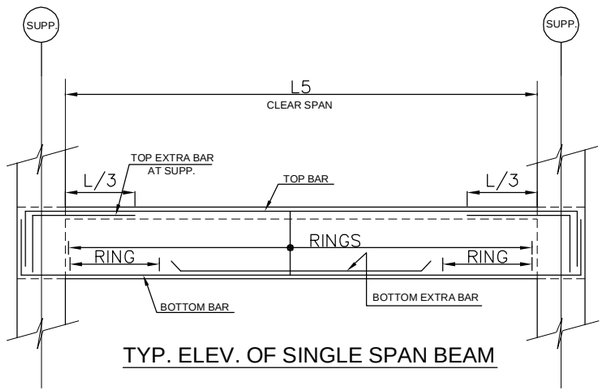
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : 1ST. SLAB BEAMS REINFORCEMENT DEATILS
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-V	

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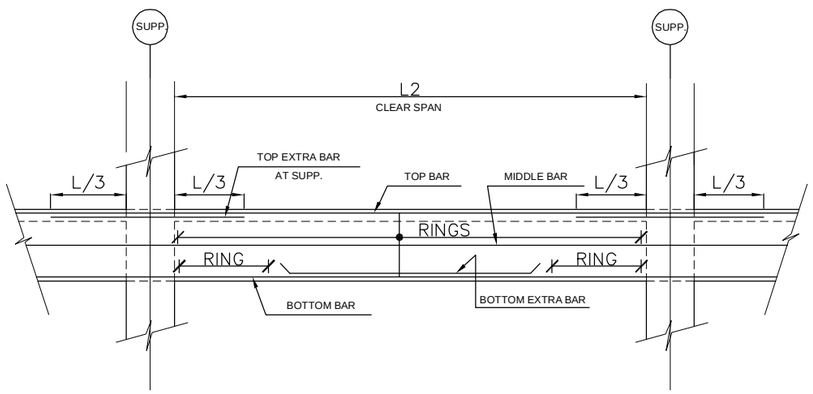
JOB NO :	303/12
DRG. NO. :	303/12 ST-05
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=8'-0"	DATE : 09-12-202



TYP. ELEV. OF EXTERIOR SPAN BEAM



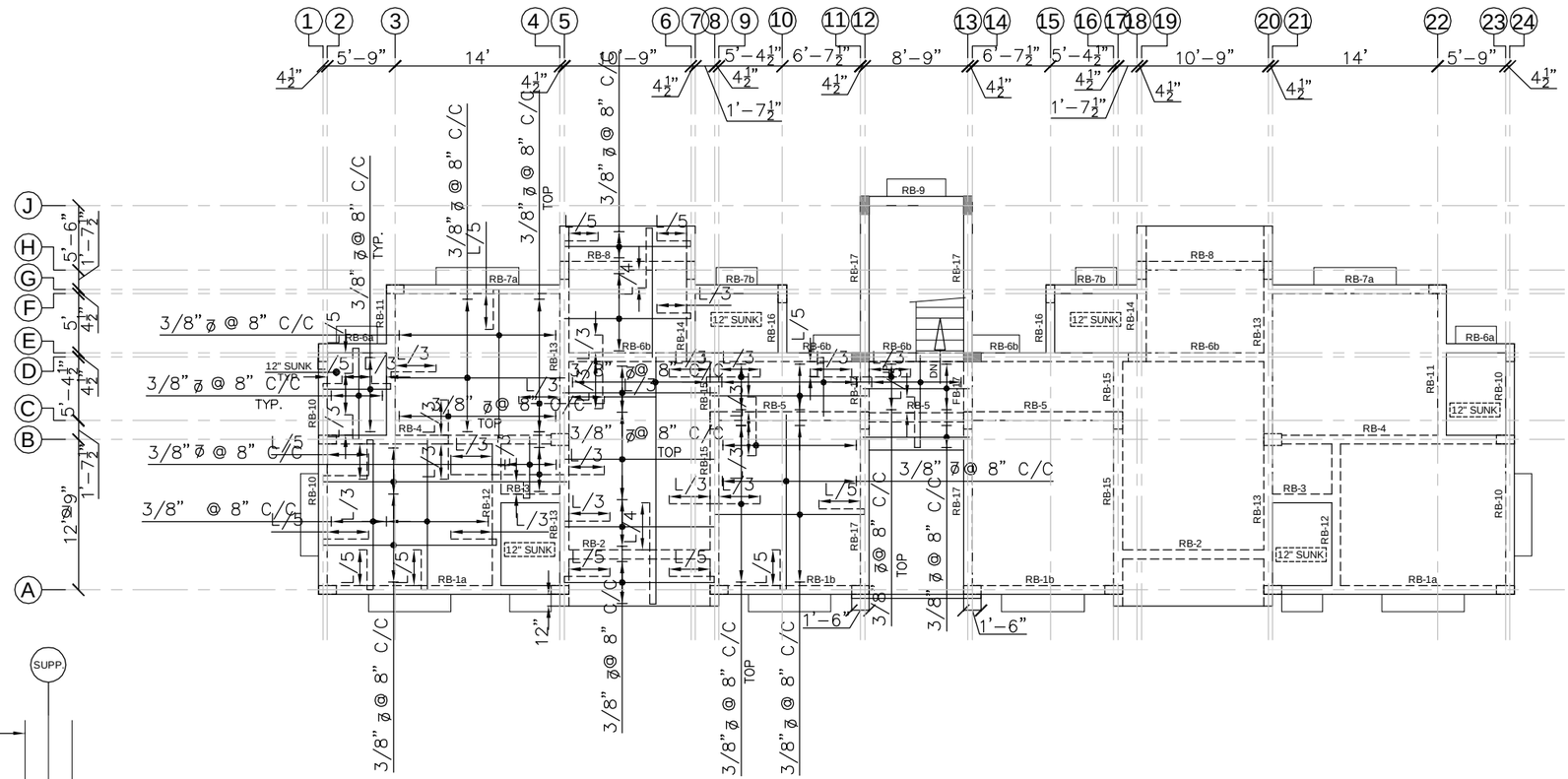
TYP. ELEV. OF SINGLE SPAN BEAM



TYP. ELEV. OF INTERIOR SPAN BEAM

SCHEDULE OF ROOF SLAB'S BEAMS AT LEV.+24'-3"

BEAMS NO.S	BEAMS SIZE B X H	TOP STEEL CONT.	MIDDLE BARS	BOTT. STEEL CONT.	EXTRA ON CONT. SUPPORT		EXTRA BOTTOM	RINGS
					L-SUPP.	R-SUPP.		
RB-1a	9" X 18"	4–5/8"ø	2–1/2" ø	2–5/8"ø+2–1/2"ø	———	———	———	3/8"ø @ 8"C/C
RB-1b	9" X 18"	2–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-2	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-3	9" X 18"	4–3/8"ø	———	4–1/2" ø	2–5/8"ø	2–5/8"ø	———	3/8"ø @ 8"C/C
RB-4	9" X 18"	4–5/8"ø	2–1/2" ø	4–5/8"ø	———	———	———	3/8"ø @5"TO 8"C/C
RB-5	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-6a	9" X 18"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-6b	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-7a	9" X 18"	4–1/2" ø	2–1/2" ø	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-7b	9" X 18"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-8	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-9	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-10	9" X 18"	4–1/2" ø	2–1/2" ø	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-11	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-12	9" X 18"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-13	9" X 18"	4–5/8"ø	2–1/2" ø	2–5/8"ø+2–1/2"ø	———	———	———	3/8"ø @5"TO 8"C/C
RB-14	9" X 18"	4–1/2" ø	———	4–1/2" ø	RB-17 9" X 18"	4–1/2" ø	———	3/8"ø @ 8"C/C
RB-15	9" X 18"	2–5/8"ø+4–1/2"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-16	9" X 18"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-17	9" X 18"	4–1/2" ø	2–1/2" ø	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C



ROOF SLAB'S FRAMING PLAN AT LEV. +24'-3"

(ALL SLAB'S 6" THICK)

NOTE :

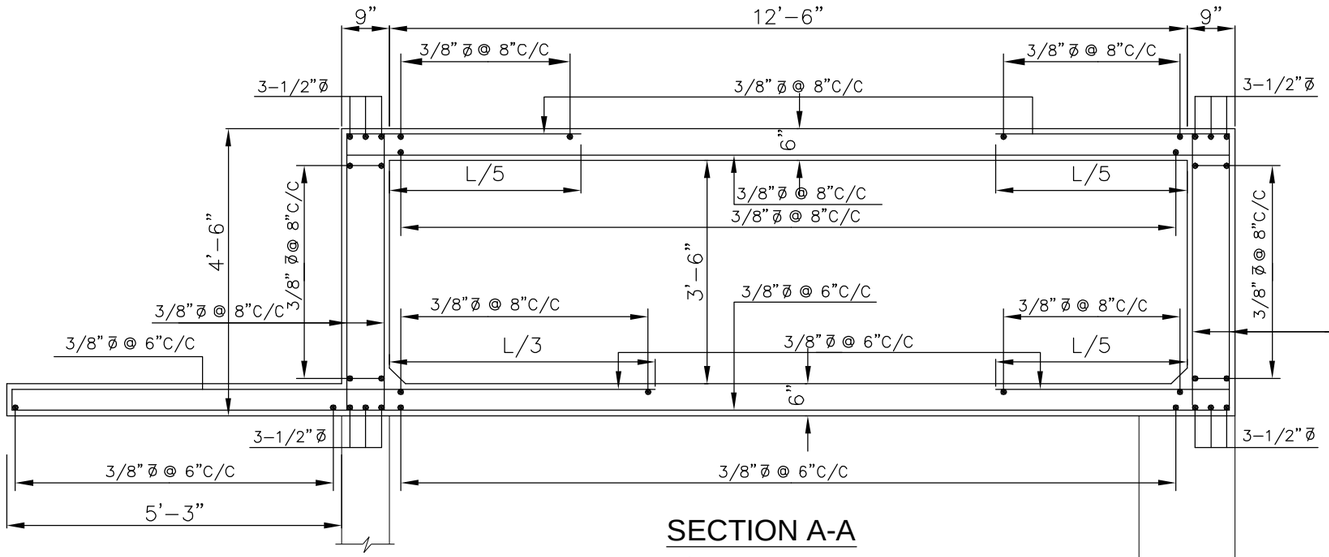
1- FOR GENERAL NOTES REFER DWG. NO. 303/12 GN.01

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2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

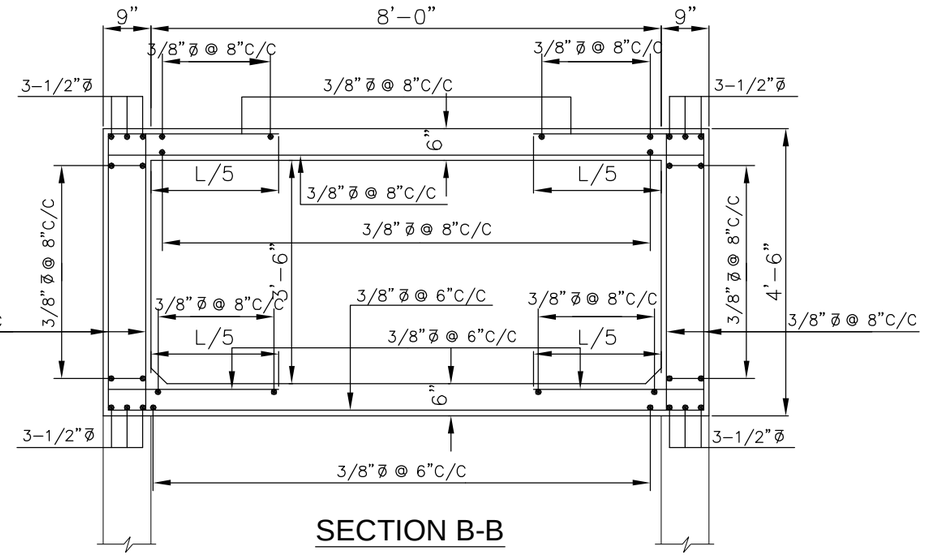
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : ROOF SLAB BEAMS REINFORCEMENT DEATILS
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-V	

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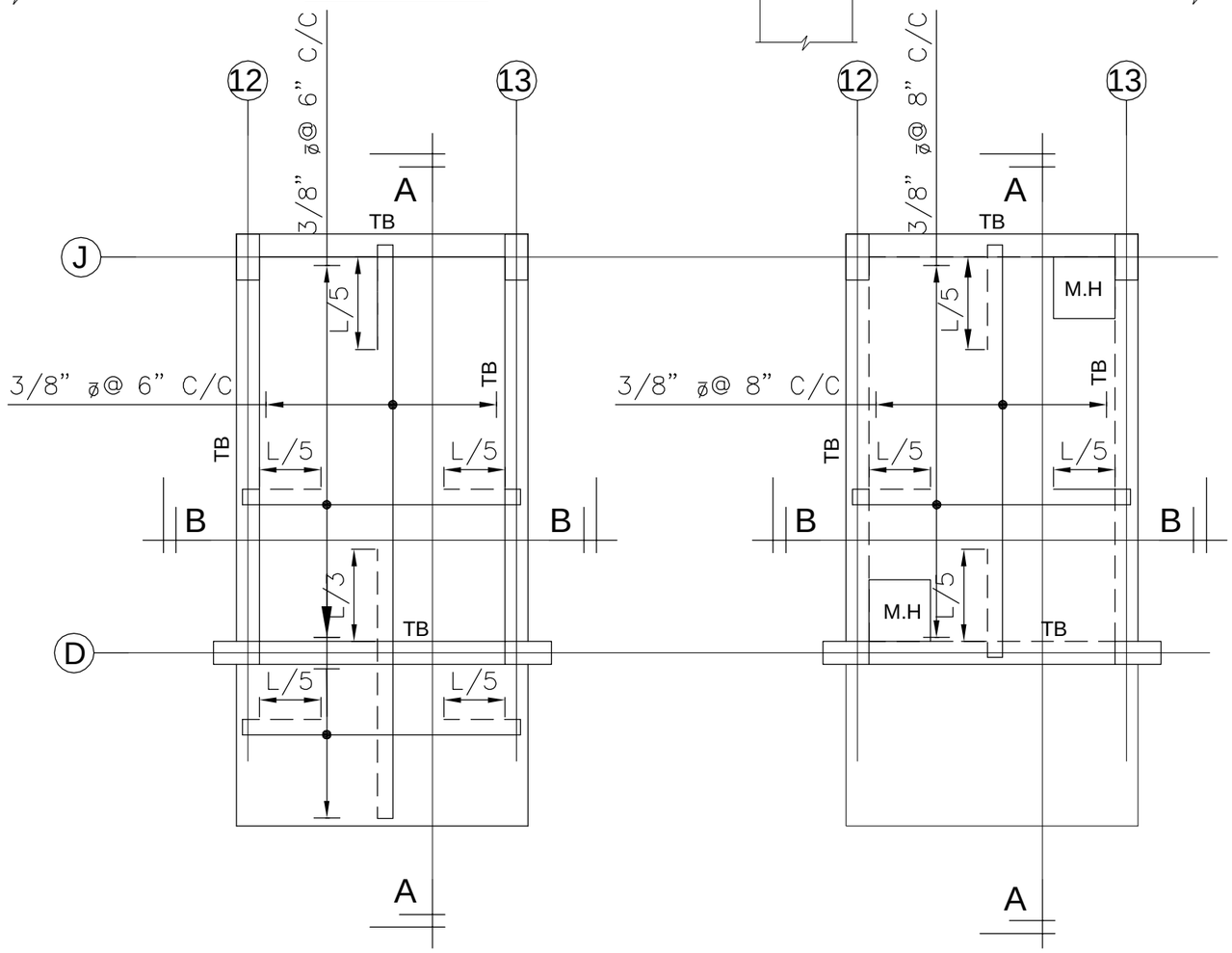
JOB NO :	303/12		
DRG. NO. :	303/12 ST-06		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1"=8'-0"	DATE :	09-12-202



SECTION A-A



SECTION B-B



BOTTOM SLAB PLAN

SLAB 6" THICK

TOP SLAB PLAN

SLAB 6" THICK

NOTE :

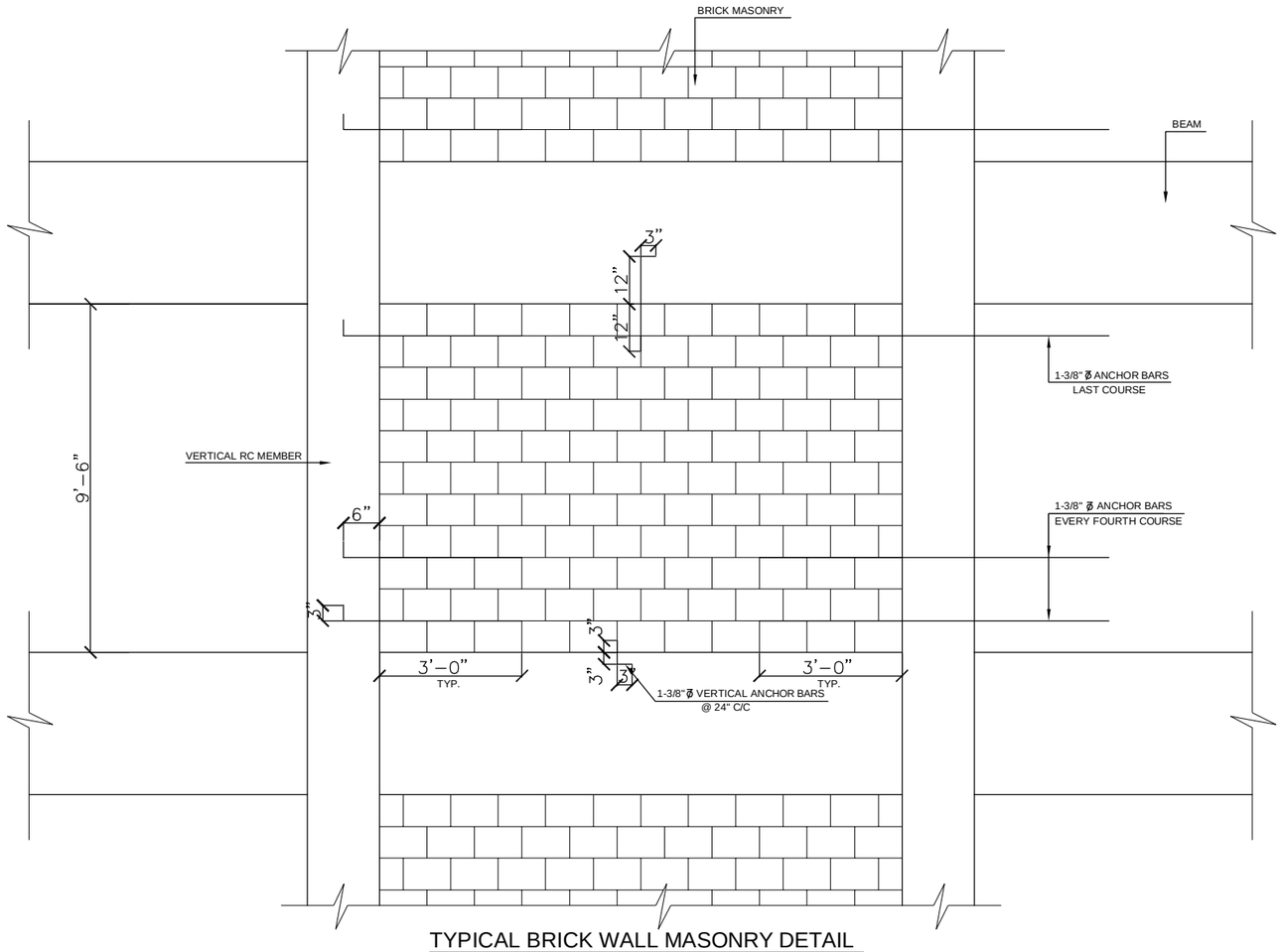
1- FOR GENERAL NOTES REFER DWG. NO. 303/12 GN.01

3rd Revision :	----------	Date :	---------
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1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

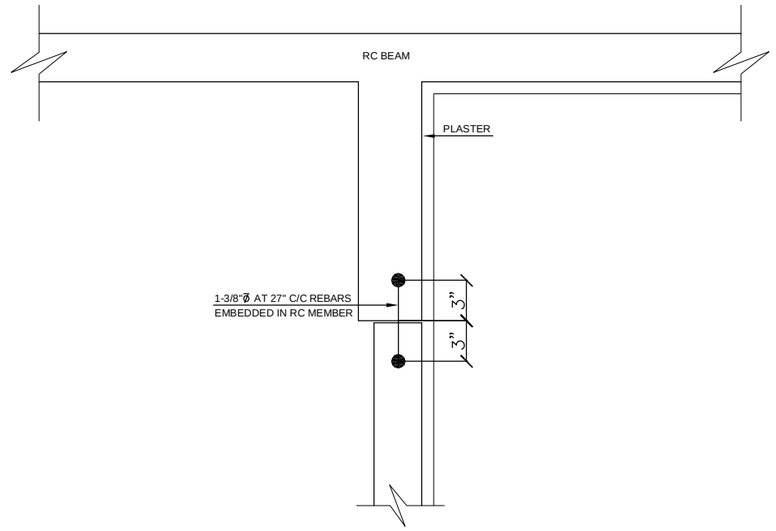
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JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-V	

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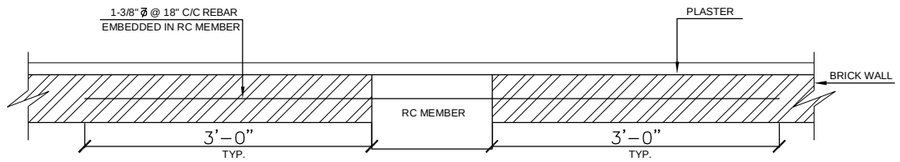
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DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=8'-0"	DATE : 09-12-202



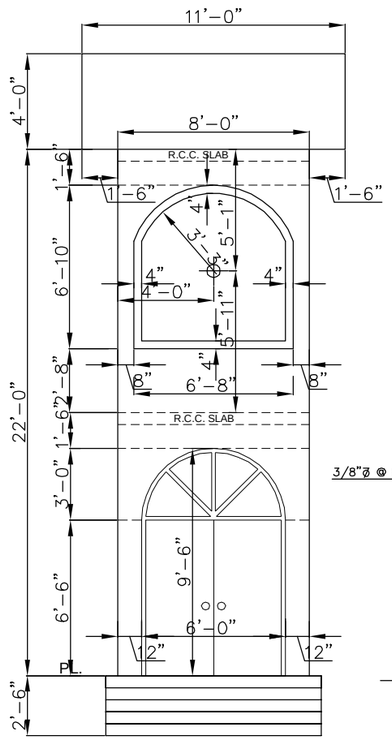
TYPICAL BRICK WALL MASONRY DETAIL



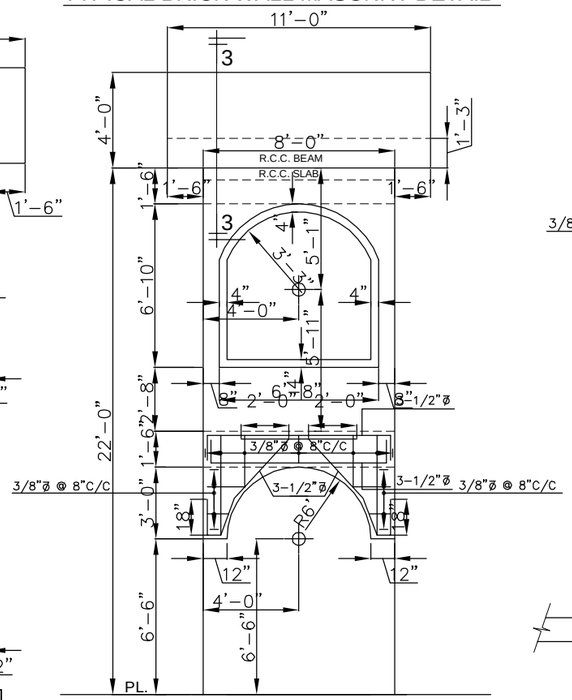
TYPICAL BRICK WALL AND RC BEAM
INTERFACE PLAN



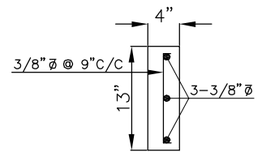
TYPICAL BRICK WALL AND RC MEMBER
INTERFACE PLAN



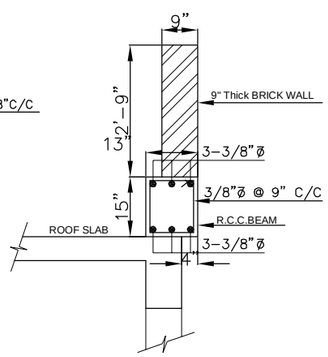
ENTRANCE DETAIL ELEVATION



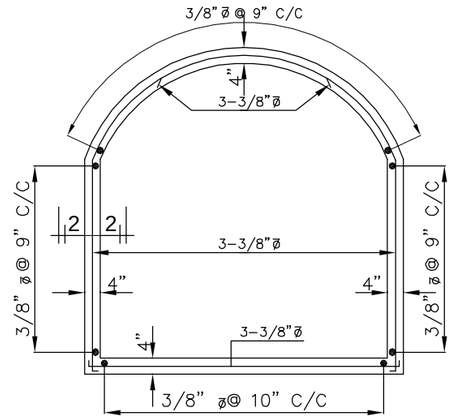
ARCH REINFORCEMENT ELEVATION



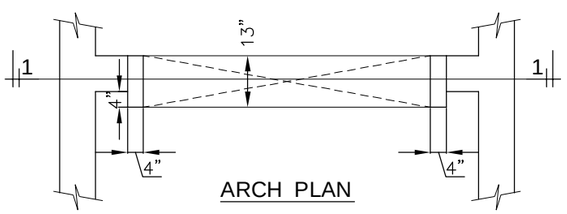
SECTION 2-2



SECTION 3-3



SECTION 1-1



ARCH PLAN

NOTE :

1- FOR GENERAL NOTES REFER DWG. NO. 303/12 GN.01

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	TYP. DETAILS OF BRICK WALL
JOB TITLE :	LOWER STAFF FAMILY QUARTERS FLATS CAT-V		

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JOB NO :	303/12		
DRG. NO. :	303/12 ST-08		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1"=8'-0"	DATE :	09-12-202

PLUMBING DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
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LIST OF PLUMMBING DRAWINGS

S.NO.	DWG. NO.	DESCRIPTION
1	P-00	LIST OF DRAWINGS
2	WS-01	GROUND FLOOR PLAN WATER SUPPLY SYSTEM
3	WS-02	FIRST FLOOR PLAN WATER SUPPLY SYSTEM
4	WS-03	ROOF WATER SUPPLY SYSTEM
5	DS-04	GROUND FLOOR PLAN DRAIN SYSTEM
6	DS-05	FIRST FLOOR PLAN DRAIN SYSTEM

3rd Revision : -------- Date : --------

2nd Revision : -------- Date : --------

1st Revision : -------- Date : --------

ISSUED FOR TENDER DRAWING Date : 09-12-2025

CLIENT: CADET COLLEGE SANGHAR

JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLTAS CAT-V

DESCRIPTION : LIST OF DRAWINGS

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JOB NO : 303/123

DRG. NO. : 303/12 P-00

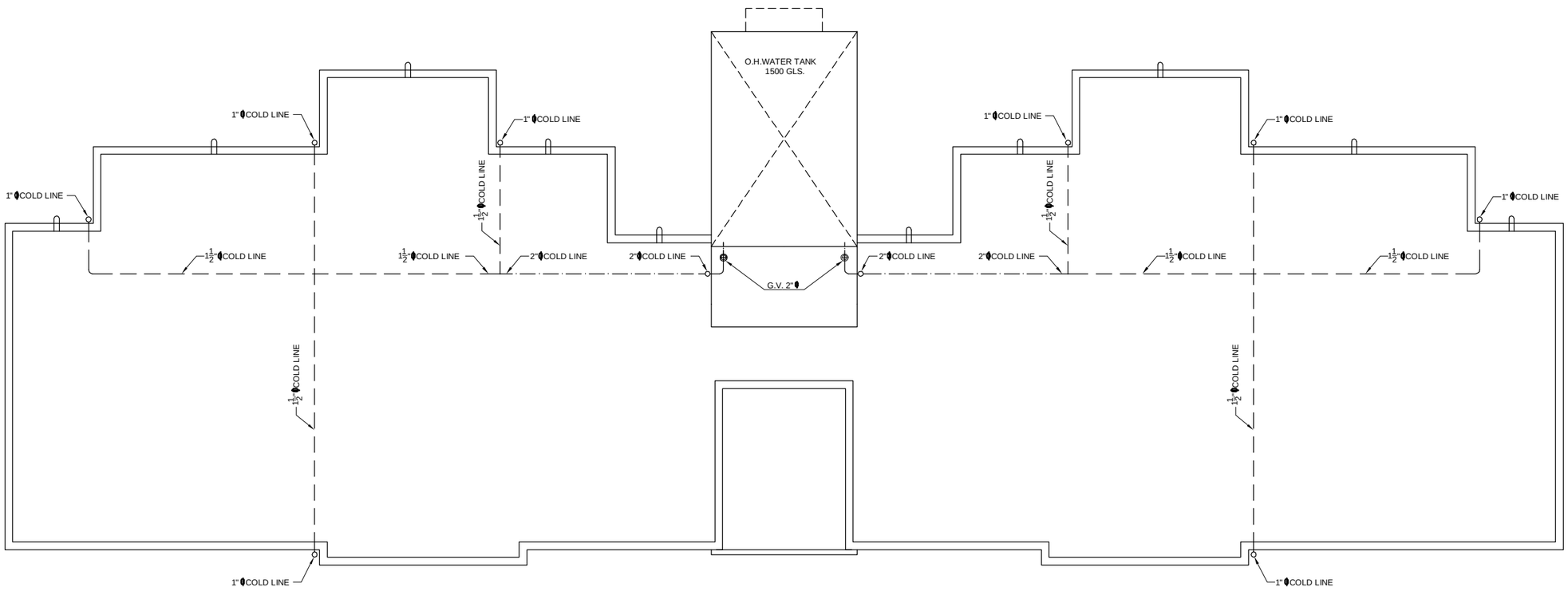
DRAWN BY : M.K ABBASI

CHECKED BY : MUNEER

SCALE : N.T.S

DATE : 09-12-202

	LEGEND	SYMBOLE
1	2" ⌀ PIPE (PPR) W / LINE	
2	$1\frac{1}{2}$" ⌀ PIPE (PPR) W / LINE	
3	1" ⌀ PIPE (PPR) W / LINE	
4	3/4" ⌀ PIPE (PPR) W / LINE	
5	1/2" ⌀ PIPE (PPR) W / LINE	
7	WASH BASIN	W.B
8	SHOWER	SH.
9	WATER CLOSET	W.C
10	BIPCOOK	
11	SINK	
12	ELECTRIC GEYSER	



ROOF PLAN

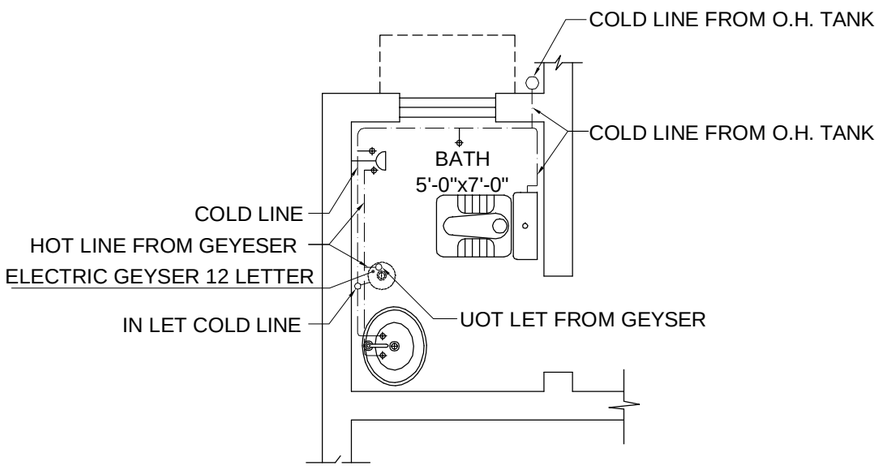
3rd Revision :	---------	Date :	---------
2nd Revision :	---------	Date :	---------
1st Revision :	---------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : ROOF FLOOR PLAN WATER SUPPLY SYSTEM
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLTAS CAT-V	

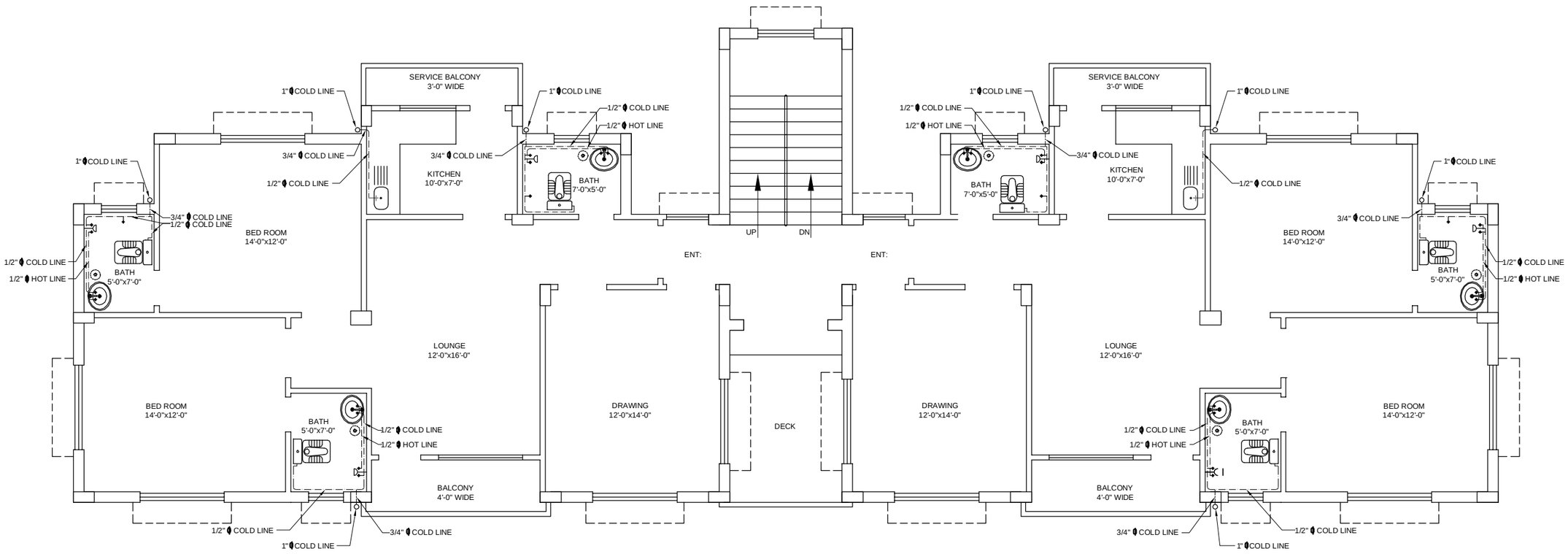
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JOB NO :	303/12
DRG. NO. :	303/12 WS-01
DRAWN BY : M.K ABBASI	CHECKED BY : MUNEER
SCALE : N.T.S	DATE : 09-12-202

	LEGEND	SYMBOLE
1	2" PIPE (PPR) W / LINE	
2	$1\frac{1}{2}$" PIPE (PPR) W / LINE	
3	1" PIPE (PPR) W / LINE	
4	3/4" PIPE (PPR) W / LINE	
5	1/2" PIPE (PPR) W / LINE	
7	WASH BASIN	W.B
8	SHOWER	SH.
9	WATER CLOSET	W.C
10	BIPCOOK	
11	SINK	
12	ELECTRIC GEYSER	



TYP. ENLARGE DETAIL PLAN



FIRST FLOOR PLAN

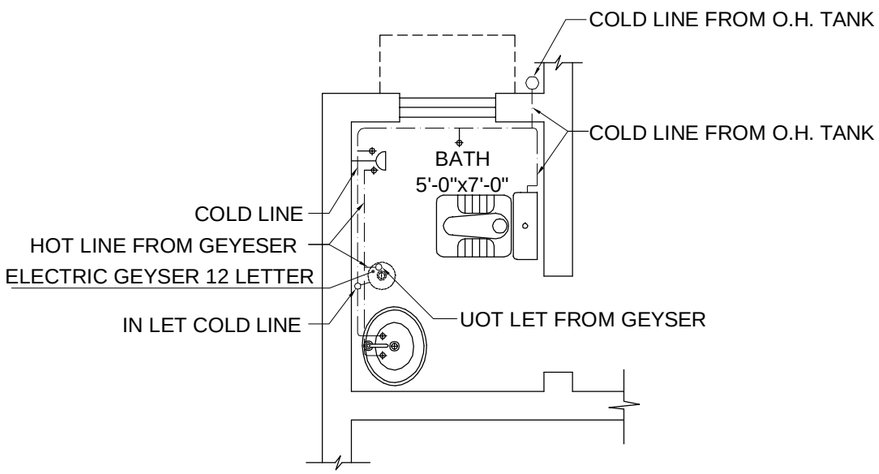
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2nd Revision :	---------	Date :	---------
1st Revision :	---------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FIRST FLOOR PLAN WATER SUPPLY SYSTEM
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLTAS CAT-V	

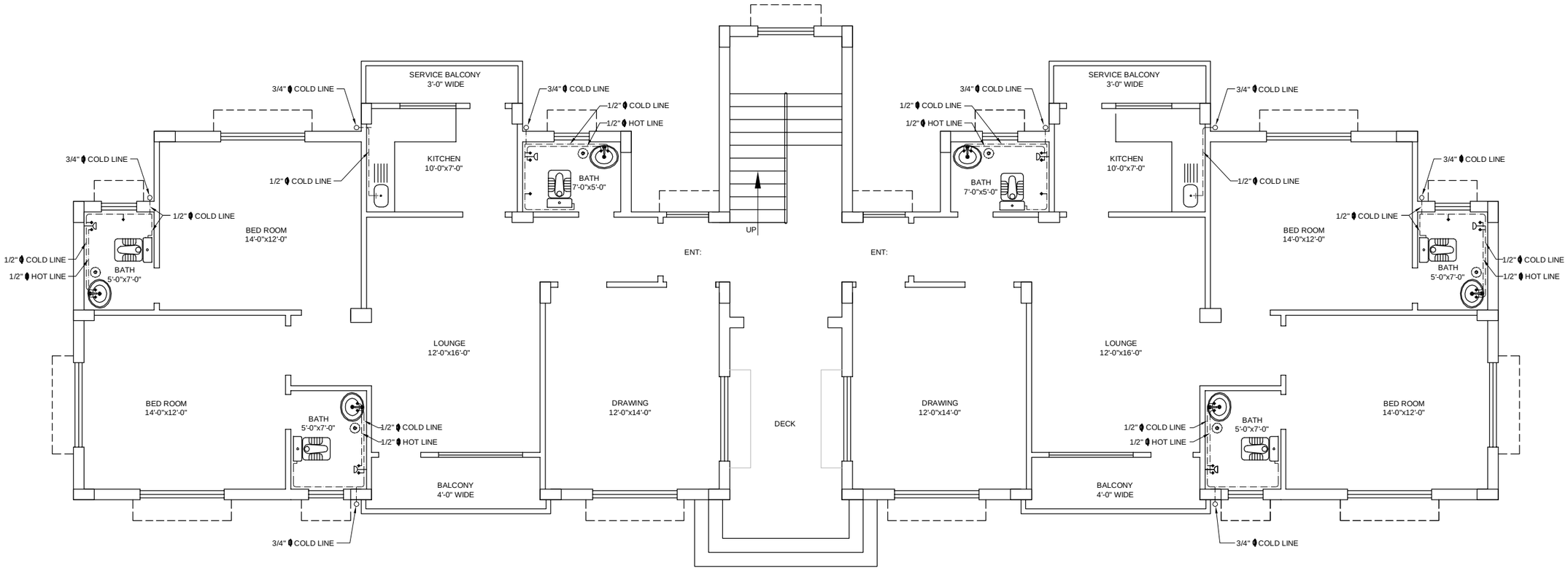
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JOB NO :	303/12
DRG. NO. :	303/12 WS-02
DRAWN BY : M.K ABBASI	CHECKED BY : MUNEER
SCALE : N.T.S	DATE : 09-12-202

	LEGEND	SYMBOLE
1	2" ⌀ PIPE (PPR) W / LINE	
2	$1\frac{1}{2}$" ⌀ PIPE (PPR) W / LINE	
3	1" ⌀ PIPE (PPR) W / LINE	
4	3/4" ⌀ PIPE (PPR) W / LINE	
5	1/2" ⌀ PIPE (PPR) W / LINE	
7	WASH BASIN	W.B
8	SHOWER	SH.
9	WATER CLOSET	W.C
10	BIPCOOK	
11	SINK	
12	ELECTRIC GEYSER	



TYP. ENLARGE DETAIL PLAN



GROUND FLOOR PLAN

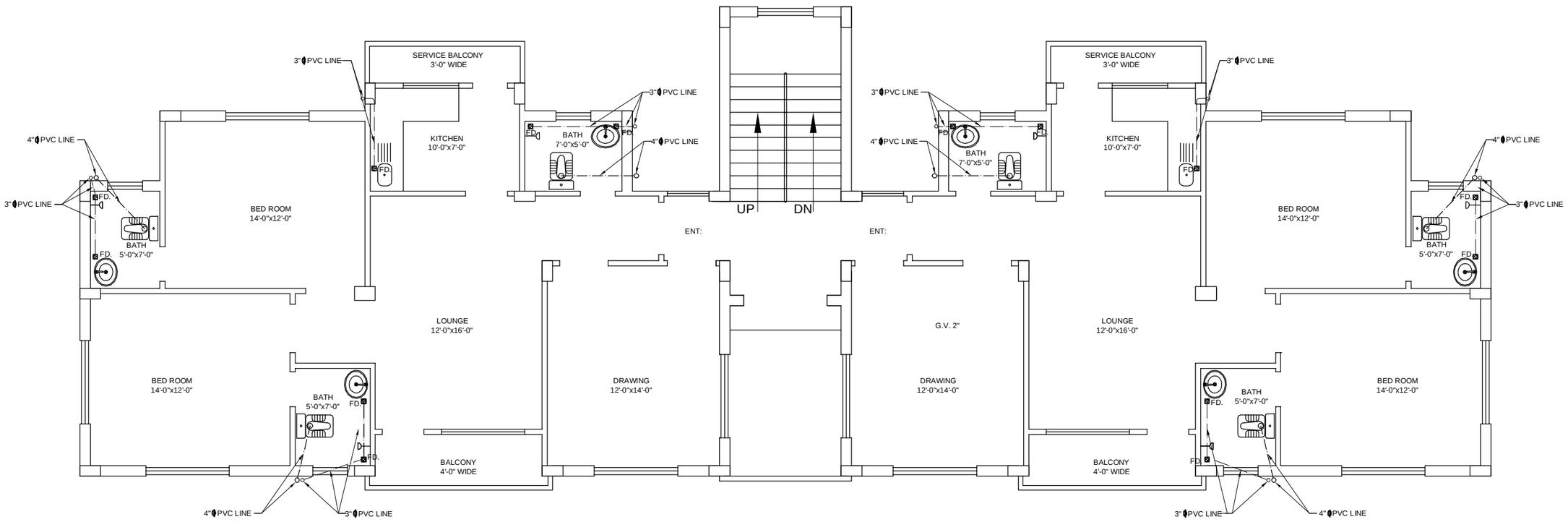
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2nd Revision :	---------	**Date :**	---------
1st Revision :	---------	**Date :**	---------
ISSUED FOR	TENDER DRAWING	**Date :**	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	**DESCRIPTION :** GROUND FLOOR PLAN WATER SUPPLY SYSTEM
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLTAS CAT-V	

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JOB NO :	303/12		
DRG. NO. :	303/12 WS-03		
DRAWN BY :	M.K ABBASI	**CHECKED BY :**	MUNEER
SCALE :	N.T.S	**DATE :**	09-12-202

	LEGEND	SYMBOLE
1	8"ϕ PIPE (UP.V.C) SEWER LINE	
2	6"ϕ PIPE (UP.V.C) SEWER LINE	
3	4"ϕ PIPE (UP.V.C) SEWER LINE	
4	3"ϕ PIPE (UP.V.C) SEWER LINE	
5	WASH BASIN	W.B
6	WATER CLOSET	W.C
7	SHOWER	SH.
~~8~~	MAN HOLE	MH.
9	GULLY TRAP	GT.
10	FLOOR DRAIN	FD.



FIRST FLOOR PLAN

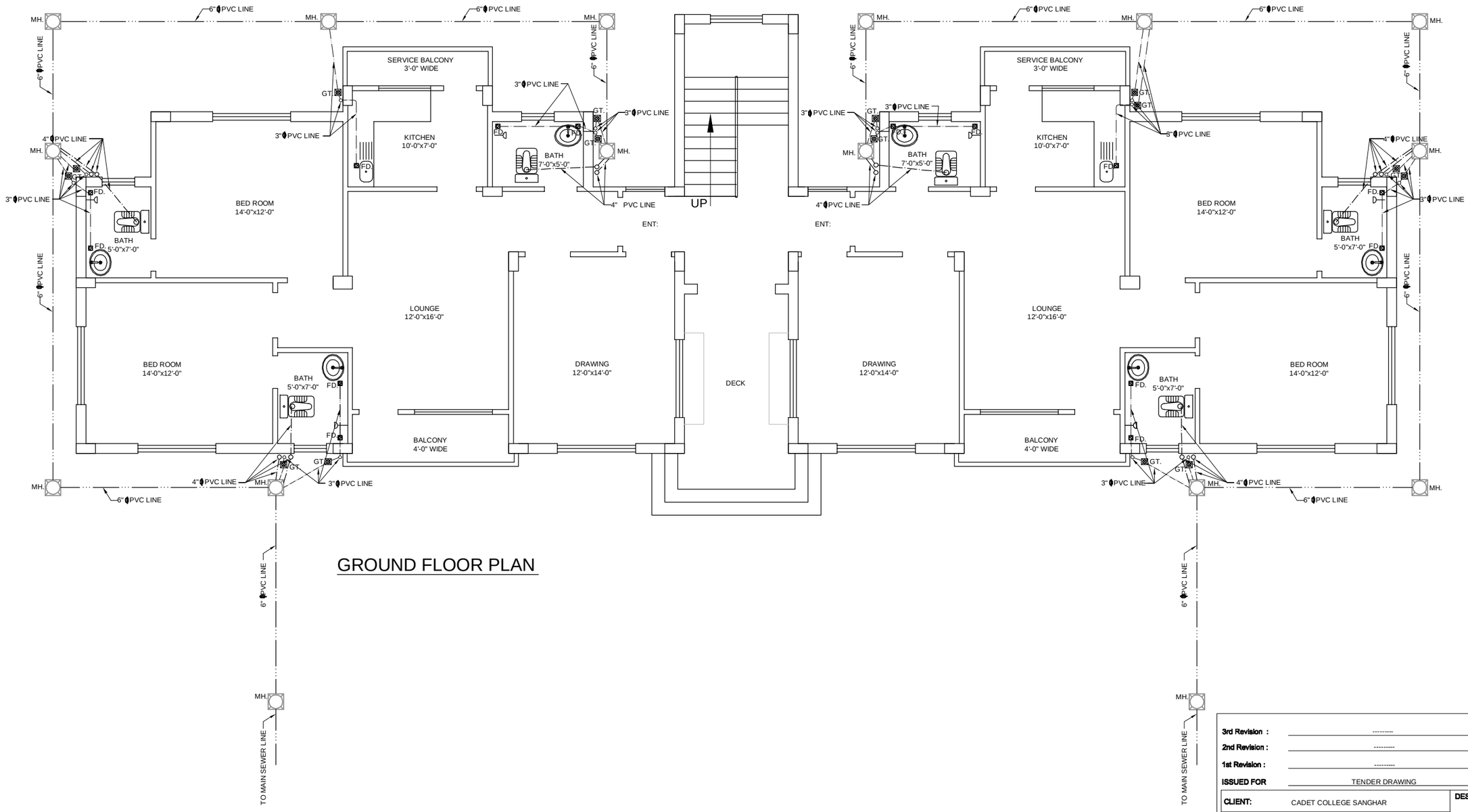
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2nd Revision :	---------	**Date :**	---------
1st Revision :	---------	**Date :**	---------
ISSUED FOR	TENDER DRAWING	**Date :**	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	**DESCRIPTION :** 1ST. FLOOR PLAN DRAIN SYSTEM
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLTAS CAT-V	

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JOB NO :	303/12
DRG. NO. :	303/12 DS-01
DRAWN BY : M.K ABBASI	**CHECKED BY :** MUNEER
SCALE : N.T.S	**DATE :** 09-12-202

	LEGEND	SYMBOLS
1	8"ϕ PIPE (UP.V.C) SEWER LINE	
2	6"ϕ PIPE (UP.V.C) SEWER LINE	
3	4"ϕ PIPE (UP.V.C) SEWER LINE	
4	3"ϕ PIPE (UP.V.C) SEWER LINE	
5	WASH BASIN	W.B
6	WATER CLOSET	W.C
7	SHOWER	SH.
8	MAN HOLE	MH.
9	GULLY TRAP	GT.
10	FLOOR DRAIN	FD.



GROUND FLOOR PLAN

3rd Revision :	--------	Date :	--------
2nd Revision :	--------	Date :	--------
1st Revision :	--------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : GROUND FLOOR PLAN DRAIN SYSTEM
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLTAS CAT-V	

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JOB NO :	303/12
DRG. NO. :	303/12 DS-02
DRAWN BY : M.K ABBASI	CHECKED BY : MUNEER
SCALE : N.T.S	DATE : 09-12-202

ELECTRICAL DRAWINGS

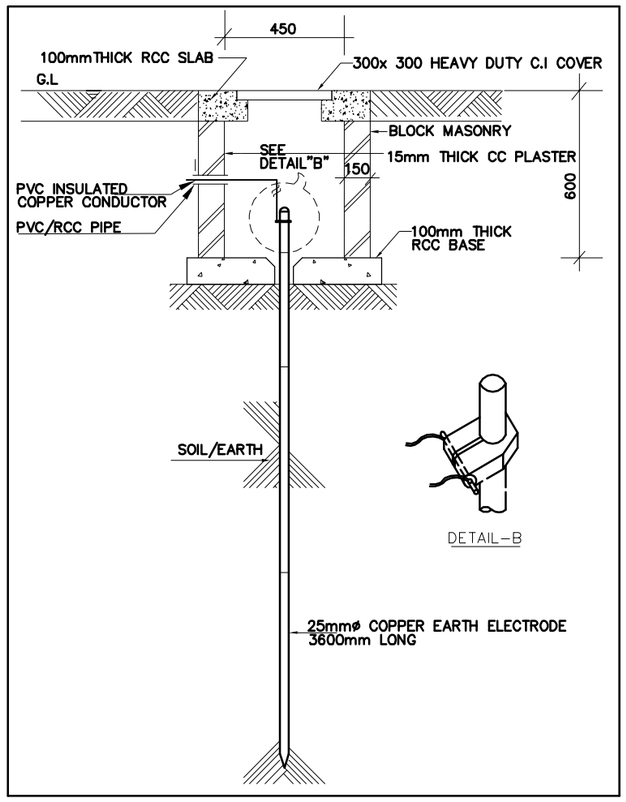
PREPARED BY:

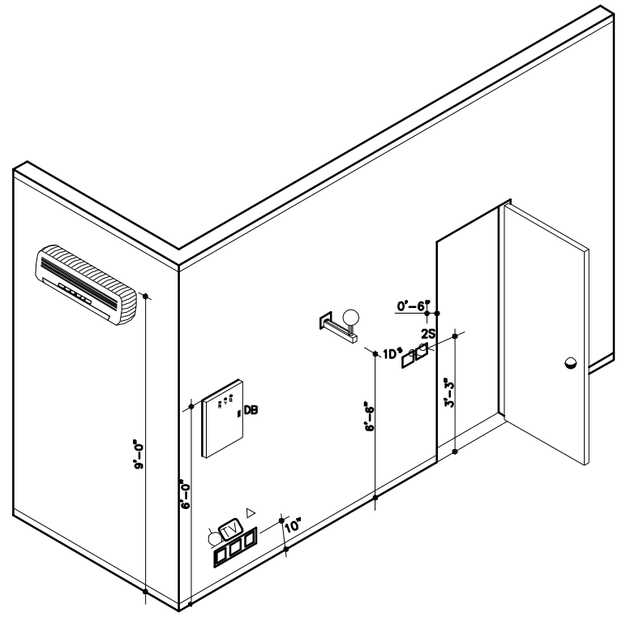
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LEGEND

SYMBOL	DESCRIPTION
	CEILING LIGHT
	WALL BRACKET LIGHT FIXTURE
	EXHAUST FAN
	CEILING FAN
2g / 3g / 4g	10A SWITCH 2, 3 & 4 gang
	FAN SPEED DIMMER
	13 AMP INTERNATIONAL SWITCH SOCKET LOW / ABOVE COUNTER
	15 AMP 3 PIN SWITCH SOCKET LOW / ABOVE COUNTER
	TELEPHONE OUTLET
TV	TV OUTLET
G.I	GATE INTERCOM
DB	DISTRIBUTION BOARD
TJB / TV JB	TELEPHONE & TV JUNCTION BOX
	SPLIT UNIT
MDB	MAIN DISTRIBUTION BOARD
S	SMOKE DETECTOR BATTERY OPERATED
H	HEAT DETECTOR BATTERY OPERATED
	PARAPET WALL LIGHT AT ROOF

EARTHING PIT DETAIL





MOUNTING HEIGHT DETAILS FOR SWITCH SOCKET ETC.

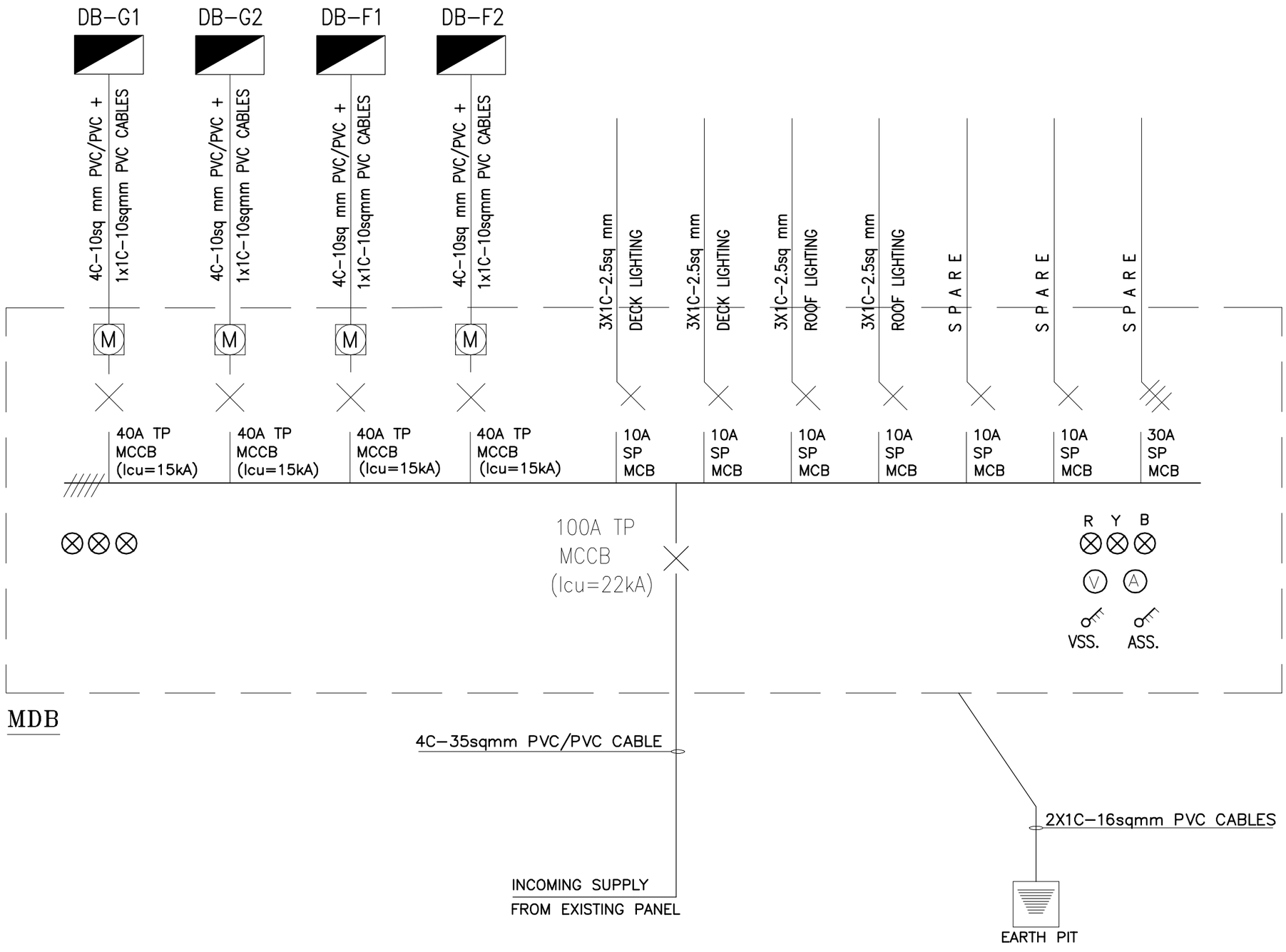
(OR AS DIRECTED BY ARCHITECT)

3rd Revision :	--------	Date :	--------
2nd Revision :	--------	Date :	--------
1st Revision :	--------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : LEGEND & OTHER DETAILS
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-V	

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JOB NO :	303/12		
DRG. NO. :	E-01		
DRAWN BY :	M.FAISAL	CHECKED BY :	A.H
SCALE :	N.T.S	DATE :	09-12-202

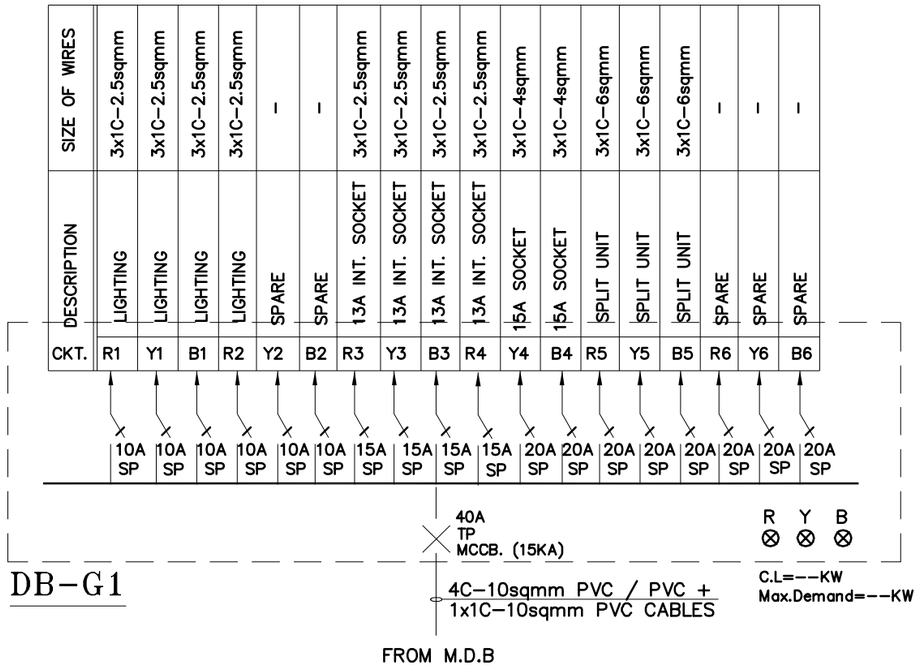


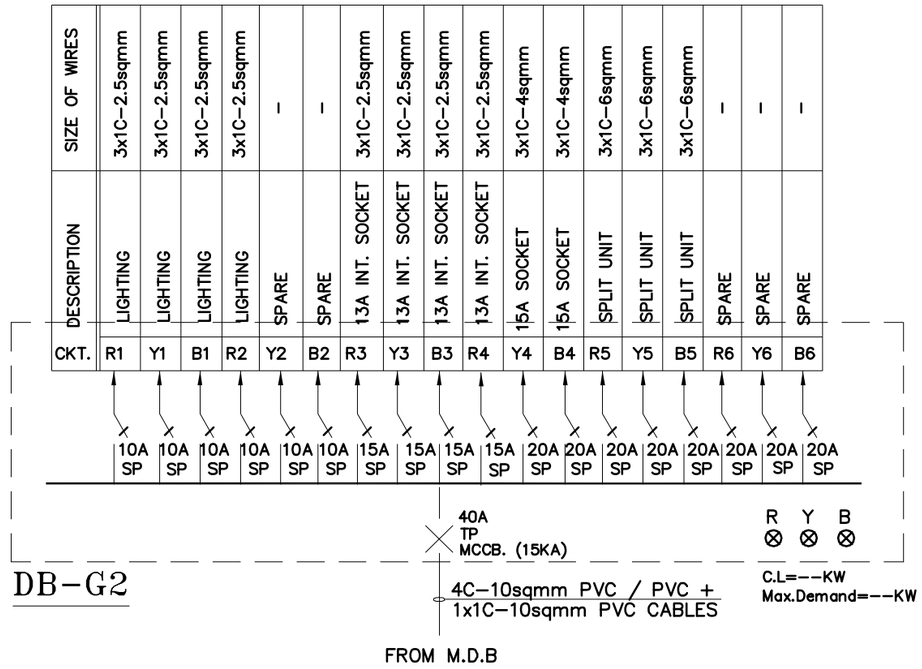
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2nd Revision :	--------	Date :	--------
1st Revision :	--------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

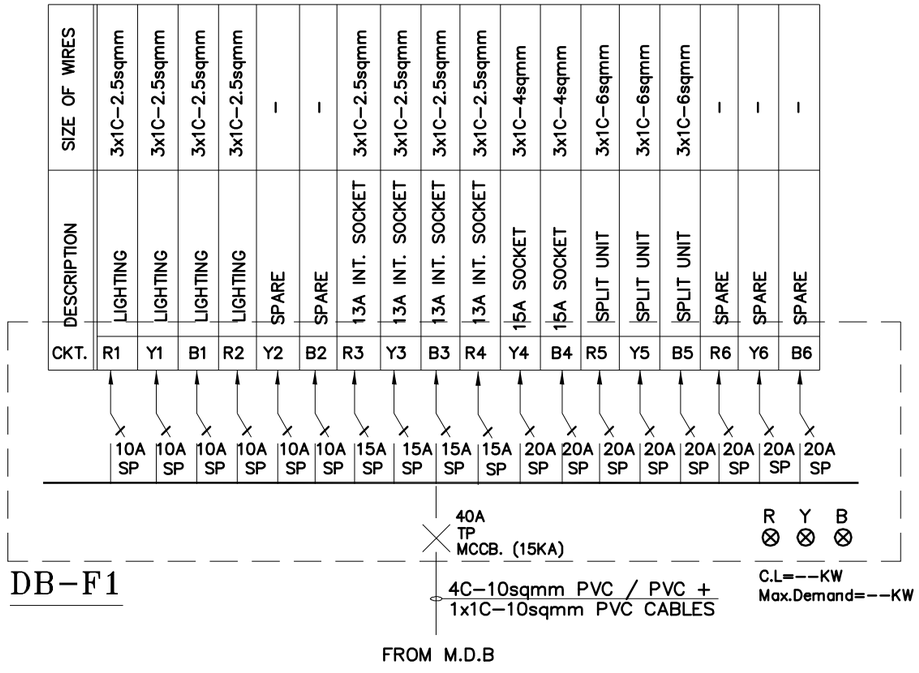
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : SINGLE LINE DIAGRAM MDB
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-V	

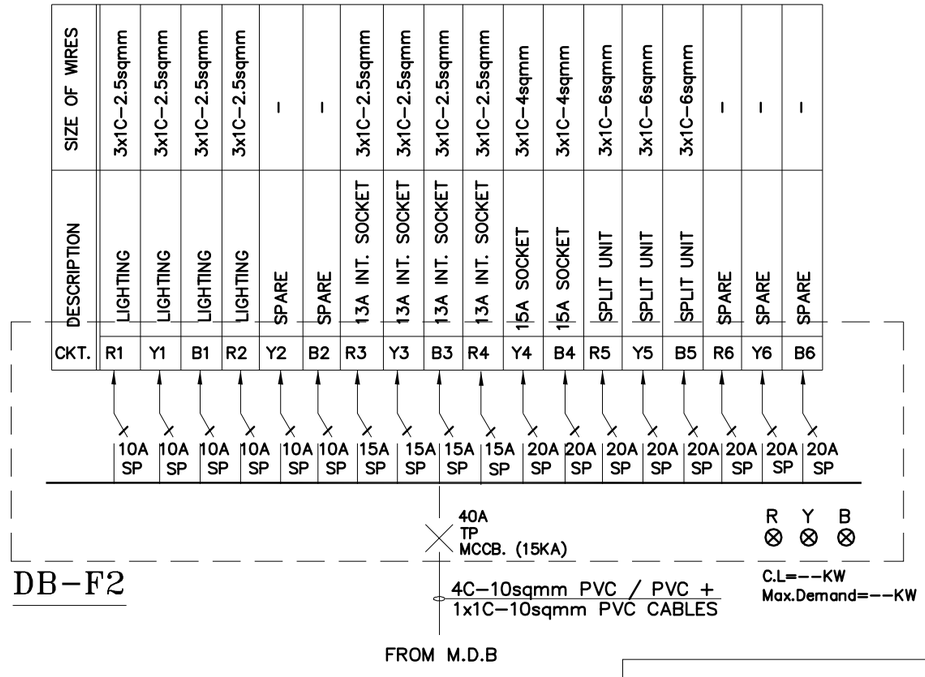
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JOB NO :	303/12		
DRG. NO. :	E-02		
DRAWN BY : M.FAISAL		CHECKED BY : A.H	
SCALE : N.T.S		DATE : 09-12-202	







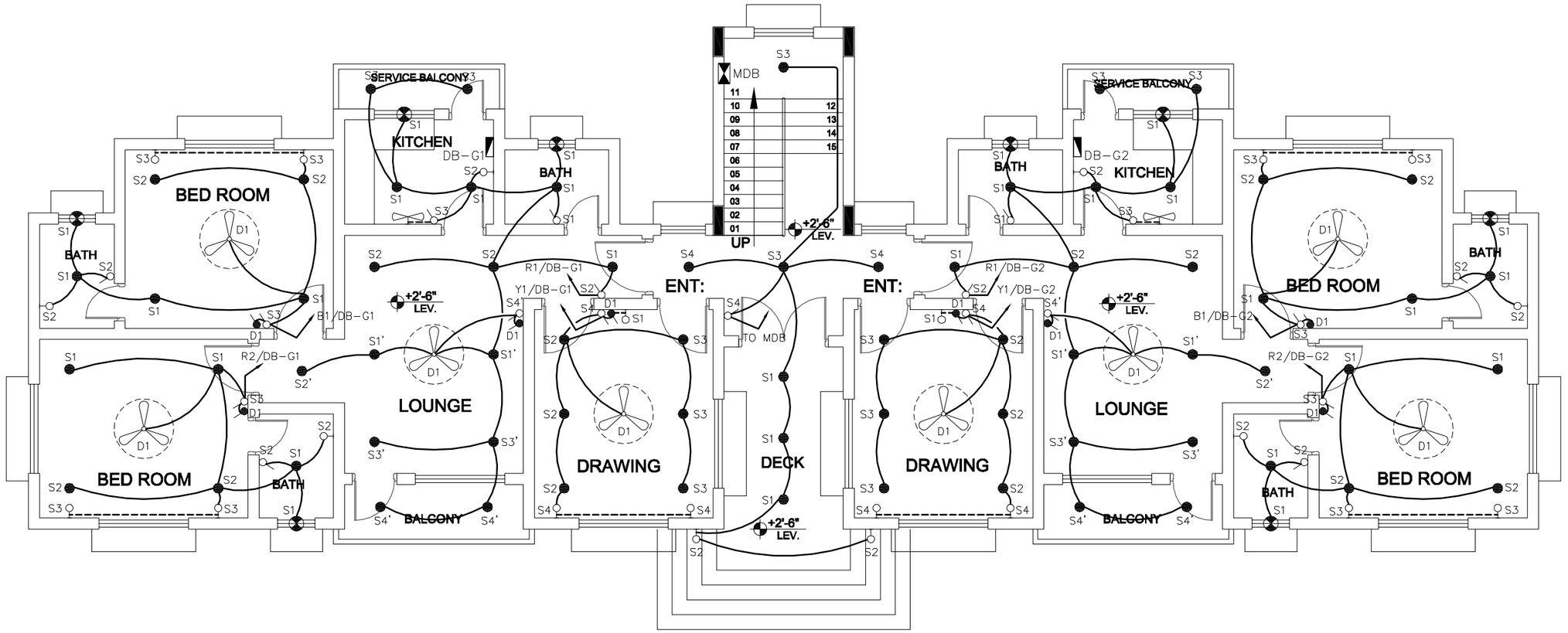


3rd Revision :	--------	Date :	--------
2nd Revision :	--------	Date :	--------
1st Revision :	--------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : SINGLE LINE DIAGRAM DB SCHEDULES
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-V	

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JOB NO :	303/12
DRG. NO. :	E-03
DRAWN BY : M.FAISAL	CHECKED BY : A.H
SCALE : N.T.S	DATE : 09-12-202



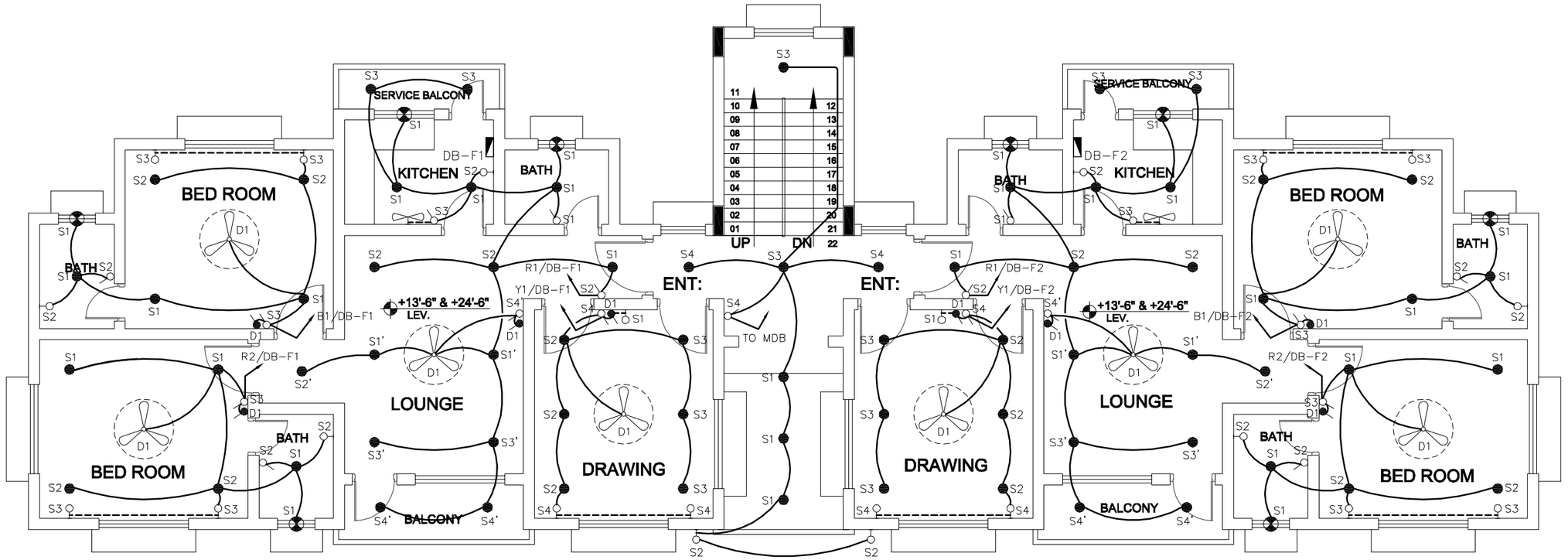
GROUND FLOOR PLAN

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2nd Revision :	--------	Date :	--------
1st Revision :	--------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : GROUND FLOOR PLAN LIGHTING LAYOUT
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-V	

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JOB NO :	303/12
DRG. NO. :	E-04
DRAWN BY : M.FAISAL	CHECKED BY : A.H
SCALE : 1/4"=1'	DATE : 09-12-202



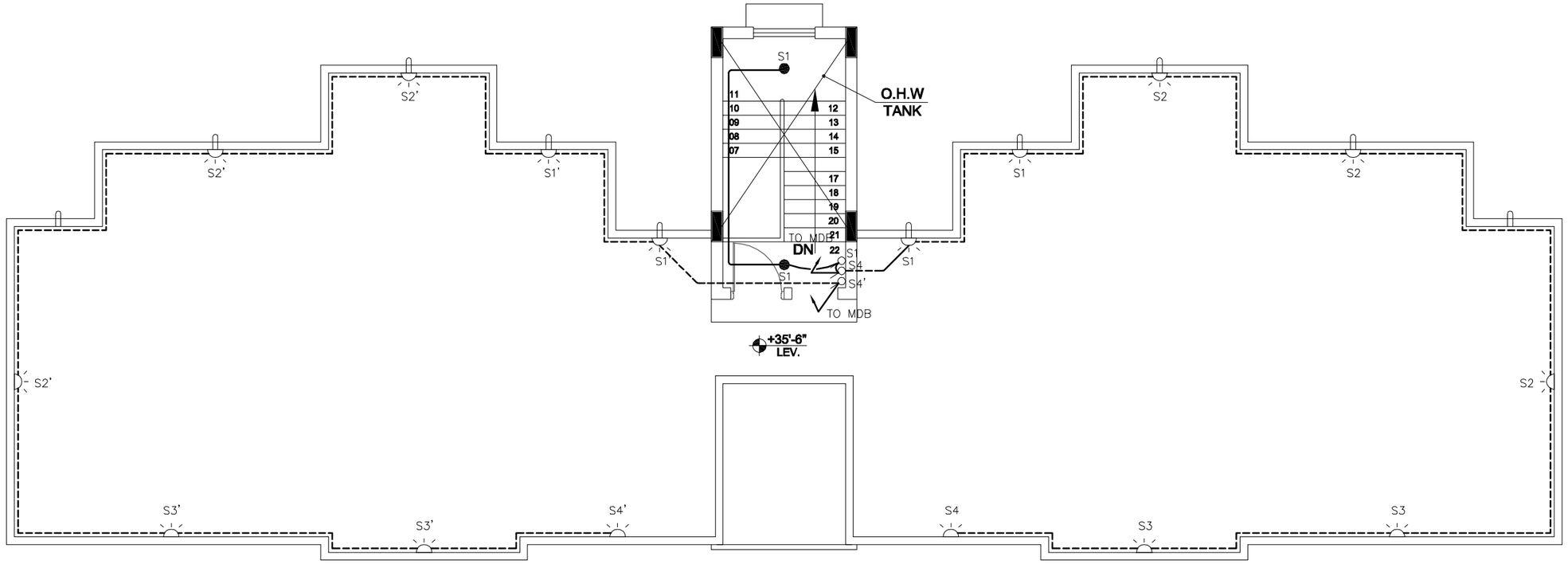
FIRST FLOOR PLAN

3rd Revision :	---------	Date :	---------
2nd Revision :	---------	Date :	---------
1st Revision :	---------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FIRST FLOOR PLAN LIGHTING LAYOUT
JOB TITLE: LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-V	

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Tel :021-35398444, 021-35312244
FAX: 021-35883106
E-mail: info@youngassociates.com.pk

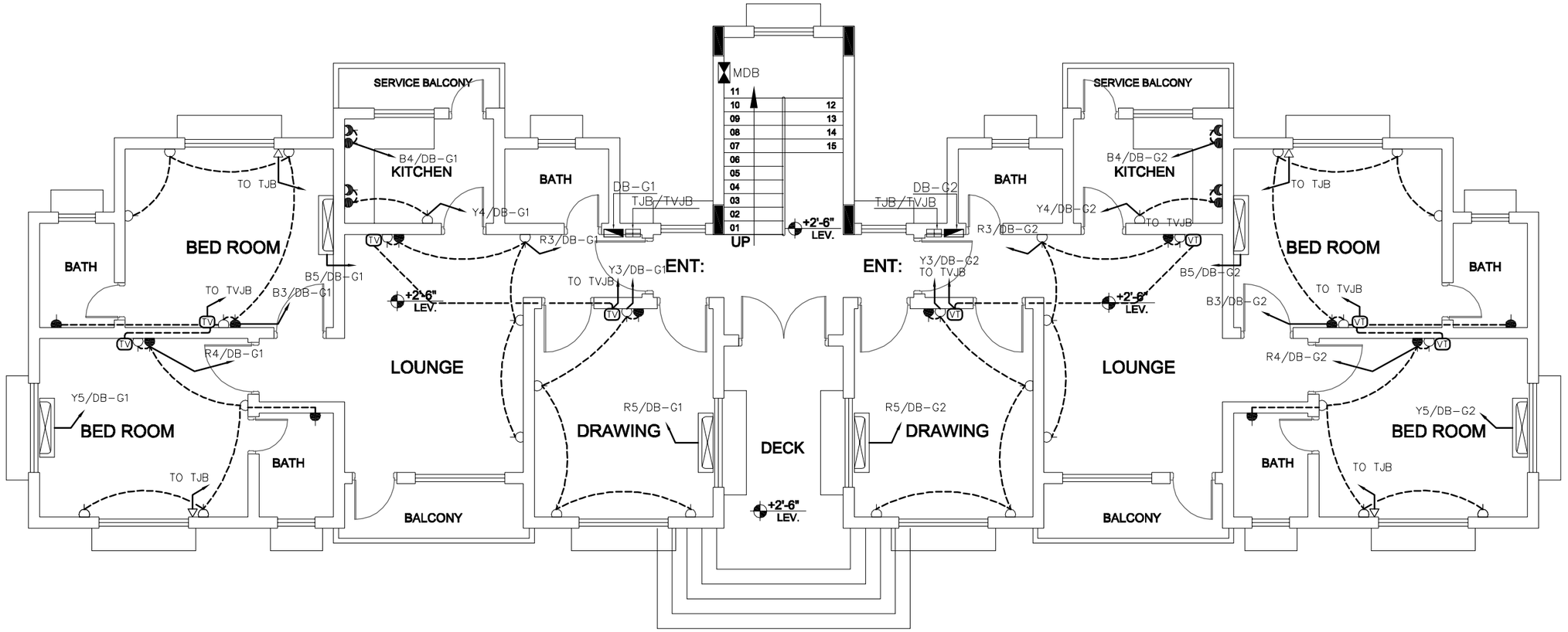
JOB NO :	303/12		
DRG. NO. :	E-05		
DRAWN BY :	M.FAISAL	CHECKED BY :	A.H
SCALE :	1/4"=1'	DATE :	09-12-202



ROOF PLAN

3rd Revision :	---------	Date :	---------
2nd Revision :	---------	Date :	---------
1st Revision :	---------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : ROOF PLAN LIGHTING LAYOUT
JOB TITLE: UNDER STAFF FAMILY QUARTERS / FLATS FOR CAT-V	
YOUNG ASSOCIATES CONSULTING ENGINEERS & ARCHITECTS 9-C 24 th Commercial street, Phase 2 (Extn), Defence Housing Authority, Karachi-75500 Tel :021-35396444, 021-35312244 FAX: 021-35883106 E-mail: info@youngassociates.com.pk	JOB NO : 303/12 DRG. NO. : E-06 DRAWN BY : M.FAISAL / CHECKED BY : A.H SCALE : 1/4"=1' / DATE : 29-11-202



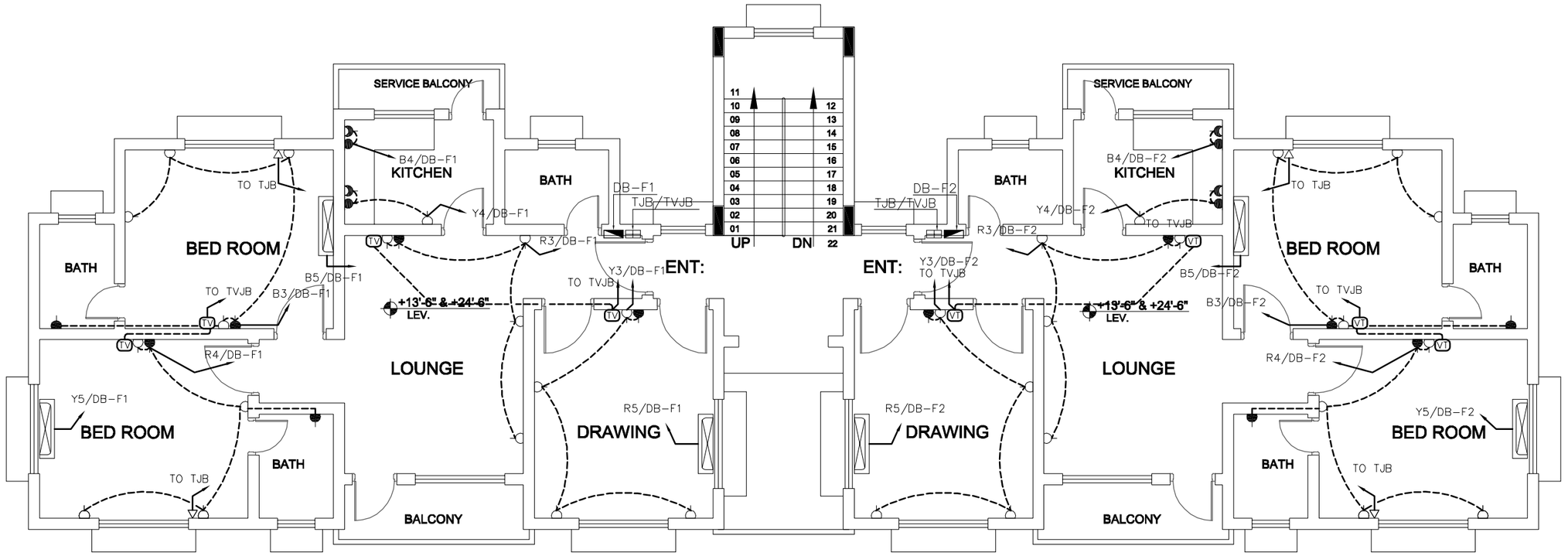
GROUND FLOOR PLAN

3rd Revision :	---------	Date :	---------
2nd Revision :	---------	Date :	---------
1st Revision :	---------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : GROUND FLOOR PLAN POWER LAYOUT
JOB TITLE: LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-V	

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Tel :021-35398444, 021-35312244
FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO :	303/12
DRG. NO. :	E-07
DRAWN BY : M.FAISAL	CHECKED BY : A.H
SCALE : 1/4"=1'	DATE : 29-11-202



FIRST FLOOR PLAN

3rd Revision :	---------	Date :	---------
2nd Revision :	---------	Date :	---------
1st Revision :	---------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FIRST FLOOR PLAN POWER LAYOUT
JOB TITLE: LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-V	

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Tel :021-35398444, 021-35312244
FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO :	303/12
DRG. NO. :	E-08
DRAWN BY : M.FAISAL	CHECKED BY : A.H
SCALE : 1/4"=1'	DATE : 09-12-202

CADET COLLEGE SANGHAR

LOWER STAFF FAMILY QUARTERS / FLATS CATEGORY-VI

TENDER DRAWINGS

ARCHITECTURAL , STRUCTURAL
ELECTRICAL & PUMBING DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
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ARCHITECTURAL DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
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LIST OF ARCHITECTURAL DRAWINGS

S.NO.	DWG. NO.	DESCRIPTION
1	AR.00	LIST OF DRAWING
2	AR.01	SITE PLAN
3	AR.02	GROUND FLOOR PLAN
4	AR.03	FIRST FLOOR PLAN
5	AR.04	ROOF PLAN
6	AR.05	LEFT SIDE & RIGHT ELEVATION
7	AR.06	FRONT ELEVATION
8	AR.07	REAR ELEVATION
9	AR.08	SECTION AT AA & B-B
10	AR.09	SCHEDULE OF OPENING

3rd Revision : ---------- Date : --------

2nd Revision : ---------- Date : --------

1st Revision : ---------- Date : --------

ISSUED FOR TENDER DRAWING Date : 09-12-2025

CLIENT: CADET COLLEGE SANGHAR

JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-VI

DESCRIPTION : LIST OF DRAWINGS

YOUNG ASSOCIATES
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Defence Housing Authority, Karachi-75500
Tel :021-35396444, 021-35312244
FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO : 303/13

DRG. NO. : 330/13 AR-00

DRAWN BY : AAMIR

CHECKED BY : MUNEER

SCALE : 1"=8'-0"

DATE : 09-12-2025

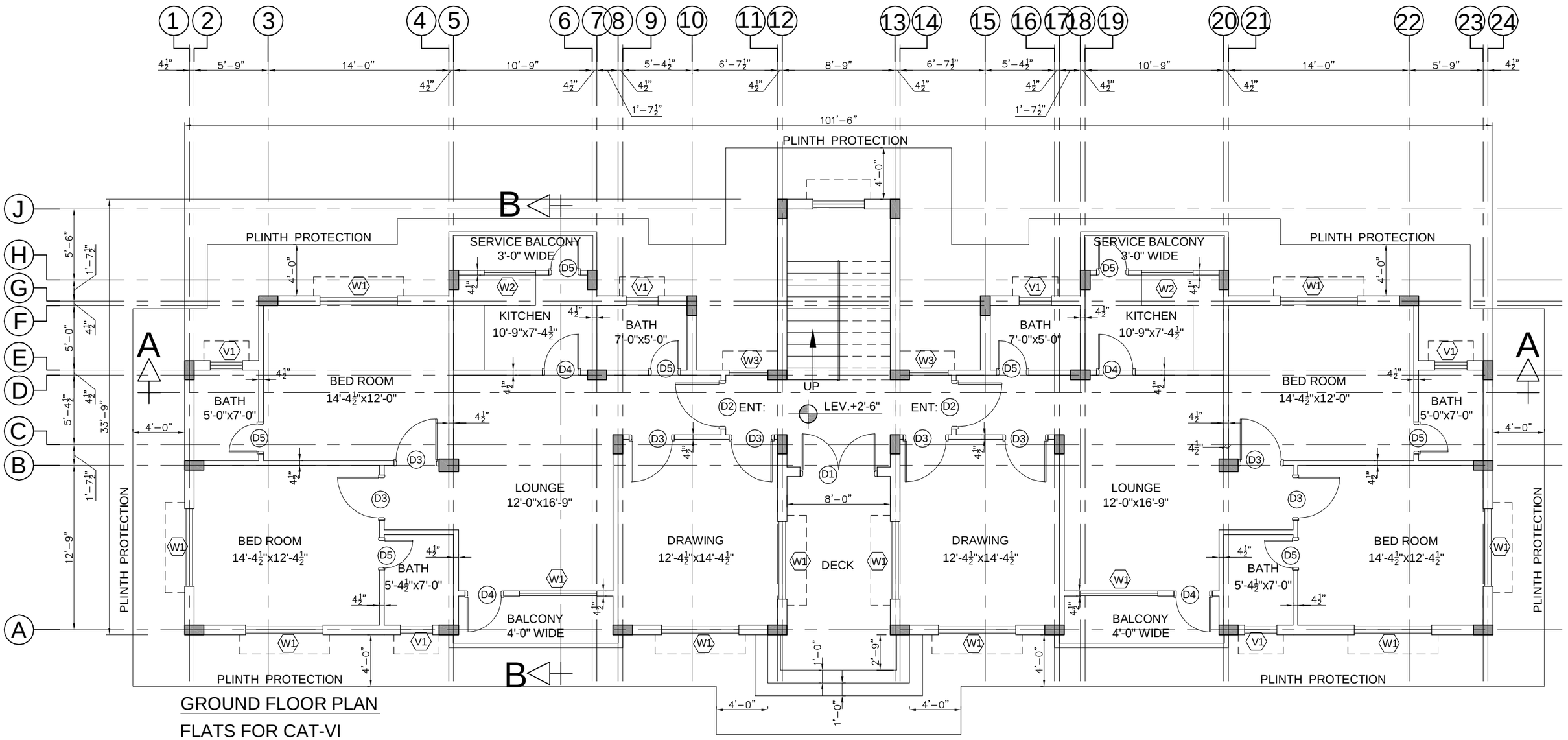


3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	GOOGLE IMAGE
JOB TITLE :	LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-VI		

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FAX: 021-35893106
E-mail: info@youngassociates.com.pk

JOB NO :	303/13		
DRG. NO. :	330/13 AR-01		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1"=8'-0"	DATE :	09-12-2025



GROUND FLOOR PLAN

FLATS FOR CAT-VI

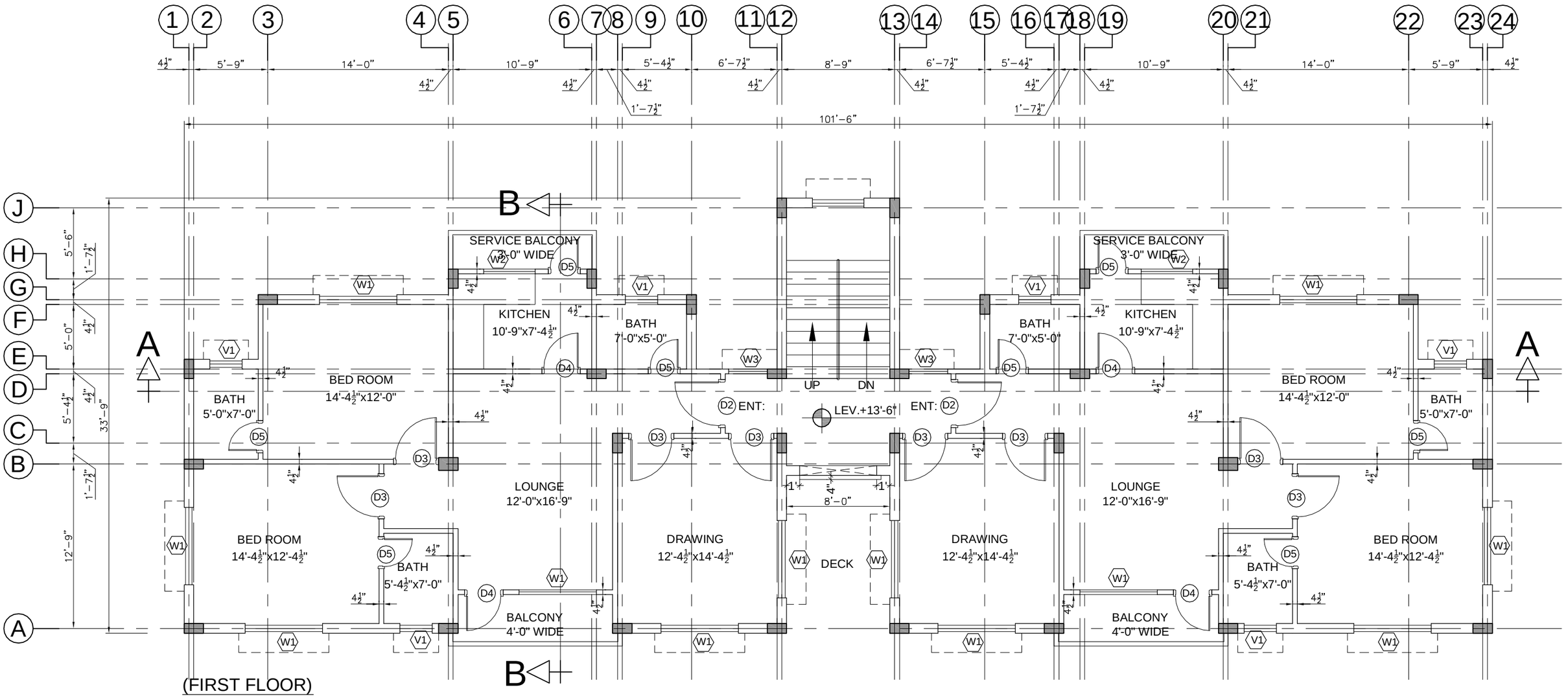
COVERED AREA = 2650.00 SQ.FT

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : GROUND FLOOR PLAN
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-VI	

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FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO : 303/13	
DRG. NO. : 330/13 AR-02	
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=8'-0"	DATE : 09-12-2025



(FIRST FLOOR)

FLATS FOR CAT-VI

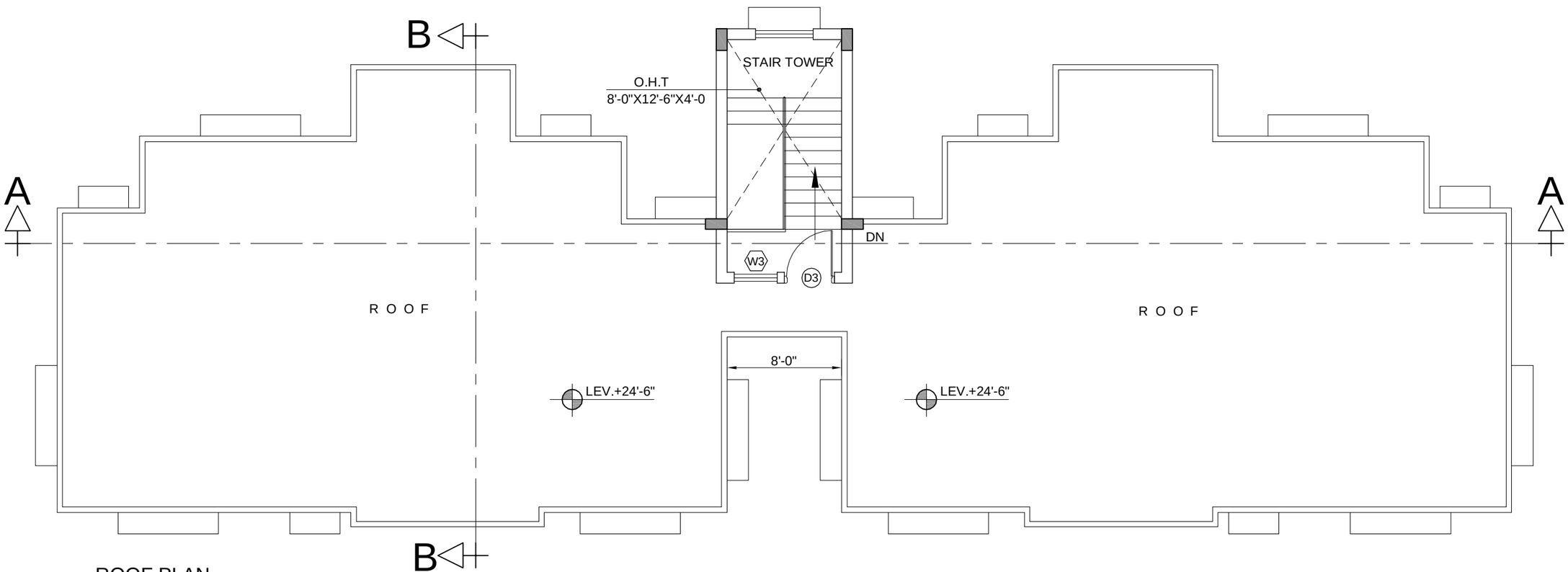
COVERED AREA = 2650.00 SQ.FT

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FIRST FLOOR PLAN
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-VI	

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E-mail: info@youngassociates.com.pk

JOB NO :	303/13
DRG. NO. :	330/13 AR-03
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=8'-0"	DATE : 09-12-2025



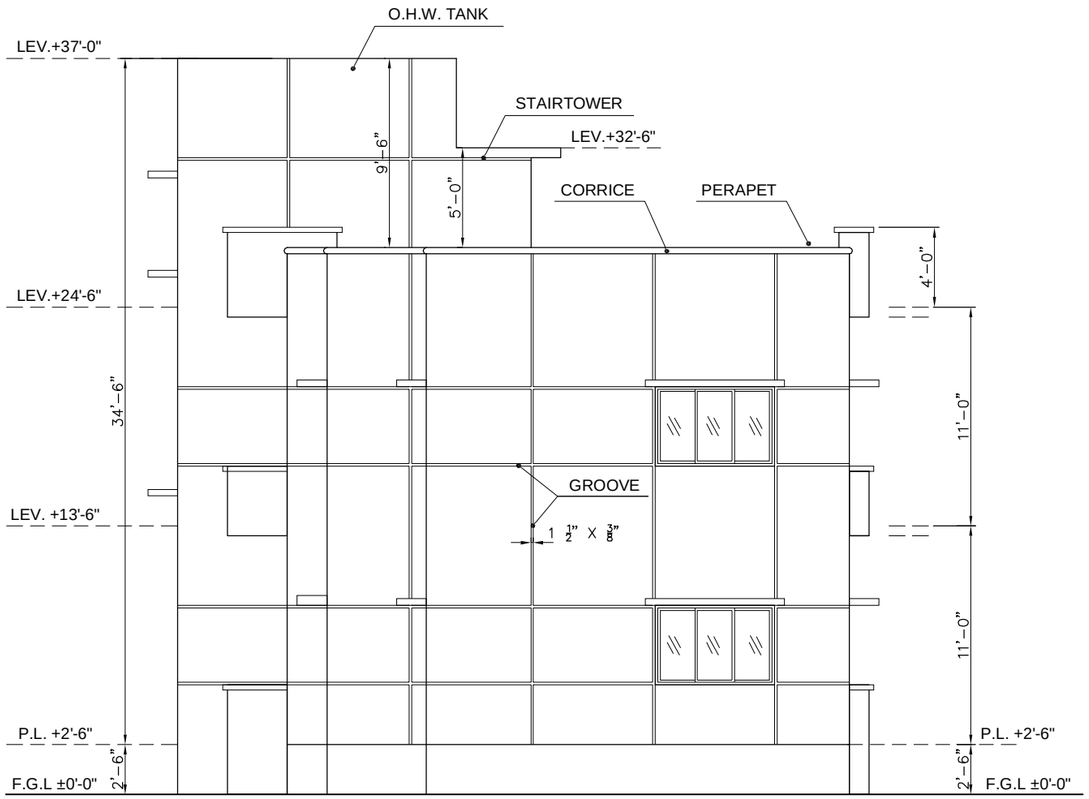
ROOF PLAN

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

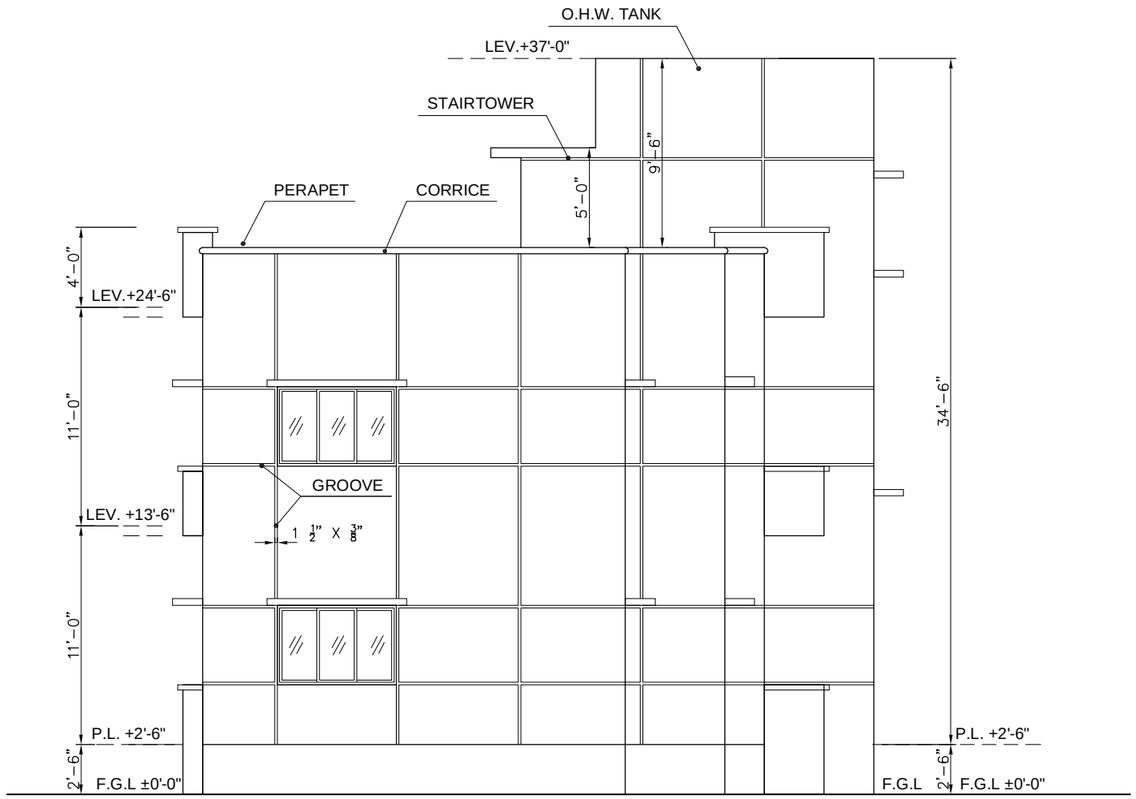
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : ROOF PLAN
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-VI	

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JOB NO : 303/13	
DRG. NO. : 330/13 AR-04	
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=8'-0"	DATE : 09-12-2025



LEFT SIDE ELEVATION



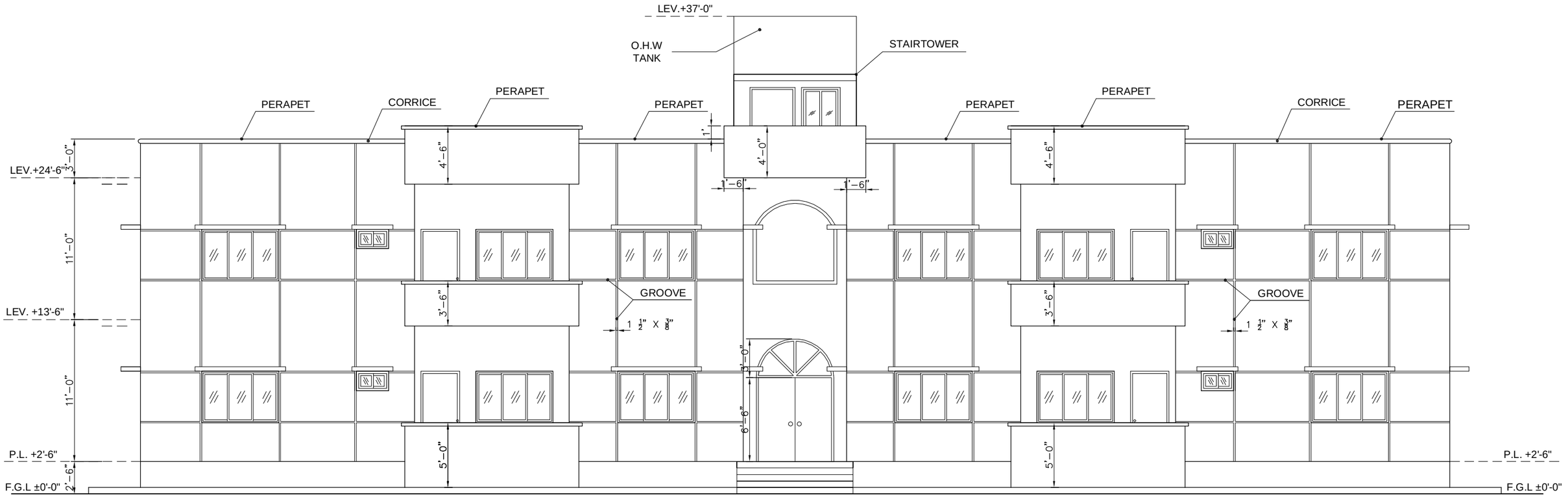
RIGHT SIDE ELEVATION

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : LEFT SIDE & RIGHT SIDE ELEVATION
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-VI	

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FAX: 021-35883106
E-mail: info@youngassociates.com.pk

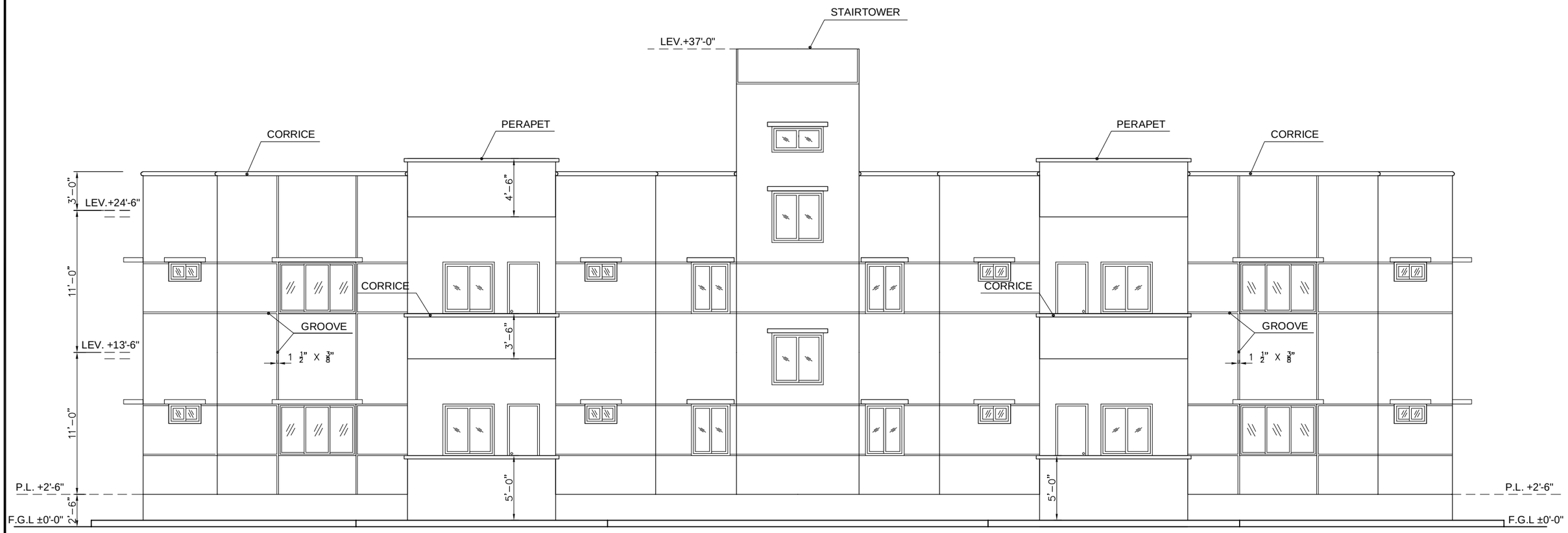
JOB NO :	303/13
DRG. NO. :	330/13 AR-05
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=8'-0"	DATE : 09-12-2025



FRONT ELEVATION

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	FORNT ELEVATION
JOB TITLE :	LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-VI		
YOUNG ASSOCIATES CONSULTING ENGINEERS & ARCHITECTS 9-C 24 th Commercial street, Phase 2 (Extn), Defence Housing Authority, Karachi-75500 Tel :021-35396444, 021-35312244 FAX: 021-35883106 E-mail: info@youngassociates.com.pk		JOB NO :	303/13
		DRG. NO. :	330/13 AR-06
		DRAWN BY : AAMIR	CHECKED BY : MUNEER
		SCALE : 1"=8'-0"	DATE : 09-12-2025



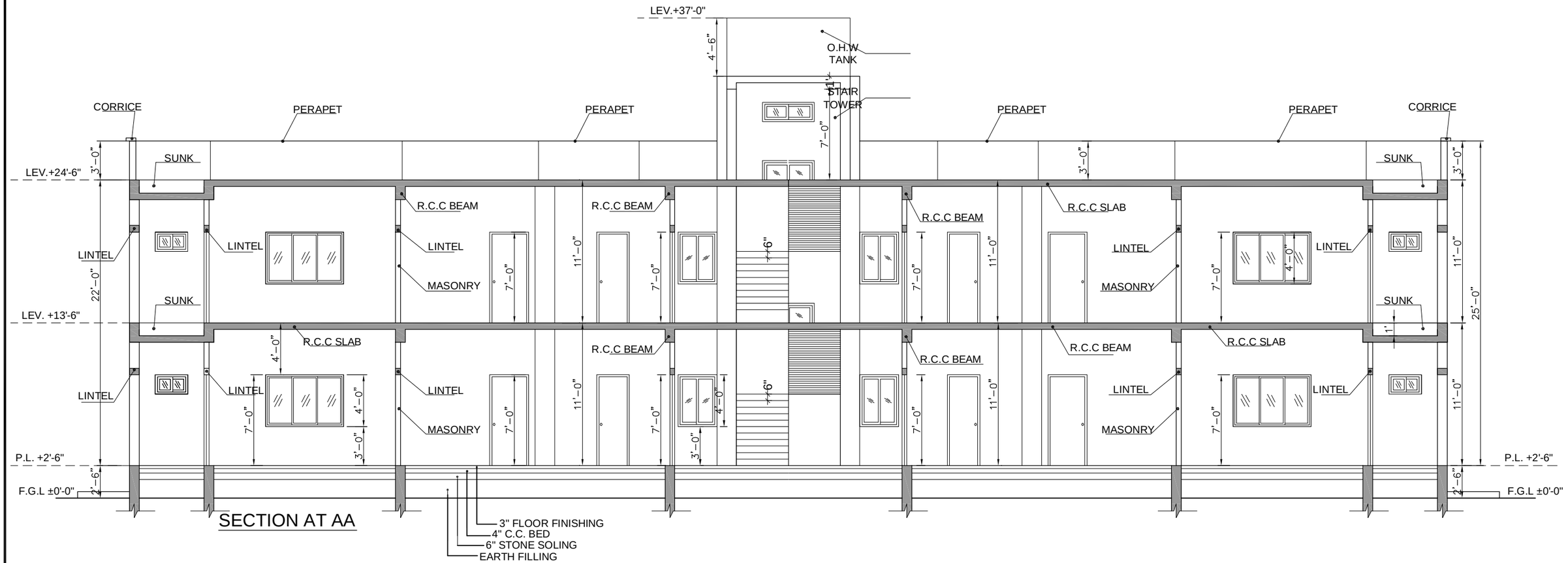
REAR ELEVATION

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

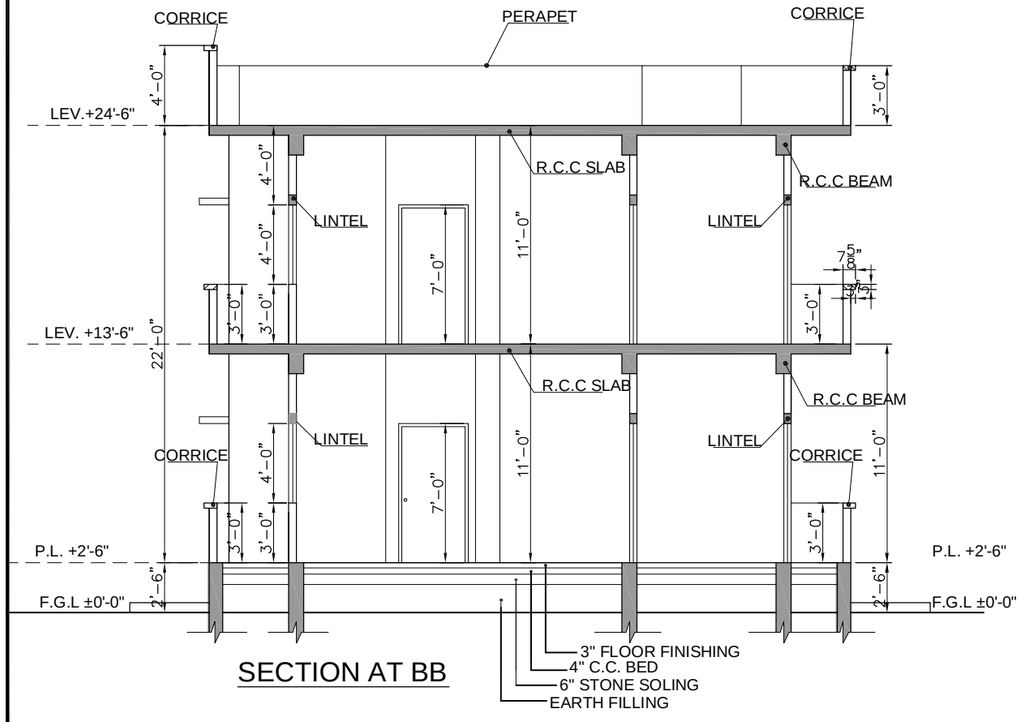
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : REAR ELEVATION
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-VI	

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E-mail: info@youngassociates.com.pk

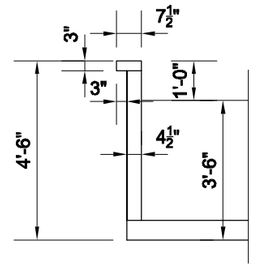
JOB NO :	303/13
DRG. NO. :	330/13 AR-07
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=8'-0"	DATE : 09-12-2025



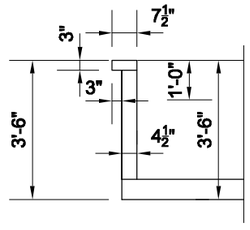
SECTION AT AA



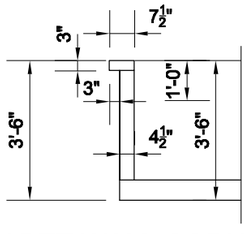
SECTION AT BB



TYP. PERAPET WALL CORNICE AT ROOF



TYP. PERAPET WALL CORNICE AT ROOF



TYP. PERAPET WALL CORNICE AT BALCONY

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	SECTION AT AA & BB
JOB TITLE :	LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-VI		

YOUNG ASSOCIATES
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JOB NO :	303/13		
DRG. NO. :	330/13 AR-08		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1"=8'-0"	DATE :	09-12-2025

DOORS & WINDOWS VENTILATORS SCHEDULE

S.N O	DESCRIPTION	SIZE	REMARKS
	DOORS		
D1	DOOR DOUBLE LEAF	6'-0" X 9'-6"	WOODE PANELLED DOOR
D2	DOOR SINGLE LEAF	3'-6" X 7'-0"	" " " "
D3	DOOR SINGLE LEAF	3'-6" X 7'-0"	" " " "
D4	DOOR SINGLE LEAF	3'-0" X 7'-0"	" " " "
D5	DOOR SINGLE LEAF	2'-6" X 7'-0"	" " " "
	WINDOWS		
W1	WINDOW FULL GLAZED	6'-0" X 4'-0"	WOODEN GLAZED SHUTTER WITH FLY PROOF
W2	WINDOW FULL GLAZED	4'-0" X 4'-0"	" " " "
W3	WINDOW FULL GLAZED	3'-0" X 6'-0"	" " " "
	VENT.		
V1	VENT. FULL GLAZED	2'-6" X 1'-6"	WOODEN GLAZED SHUTTER WITH FLY PROOF

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : SCHEDULE OF OPENING
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS FOR CAT-VI	

YOUNG ASSOCIATES
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JOB NO :	303/13
DRG. NO. :	330/13 AR-09
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=8'-0"	DATE : 09-12-2025

STRUCTURAL DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
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Tel :021-35396444, 021-35312244, FAX : 021-35883106
E-mail: info @ young associates .com.pk

LIST OF STRUCTURAL DRAWINGS

S.NO.	DWG. NO.	DESCRIPTION
1	GN.-01	GENERAL NOTES
2	ST.00	LIST OF DRAWING
3	ST.01	FOUNDATION & COLUMN LAYOUT PLAN
4	ST.02	FOUNDATION REINFORCEMENT DETAILS
5	ST.03	PLINTH BEAM LAYOUT & REINFORCEMENT DETAILS
6	ST.04	STAIR CASE SECTION & REINFORCEMENT DETAILS
7	ST.05	1ST. SLAB BEAMS & REINFORCEMENT DETAILS
8	ST.06	ROOF SLAB BEAMS & REINFORCEMENT DETAILS
9	ST.07	TOWER & O.H. TANK REINFORCEMENT DETAILS
10	ST.08	TYP. DETAILS OF BRICK WALL

3rd Revision : ---------- Date : --------

2nd Revision : ---------- Date : --------

1st Revision : ---------- Date : --------

ISSUED FOR TENDER DRAWING Date : 09-12-2025

CLIENT: CADET COLLEGE SANGHAR

JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-VI

DESCRIPTION : LIST OF DRAWINGS

YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
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JOB NO : 303/13

DRG. NO. : 303/13 ST-00

DRAWN BY : AAMIR

CHECKED BY : MUNEER

SCALE : 1"=8'-0"

DATE : 09-12-202

GENERAL NOTES

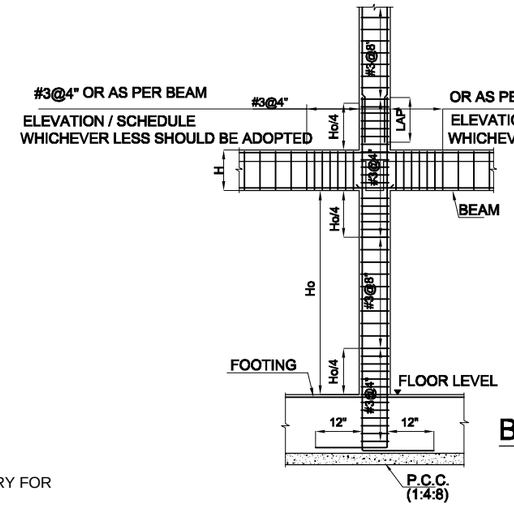
1. REINFORCED CONCRETE DESIGN IS BASED ON BUILDING CODE REQUIREMENT FOR REINFORCED CONCRETE UBC -97 AND ACI 318-08
2. FOUNDATION DESIGN IS BASED UPON A SAFE SOIL BEARING CAPACITY OF 0.65 T / SQ.FT. AT 6'-6" BELOW EXISTING GROUND LEVEL AS PER SOIL REPORT.
3. COORDINATE STRUCTURAL DRAWINGS WITH ARCHITECTURAL DRAWINGS IN CASE OF DISCREPANCY REFER TO ENGINEER IN CHARGE
4. ALL DIMENSIONS ARE IN FEET/INCHES.
5. DO NOT SCALE THE DRAWING, FOLLOW WRITTEN DIMENSIONS OR REFER TO CONSULTANT
6. THE CONTRACTOR IS TO CHECK AND VERIFY ALL DIMENSIONS AND LEVELS BEFORE EXECUTION
7. ALL ERRORS AND OMISSIONS TO BE REFERED TO THE CONSULTANT / ENGINEER PRIOR TO EXECUTION OF WORK
8. PRIOR TO CASTING CONCRETE REFER TO ARCHITECTURAL, PLUMBING , ELECTRICAL AND HAVC DRAWINGS FOR EMBEDDED ITEMS.
9. ALL MATERIALS SHALL COMPLY TO THE SPECIFICATIONS SHOWN ON THE DRAWINGS IN ABSENCE OF ANY SPECIFICATION ALL ABSENT MATERIALS SHOULD COMPLY TO RELEVANT ACI STANDARDS AND SHALL BE SUBJECTED TO APPROVAL OF THE CONSULTANT.
10. CONCRETE CUBES SHALL BE MADE AVAILABAL AT SITE BY THE CONTRACTOR AND SAMPLE FROM RANDOM BATCHES WILL BE TAKEN DURING CONCRETING.
11. SLUMP CONE SHALL BE MADE AVAILBLE AT SITE BY THE CONTRACTOR AND RANDOM SAMPLES WILL BE CHECKED DURING CONCRETING.
12. THE WATER USED FOR CONCRETE MIXING AND CURING SHOULD BE OF POTABLE QUALITY AND WITHOUT ANY IMPURITIES. A SAMPLE SHOULD BE TESTED IN LABORATORY FOR SULPHATE AND CHLORIDE CONTENTS.
13. FINE AND COARSE AGGREGATES SHOULD BE FREE FROM CLAY, LOAMS OR ANY OTHER ORGANIC IMPURITIES. A TEST SHOULD BE CARRIED OUT BEFORE USE.
14. ATMOSPHERIC TEMPERATURE SHOULD BE BETWEEN 32 C TO 35 C, AT THE TIME OF CONCRETE POURING.
15. R.C.C.CONCRETE (STANDARD CYLINDRICAL) STRENGTHS (fc IN PSI) AT 28 DAYS FOR VARIOUS STRUCTURAL MEMBERS SHALL BE.

    FOUNDATION/ BEAMS/ SLAB (fc' = 3000 psi)
    COLUMNS (fc' = 3000 psi)
    LEAN CONCRETE (fc' = 1500 psi)

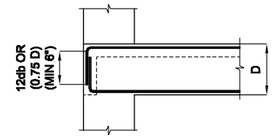
16. ALL R.C.C. SPACE WORKS SHALL BE CONTINUOUSLY MOIST CURED FOR AT LEAST 14 DAYS OR CURED BY CURING COMPOUND.
17. FORM WORK SUPPORTING R.C.C. MEMBERS SHALL NOT BE REMOVED PRIOR TO 14 DAYS. AFTER POURING.
18. ALL R.C.C. SPACE WORKS SHALL BE INTERNALLY VIBRATED WITH ELECTRO MECHANICAL VIBRATOR.
19. MINIMUM CLEAR CONCRETE COVER TO REINFORCEMENT SHALL BE AS FOLLOWS.

    FOUNDATION.....3"
    BEAMS .....1 1/2"
    COLUMNS/WALLS .....1 1/2" / 1"
    SLAB..... 3/4"
    WATER RETAINING STRUCTURES .....2"

20. BEAMS AND SLABS SHOULD BE CASTED MONOLITHICALLY.
21. PRIOR TO PLACING CONCRETE ALL REINFORCING SHALL BE FREE OF LOOSE RUST AND SCALE OR ANY FOREIGN MATERIALS.
22. SPLICE LENGTH SHALL BE 60 TIMES DIA OF BAR
23. ALL INTERNAL & EXTERNAL PLASTER ON R.C.C. MEMBERS TO BE OF RATIO 1:4 AND THICKNESS SHOULD NOT EXCEED 3/4".

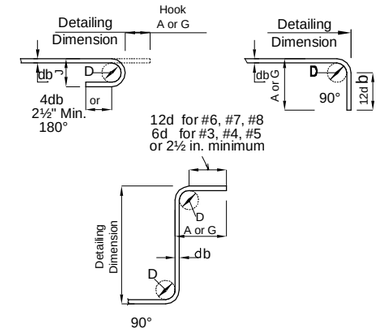


SEISMIC BEAM/COLUMN JOINT DETAIL



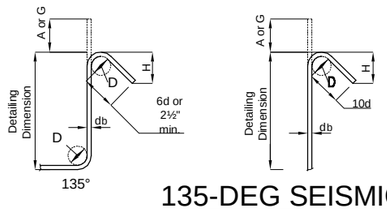
BAR BENDING DETAIL AT BEAM END

RECOMENDED END HOOKS, ALL GRADES				
Bar Size	Finished bend diameter D,in.	180-deg hooks		90-deg hooks
		A or G, in.	J, in.	A or G, in.
#3	2¼	5	3	6
#4	3	6	4	8
#5	3¾	7	5	10
#6	4½	8	6	12
#7	5¼	10	7	14
#8	6	11	8	16
#9	9½	15	11¾	19
#10	10¾	17	13¼	20
#11	12	19	14¾	24
#14	18¼	27	21¾	31
#18	24	36	28½	41



STIRRUP AND TIE HOOKS

Bar Size	D (in.)	135 deg Stirrup-tie hook dimensions, in.	
		135-deg hooks	
		A or G, in.	H approx
#3	1½	5	3½
#4	2	6½	4½
#6	4½	10 ¾	6½



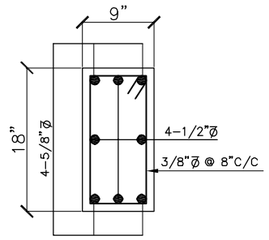
135-DEG SEISMIC STIRRUP/TIE HOOKS

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : GENERAL NOTES
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-VI	

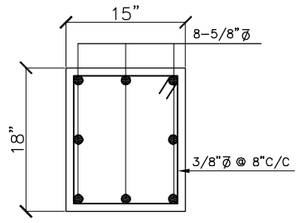
YOUNG ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
9-C 24 th Commercial street, Phase 2 (Extn),
Defence Housing Authority, Karachi-75500
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FAX: 021-35883106
E-mail: info@youngassociates.com.pk

JOB NO : 303/13	
DRG. NO. : 303/13 GN-01	
DRAWN BY : AAMIR	CHECKED BY : MUNEEB
SCALE : 1"=8'-0"	DATE : 09-12-20



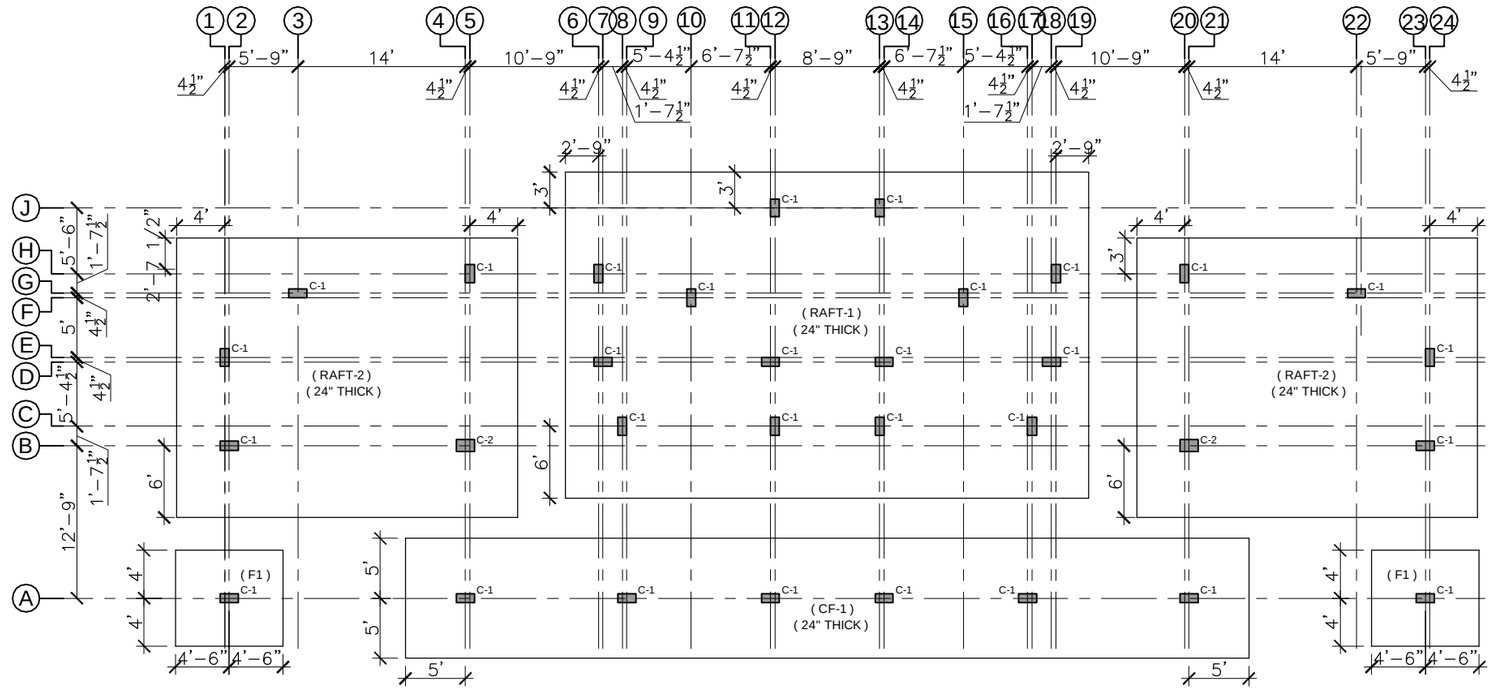
TYP. SEC. OF COLUMN C-1

9” X 18”

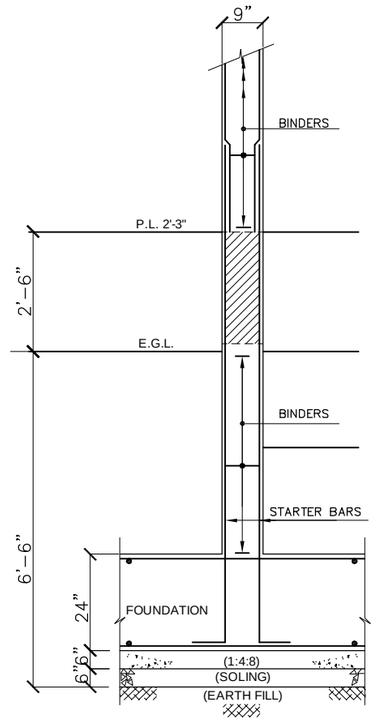


TYP. SEC. OF COLUMN C-2

15” X 18”



FOUNDATION & COLUMN LAYOUT PLAN



TYP.SECTION OF COLUMN

NOTE :

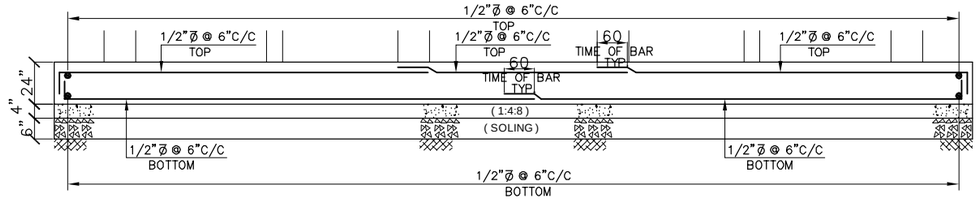
1- FOR GENERAL NOTES REFER DWG. NO. 303/13 GN.01

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

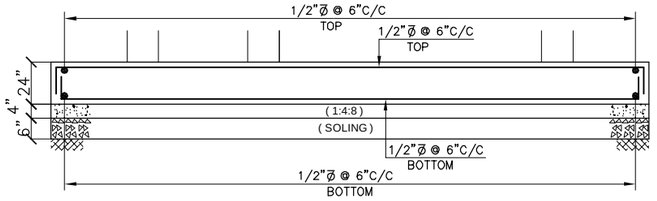
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FOUNDATION & COLUMN LAYOUT PLAN
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-VI	

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E-mail: info@youngassociates.com.pk

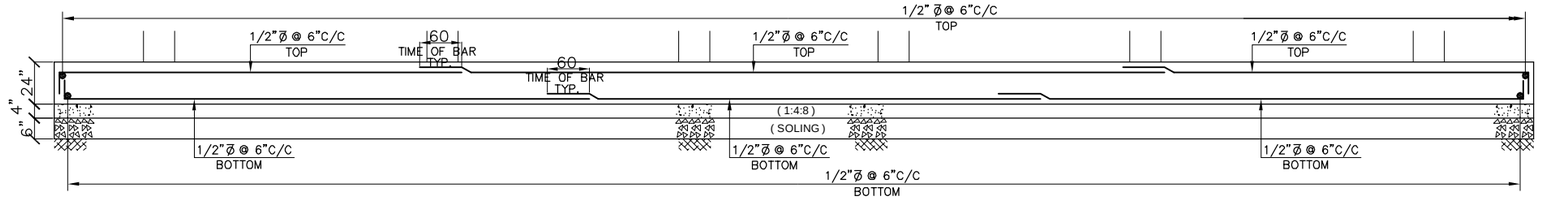
JOB NO : 303/13	
DRG. NO. : 303/13 ST-01	
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1”=8’-0”	DATE : 09-12-202



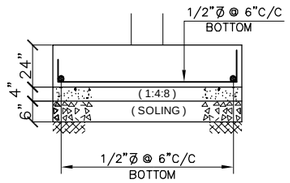
SECTION 1-1
(RAFT-1)



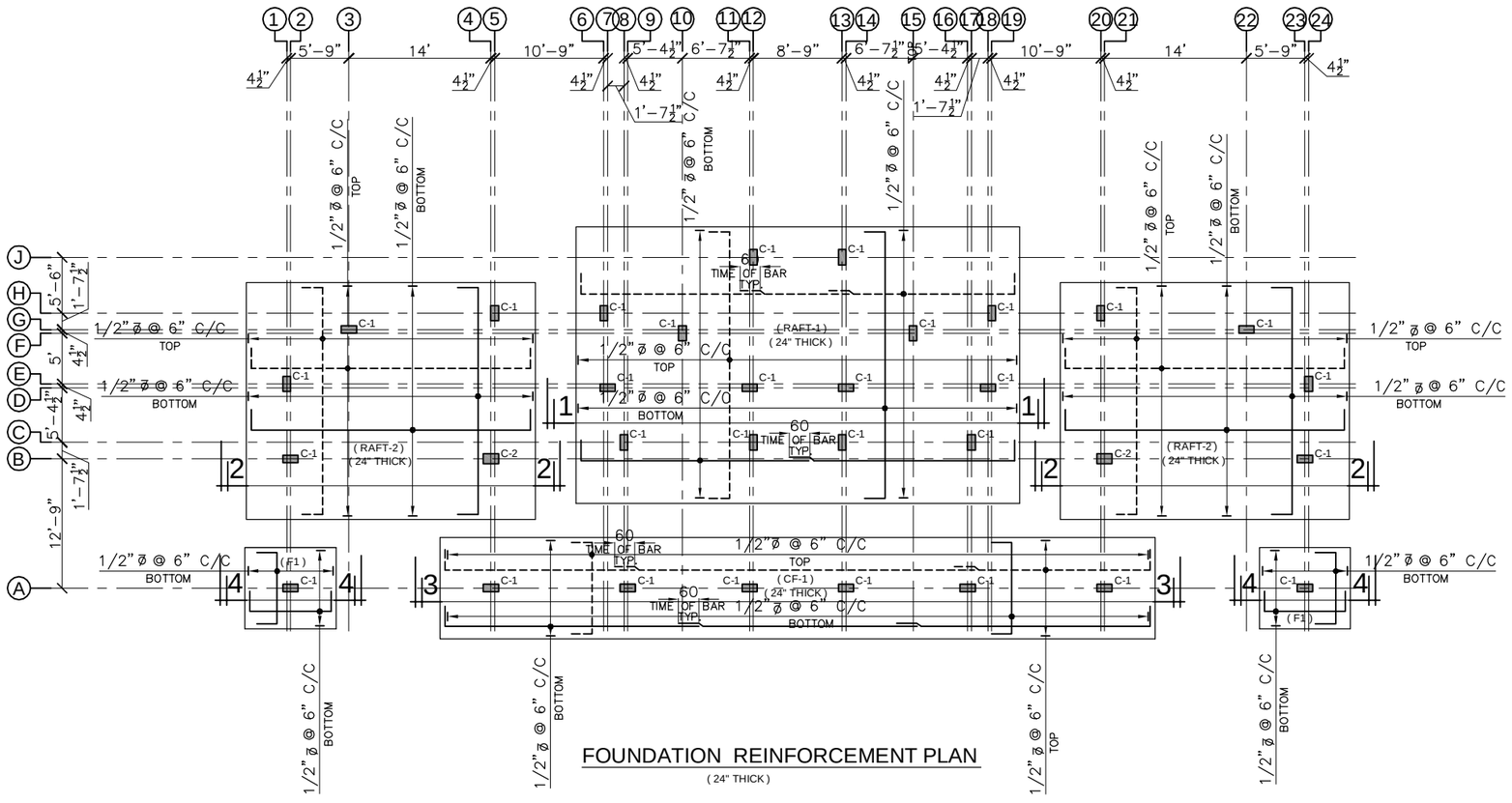
SECTION 2-2
(RAFT-2)



SECTION 3-3
(CF-1)



SECTION 4-4
(F1)



FOUNDATION REINFORCEMENT PLAN
(24" THICK)

NOTE :

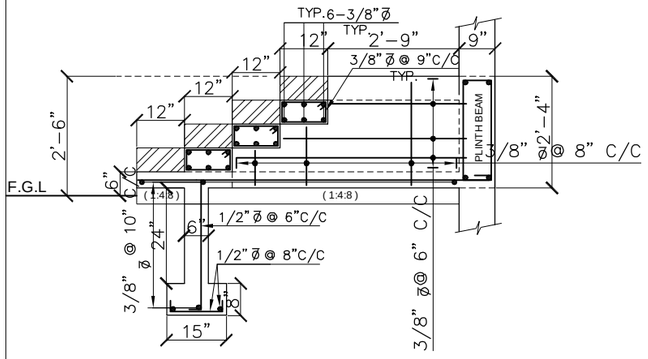
1- FOR GENERAL NOTES REFER DWG. NO. 303/13 GN.01

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

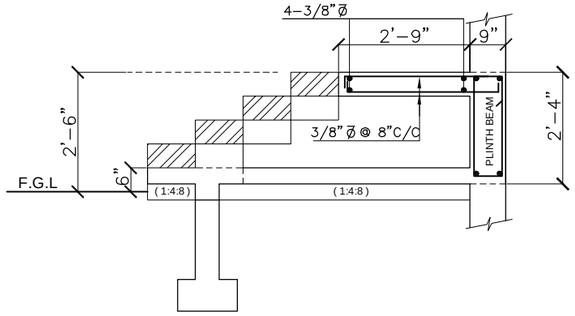
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FOUNDATION REINFORCEMENT DEATILS
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-VI	

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JOB NO :	303/13
DRG. NO. :	303/13 ST-02
DRAWN BY : AAMIR	CHECKED BY : MUNEEI
SCALE : 1"=8'-0"	DATE : 09-12-202



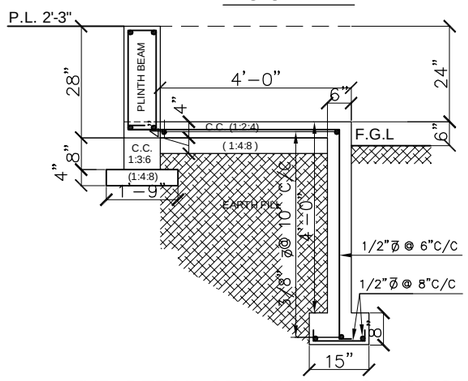
SECTION OF MAIN ENTRANCE STEPS AND R.C.C. WALL



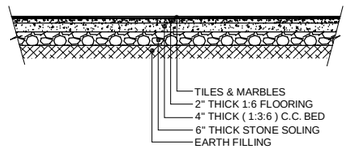
SECTION OF MAIN ENTRANCE R.C.C. SLAB

SCHEDULE OF PLINTH BEAMS AT LEV. +2'-3"

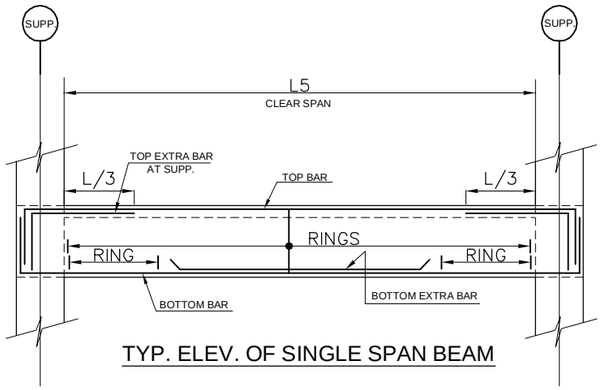
BEAMS NO.S	BEAMS SIZE B X H	TOP STEEL CONT.	MIDDLE BARS	BOTT. STEEL CONT.	EXTRA ON CONT. SUPPORT		EXTRA BOTTOM	RINGS
					L-SUPP.	R-SUPP.		
PB-1	9" X 28"	4-1/2"ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-2	9" X 28"	4-1/2" ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-3	9" X 28"	4-3/8"ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-4a	9" X 28"	4-3/8"ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-4b	9" X 28"	4-1/2" ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-5a	9" X 28"	4-1/2" ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-5b	9" X 28"	4-3/8"ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-6	9" X 28"	4-3/8"ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-7	9" X 28"	4-1/2" ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-8	9" X 28"	4-1/2" ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-9	9" X 28"	4-1/2" ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-10	9" X 28"	4-1/2" ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-11	9" X 28"	4-3/8"ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-12	9" X 28"	4-1/2" ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-13	9" X 28"	4-3/8"ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C
PB-14	9" X 28"	4-1/2" ø	———	4-1/2" ø	———	———	———	3/8"ø @ 8"C/C



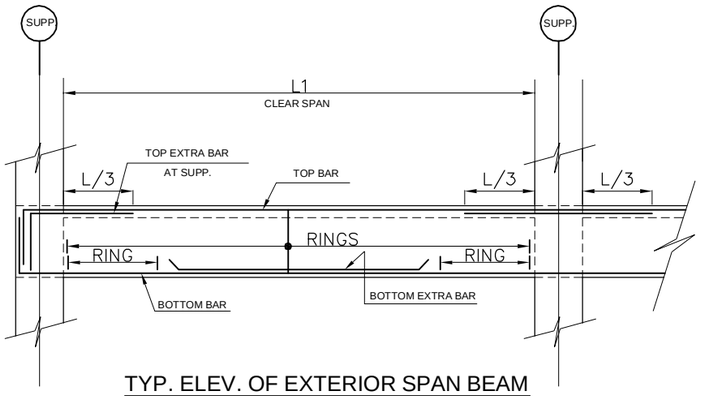
TYP. DETAIL OF PLINTH PROTECTION



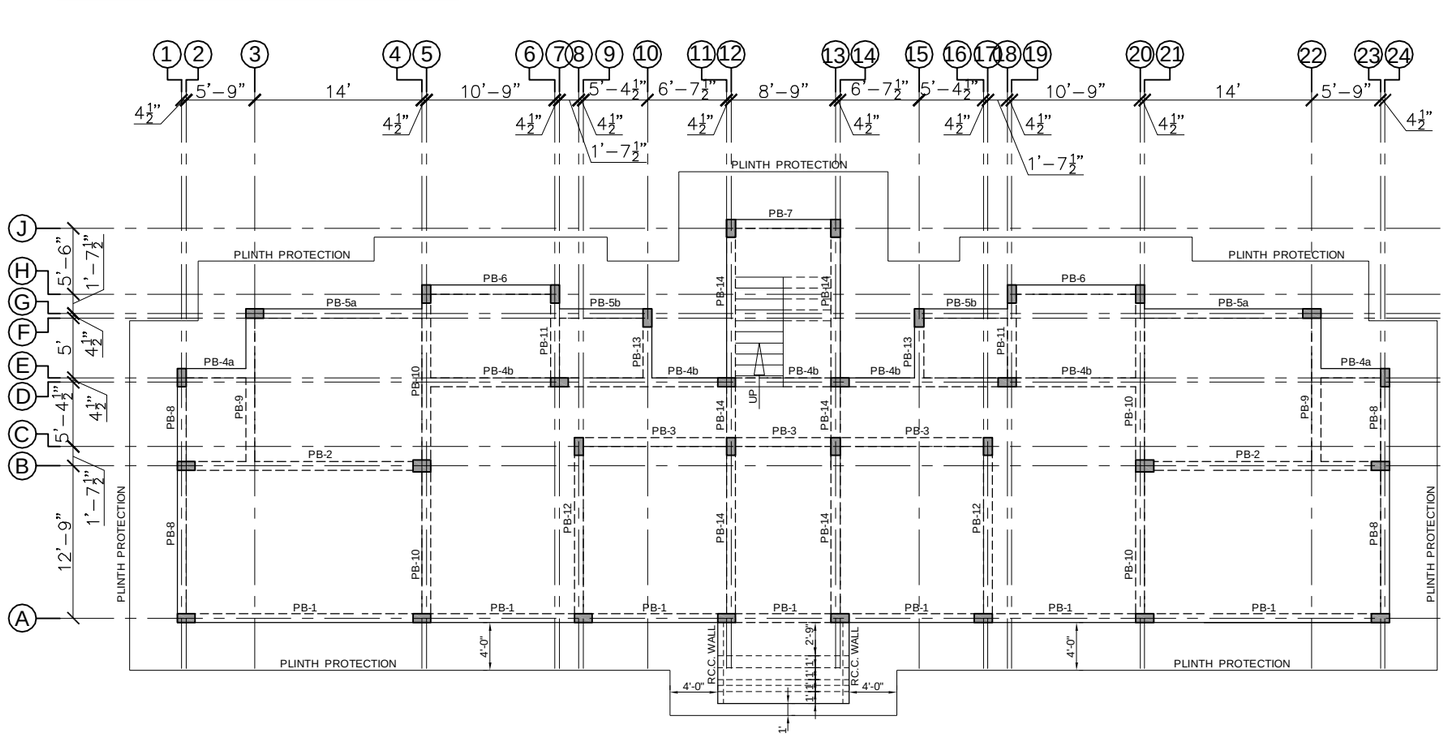
TYP. DETAIL OF FLOORING



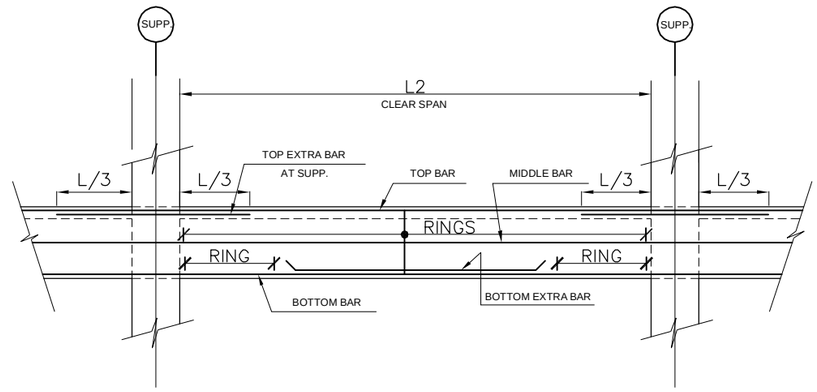
TYP. ELEV. OF SINGLE SPAN BEAM



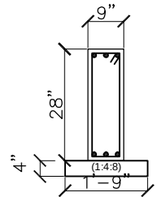
TYP. ELEV. OF EXTERIOR SPAN BEAM



PLINTH BEAM LAYOUT PLAN AT +2'-3"



TYP. ELEV. OF INTERIOR SPAN BEAM



TYP. SEC. OF INTERNAL PLINTH BEAM
(9" X 28")

NOTE :

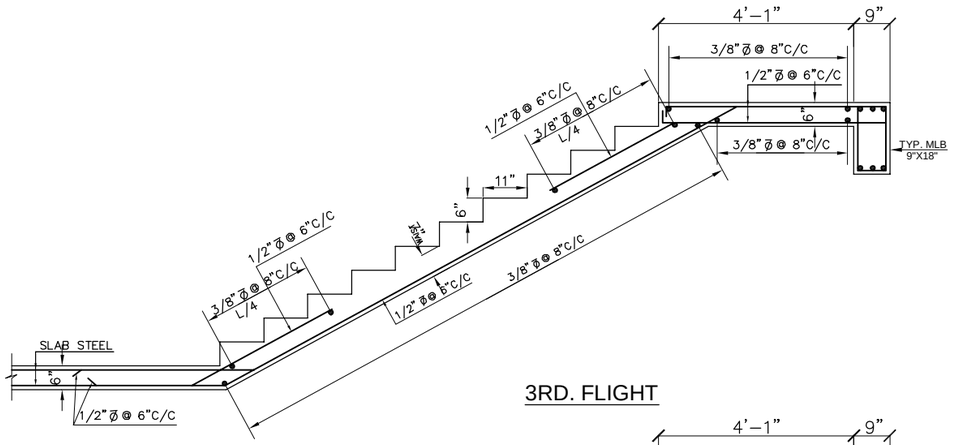
1- FOR GENERAL NOTES REFER DWG. NO. 303/12 GN.01

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

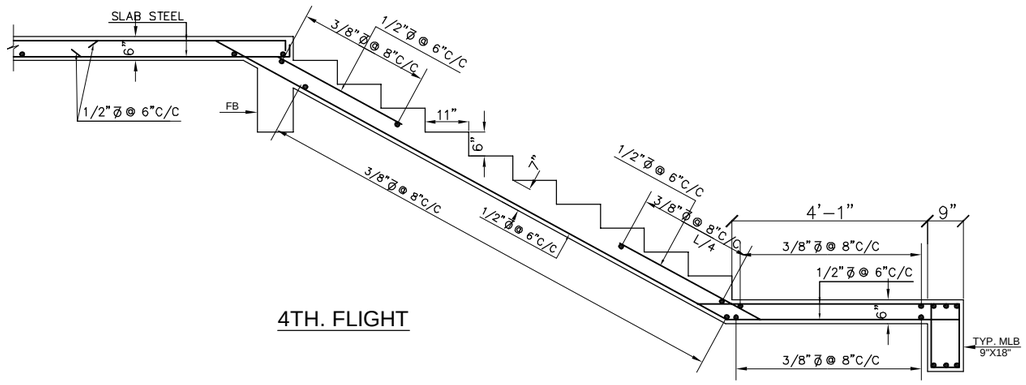
CLIENT:	CADET COLLEGE SANGAR	DESCRIPTION :	PLINTH BEAM LAYOUT PLAN & REINFORCEMENT DEATILS
JOB TITLE :	LOWER STAFF FAMILY QUARTERS FLATS CAT-VI		

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E-mail: info@youngassociates.com.pk

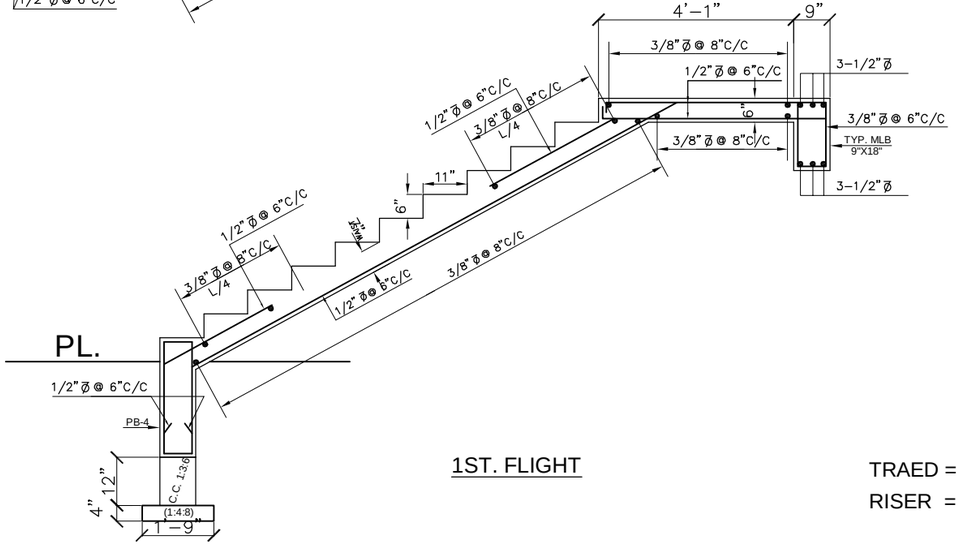
JOB NO :	303/13		
DRG. NO. :	303/13 ST-03		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1"=8'-0"	DATE :	09-12-202



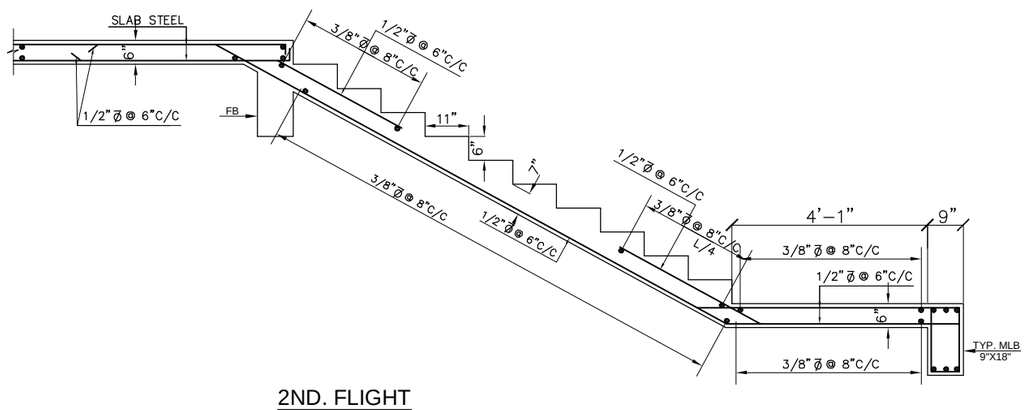
3RD. FLIGHT



4TH. FLIGHT



1ST. FLIGHT



2ND. FLIGHT

TRAED = 11"
RISER = 6"

NOTE :

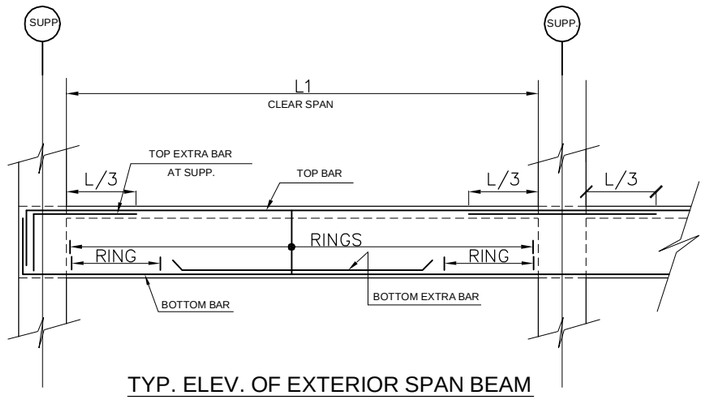
1- FOR GENERAL NOTES REFER DWG. NO. 303/13 GN.01

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	STAIR CASE SECTION & REINFORCEMENT DEATILS
JOB TITLE :	LOWER STAFF FAMILY QUARTERS FLATS CAT-VI		

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JOB NO :	303/13		
DRG. NO. :	303/13 ST-04		
DRAWN BY :	AAMIR	CHECKED BY :	MUNEER
SCALE :	1"=8'-0"	DATE :	09-12-202



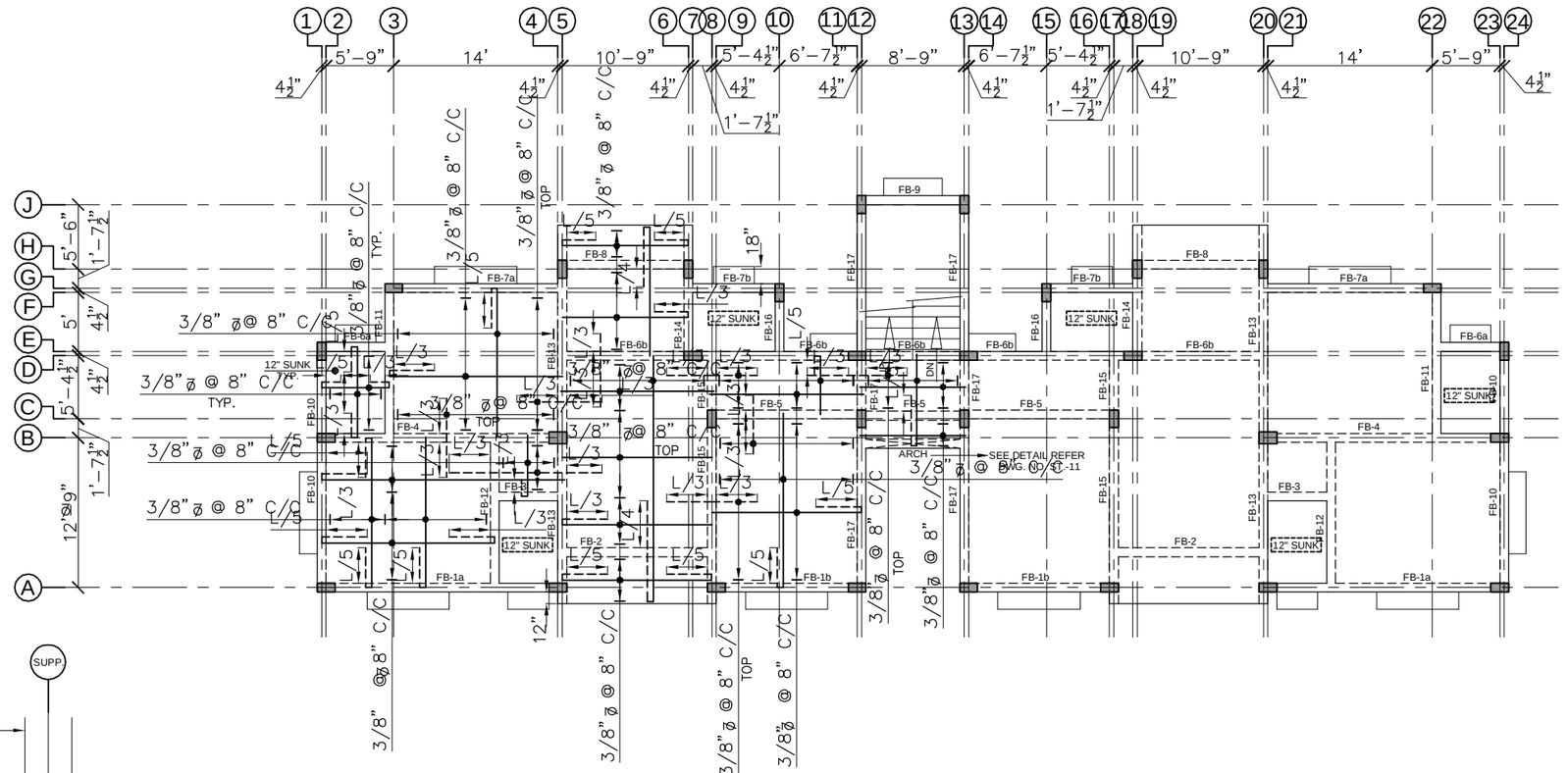
TYP. ELEV. OF EXTERIOR SPAN BEAM

TYP. ELEV. OF SINGLE SPAN BEAM

TYP. ELEV. OF INTERIOR SPAN BEAM

SCHEDULE OF 1st. SLAB'S BEAMS AT LEV.+13'-3"

BEAMS NO.S	BEAMS SIZE B X H	TOP STEEL CONT.	MIDDLE BARS	BOTT. STEEL CONT.	EXTRA ON CONT. SUPPORT		EXTRA BOTTOM	RINGS
					L-SUPP.	R-SUPP.		
FB-1a	9" X 18"	4–5/8"ø	2–1/2" ø	2–5/8"ø+2–1/2"ø	———	———	———	3/8"ø @ 8"C/C
FB-1b	9" X 18"	2–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-2	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-3	9" X 18"	4–1/2" ø	———	4–1/2" ø	2–5/8"ø	2–5/8"ø	———	3/8"ø @ 8"C/C
FB-4	9" X 18"	4–5/8"ø	2–1/2" ø	4–5/8"ø	———	———	———	3/8"ø @5"TO 8"C/C
FB-5	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-6a	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-6b	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-7a	9" X 18"	4–1/2" ø	2–1/2" ø	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-7b	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-8	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-9	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-10	9" X 18"	4–1/2" ø	2–1/2" ø	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-11	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-12	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-13	9" X 18"	4–5/8"ø	2–1/2" ø	2–5/8"ø+2–1/2"ø	———	———	———	3/8"ø @5"TO 8"C/C
FB-14	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-15	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-16	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
FB-17	9" X 18"	4–1/2" ø	2–1/2" ø	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C



1ST. SLAB'S FRAMING PLAN AT LEV. +13'-3"

(ALL SLAB'S 6" THICK)

NOTE :

1- FOR GENERAL NOTES REFER DWG. NO. 303/13 GN.01

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

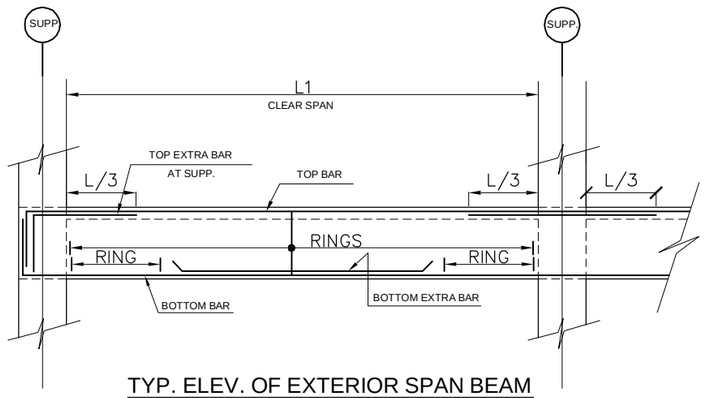
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : 1ST. SLAB BEAMS REINFORCEMENT DEATILS
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-VI	

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FAX: 021-35883106
E-mail: info@youngassociates.com.pk

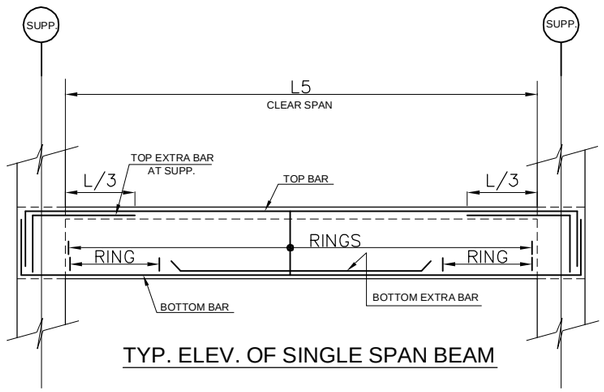
JOB NO : 303/13	
DRG. NO. : 303/13 ST-05	
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=8'-0"	DATE : 09-12-202

SCHEDULE OF ROOF SLAB'S BEAMS AT LEV.+24'-3"

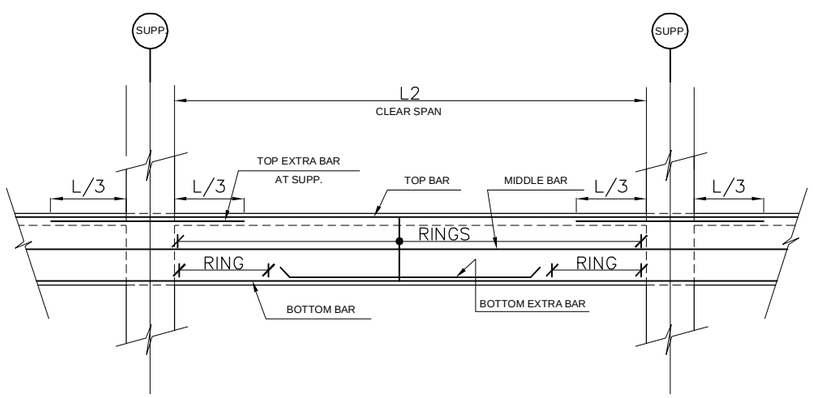
BEAMS NO.S	BEAMS SIZE B X H	TOP STEEL CONT.	MIDDLE BARS	BOTT. STEEL CONT.	EXTRA ON CONT. SUPPORT		EXTRA BOTTOM	RINGS
					L-SUPP.	R-SUPP.		
RB-1a	9" X 18"	4–5/8"ø	2–1/2" ø	2–5/8"ø+2–1/2"ø	———	———	———	3/8"ø @ 8"C/C
RB-1b	9" X 18"	2–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-2	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-3	9" X 18"	4–3/8"ø	———	4–1/2" ø	2–5/8"ø	2–5/8"ø	———	3/8"ø @ 8"C/C
RB-4	9" X 18"	4–5/8"ø	2–1/2" ø	4–5/8"ø	———	———	———	3/8"ø @5"TO 8"C/C
RB-5	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-6a	9" X 18"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-6b	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-7a	9" X 18"	4–1/2" ø	2–1/2" ø	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-7b	9" X 18"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-8	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-9	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-10	9" X 18"	4–1/2" ø	2–1/2" ø	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-11	9" X 18"	4–1/2" ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-12	9" X 18"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-13	9" X 18"	4–5/8"ø	2–1/2" ø	2–5/8"ø+2–1/2"ø	———	———	———	3/8"ø @5"TO 8"C/C
RB-14	9" X 18"	4–1/2" ø	———	4–1/2" ø	RB-17 9" X 18"	4–1/2" ø	———	3/8"ø @ 8"C/C
RB-15	9" X 18"	2–5/8"ø+4–1/2"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-16	9" X 18"	4–3/8"ø	———	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C
RB-17	9" X 18"	4–1/2" ø	2–1/2" ø	4–1/2" ø	———	———	———	3/8"ø @ 8"C/C



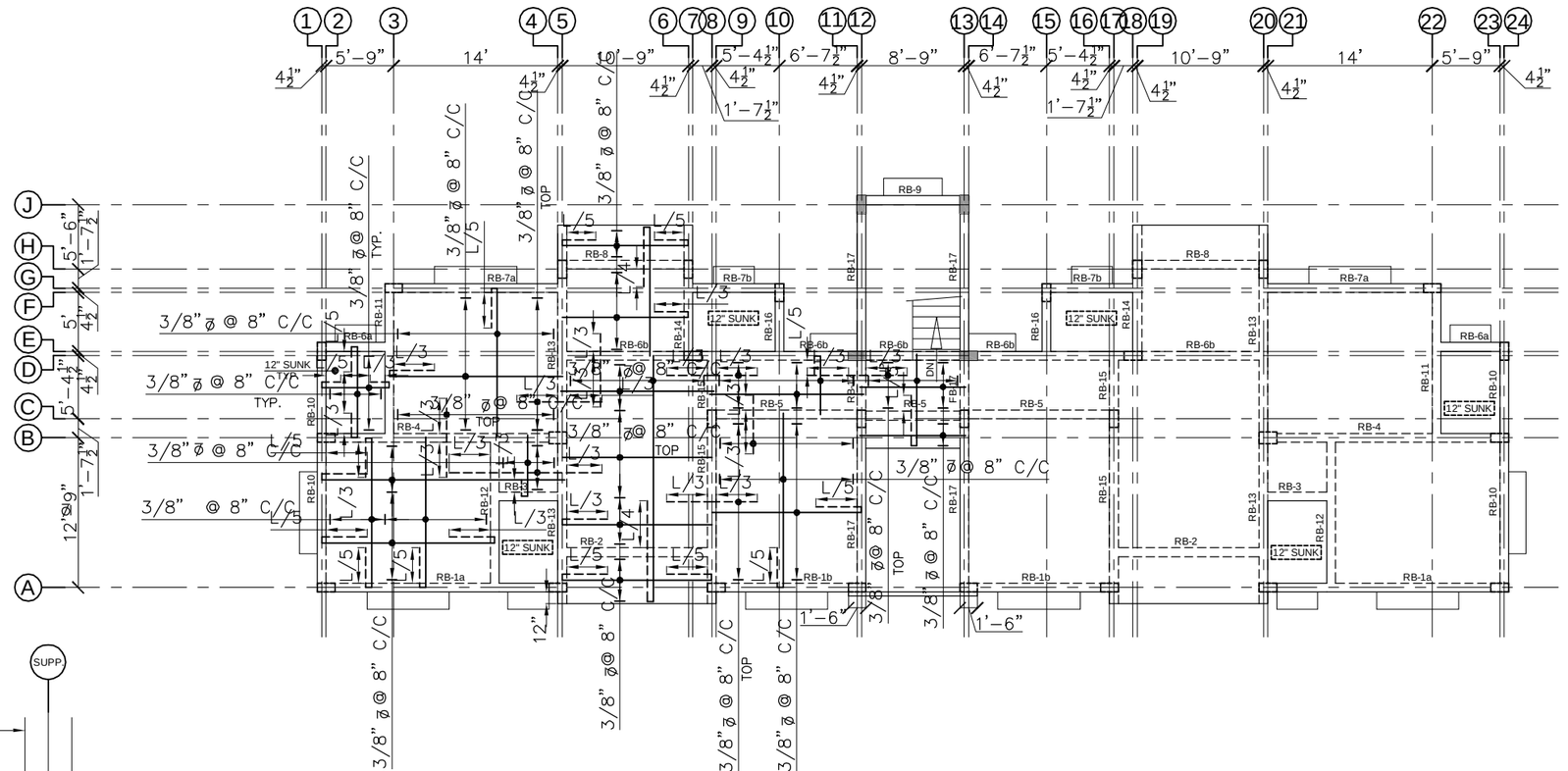
TYP. ELEV. OF EXTERIOR SPAN BEAM



TYP. ELEV. OF SINGLE SPAN BEAM



TYP. ELEV. OF INTERIOR SPAN BEAM



ROOF SLAB'S FRAMING PLAN AT LEV. +24'-3"

(ALL SLAB'S 6" THICK)

NOTE :

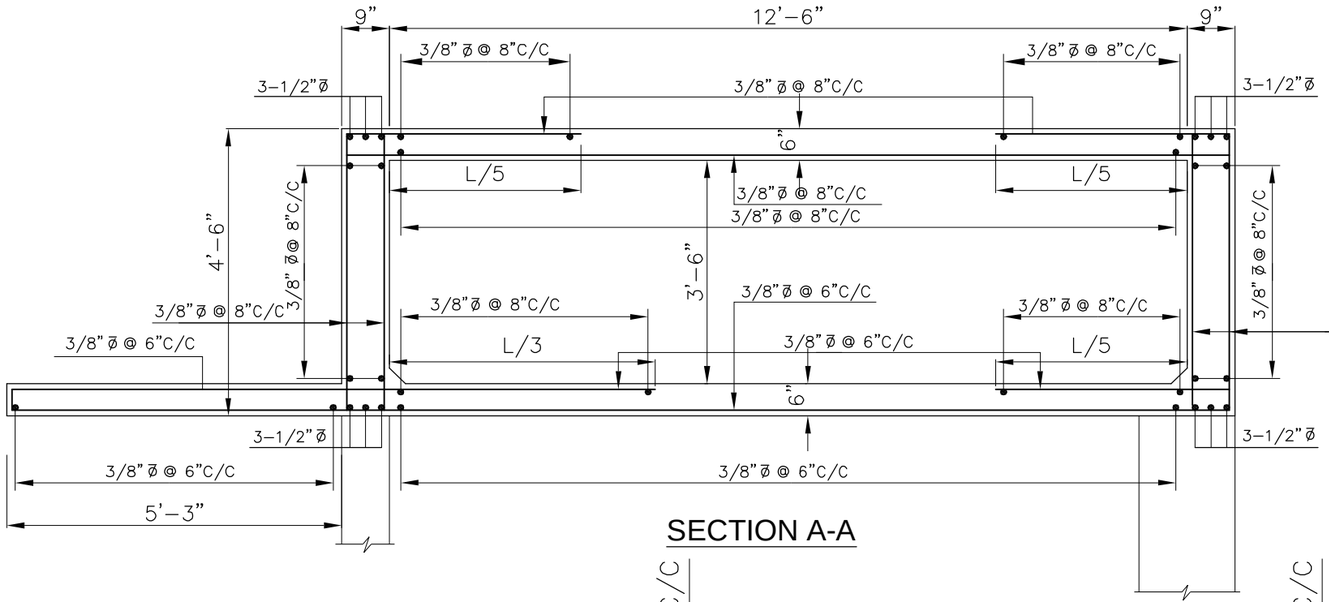
1- FOR GENERAL NOTES REFER DWG. NO. 303/13 GN.01

3rd Revision :	----------	Date :	---------
2nd Revision :	----------	Date :	---------
1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

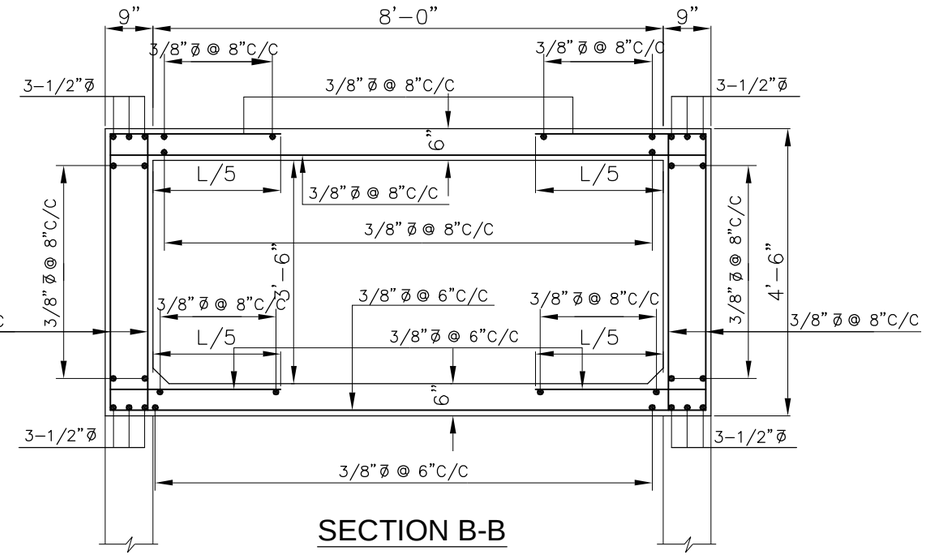
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : ROOF SLAB BEAMS REINFORCEMENT DEATILS
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-VI	

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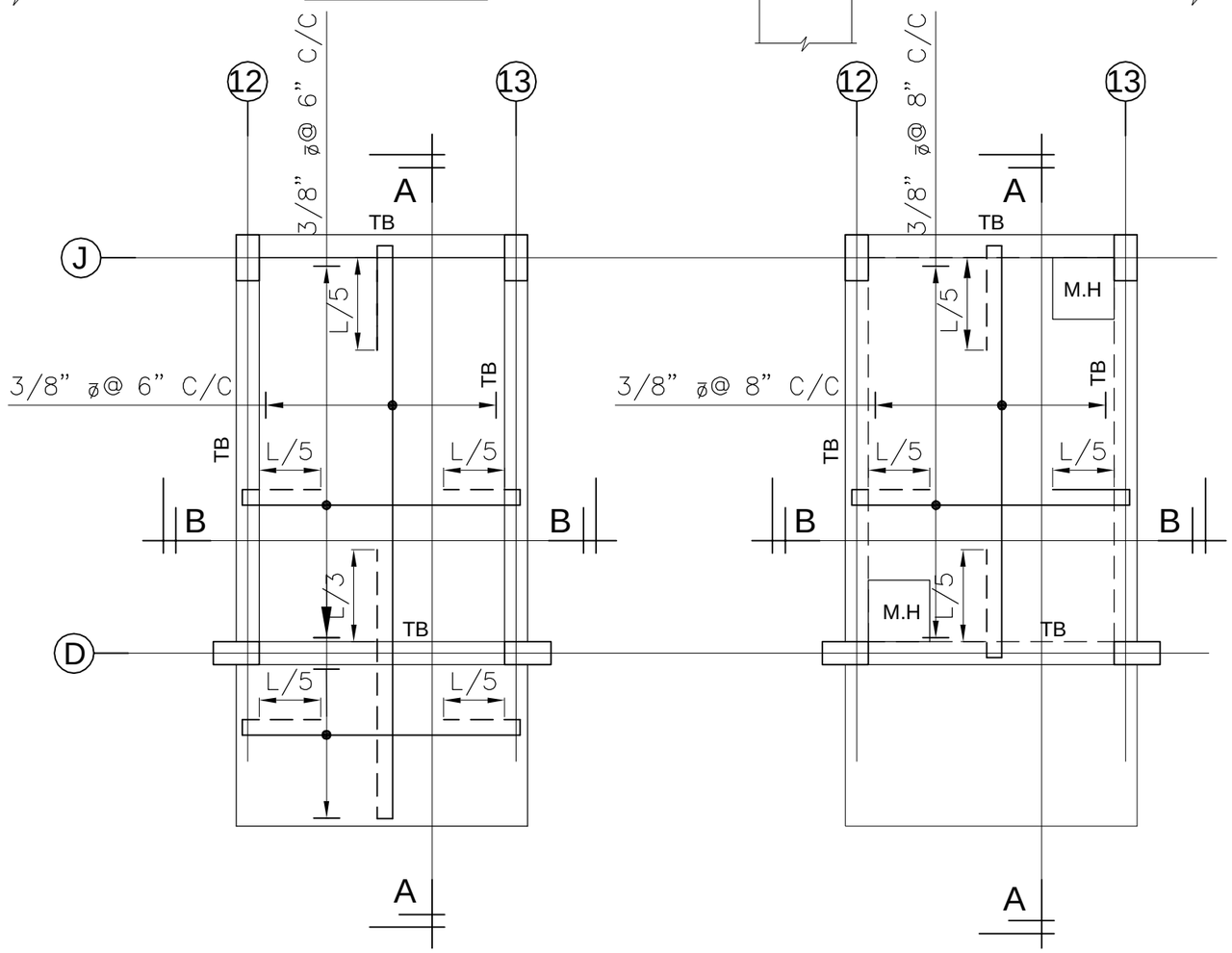
JOB NO : 303/13	
DRG. NO. : 303/13 ST-06	
DRAWN BY : AAMIR	CHECKED BY : MUNEER
SCALE : 1"=8'-0"	DATE : 09-12-202



SECTION A-A



SECTION B-B



BOTTOM SLAB PLAN

SLAB 6" THICK

TOP SLAB PLAN

SLAB 6" THICK

NOTE :

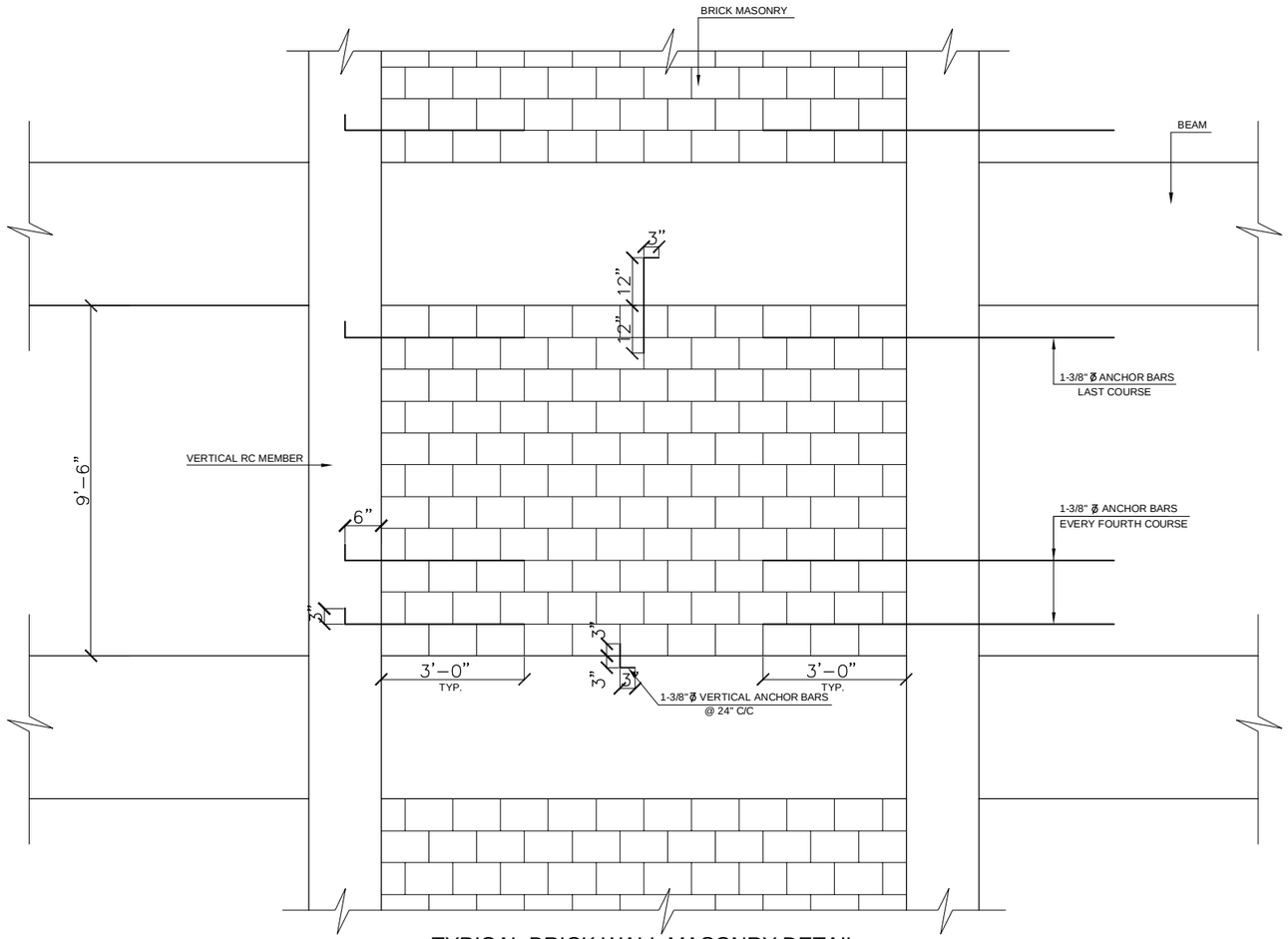
1- FOR GENERAL NOTES REFER DWG. NO. 303/13 GN.01

3rd Revision :	----------	Date :	--------
2nd Revision :	----------	Date :	--------
1st Revision :	----------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

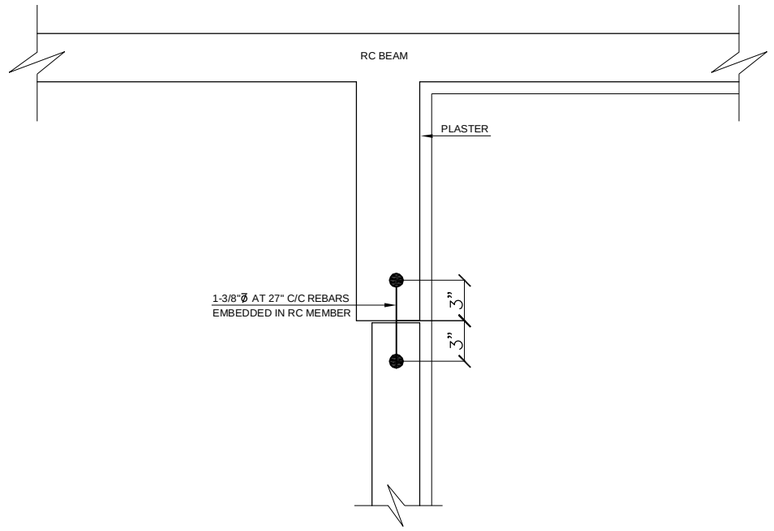
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : TOWER & O.H. TANK REINFORCEMENT DEATILS
JOB TITLE : LOWER STAFF FAMILY QUARTERS FLATS CAT-VI	

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E-mail: info@youngassociates.com.pk

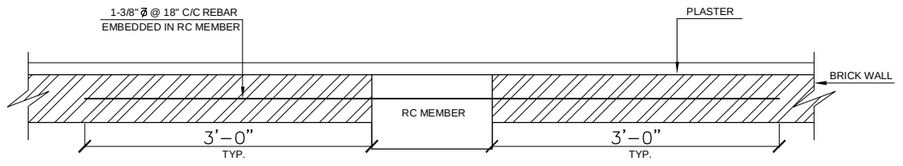
JOB NO : 303/13		
DRG. NO. : 303/13 ST-07		
DRAWN BY : AAMIR	CHECKED BY : MUNEER	
SCALE : 1"=8'-0"	DATE : 09-12-202	



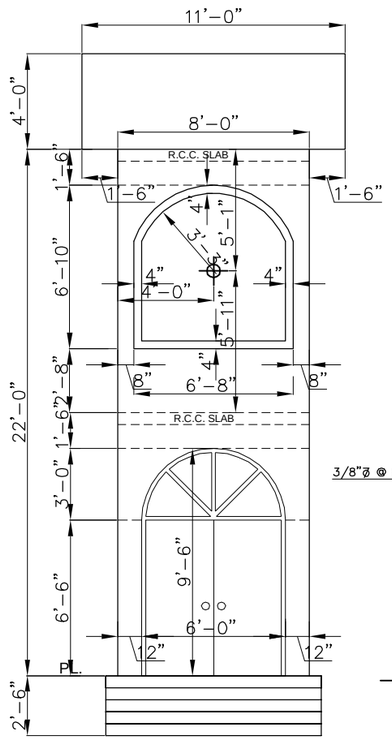
TYPICAL BRICK WALL MASONRY DETAIL



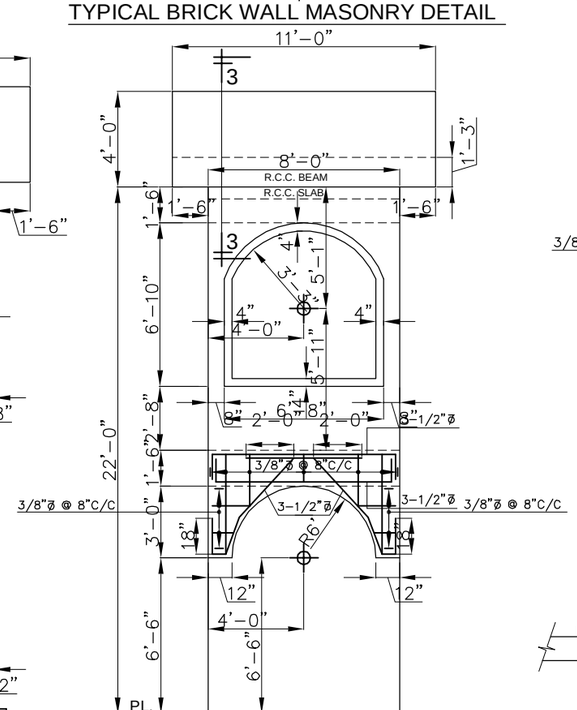
TYPICAL BRICK WALL AND RC BEAM
INTERFACE PLAN



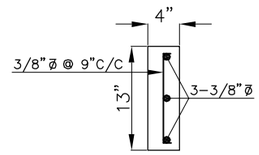
TYPICAL BRICK WALL AND RC MEMBER
INTERFACE PLAN



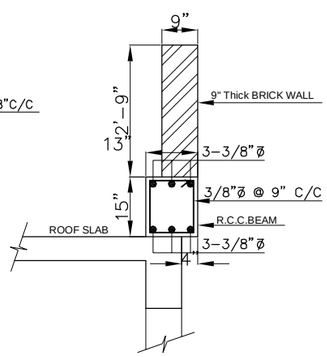
ENTRANCE DETAIL ELEVATION



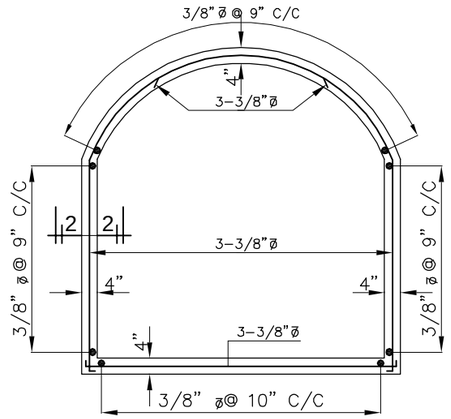
ARCH REINFORCEMENT ELEVATION



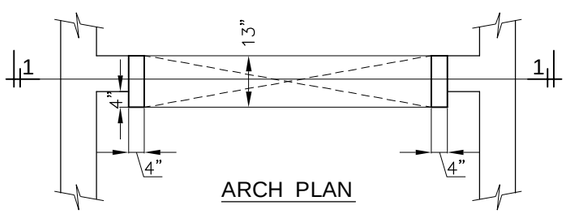
SECTION 2-2



SECTION 3-3



SECTION 1-1



ARCH PLAN

NOTE :

1- FOR GENERAL NOTES REFER DWG. NO. 303/13 GN.01

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1st Revision :	----------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT:	CADET COLLEGE SANGHAR	DESCRIPTION :	TYP. DETAILS OF BRICK WALL
JOB TITLE :	LOWER STAFF FAMILY QUARTERS FLATS CAT-VI		

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FAX: 021-35883106
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JOB NO :	303/13	
DRG. NO. :	303/13 ST-08	
DRAWN BY : AAMIR	CHECKED BY : MUNEER	
SCALE : 1"=8'-0"	DATE : 09-12-202	

PLUMBING DRAWINGS

PREPARED BY:

YOUNG ASSOCIATES
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LIST OF PLUMMBING DRAWINGS

S.NO.	DWG. NO.	DESCRIPTION
1	P-00	LIST OF DRAWINGS
2	WS-01	GROUND FLOOR PLAN WATER SUPPLY SYSTEM
3	WS-02	FIRST FLOOR PLAN WATER SUPPLY SYSTEM
4	WS-03	ROOF WATER SUPPLY SYSTEM
5	DS-04	GROUND FLOOR PLAN DRAIN SYSTEM
6	DS-05	FIRST FLOOR PLAN DRAIN SYSTEM

3rd Revision : -------- Date : --------

2nd Revision : -------- Date : --------

1st Revision : -------- Date : --------

ISSUED FOR TENDER DRAWING Date : 09-12-2025

CLIENT: CADET COLLEGE SANGHAR

JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLTAS CAT-VI

DESCRIPTION : LIST OF DRAWINGS

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JOB NO : 303/13

DRG. NO. : 303/13 P-00

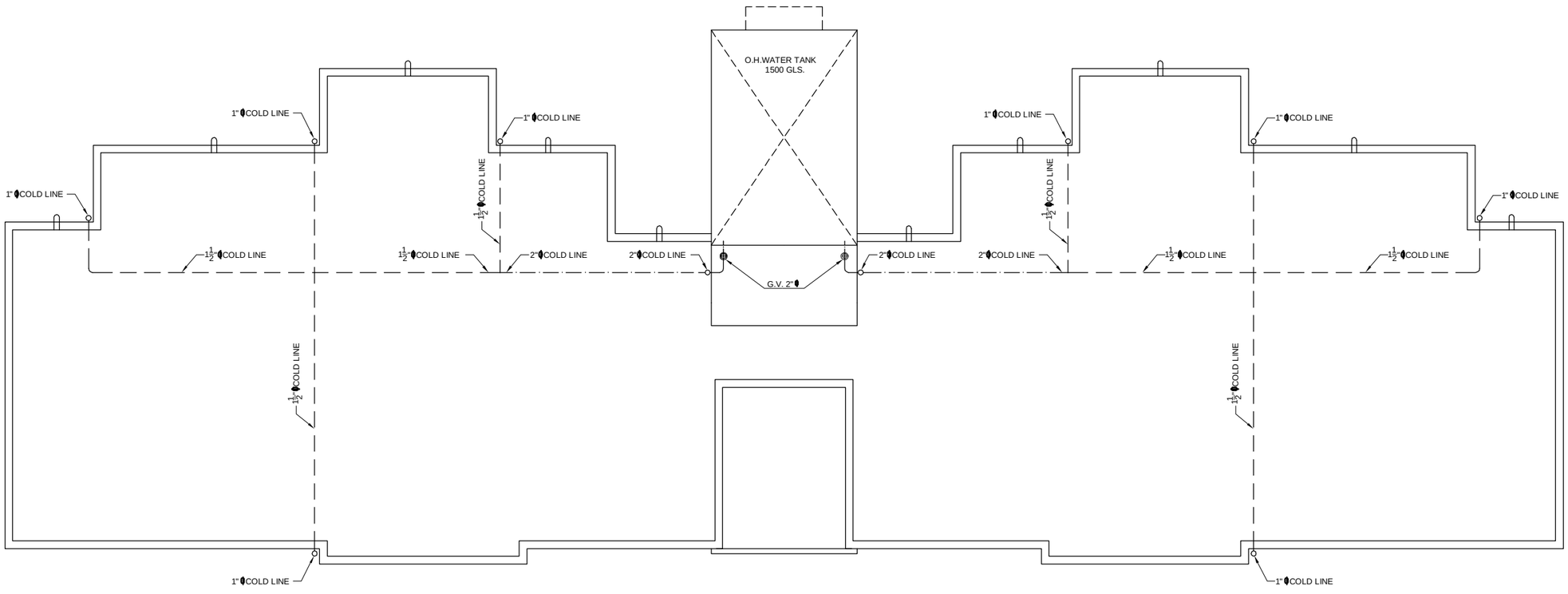
DRAWN BY : M.K ABBASI

CHECKED BY : MUNEER

SCALE : N.T.S

DATE : 09-12-202

	LEGEND	SYMBOLE
1	2" ⌀ PIPE (PPR) W / LINE	
2	$1\frac{1}{2}$" ⌀ PIPE (PPR) W / LINE	
3	1" ⌀ PIPE (PPR) W / LINE	
4	3/4" ⌀ PIPE (PPR) W / LINE	
5	1/2" ⌀ PIPE (PPR) W / LINE	
7	WASH BASIN	W.B
8	SHOWER	SH.
9	WATER CLOSET	W.C
10	BIPCOOK	
11	SINK	
12	ELECTRIC GEYSER	



ROOF PLAN

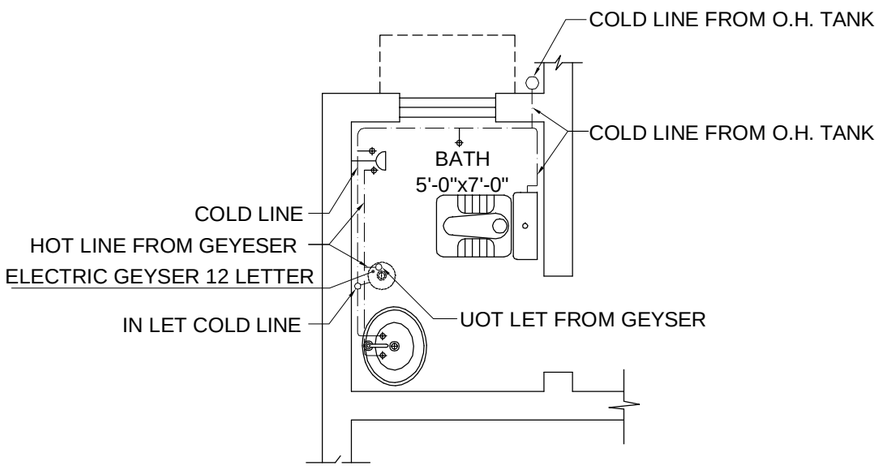
3rd Revision :	---------	Date :	---------
2nd Revision :	---------	Date :	---------
1st Revision :	---------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : ROOF FLOOR PLAN WATER SUPPLY SYSTEM
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLTAS CAT-VI	

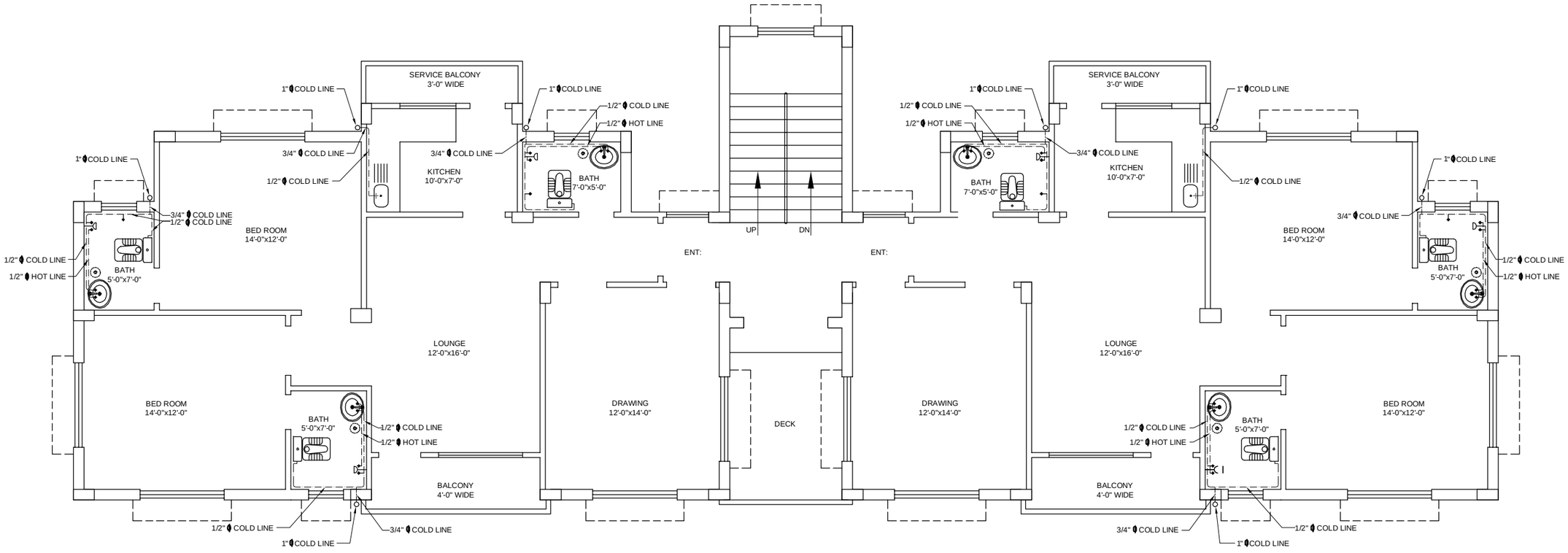
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E-mail: info@youngassociates.com.pk

JOB NO :	303/13
DRG. NO. :	303/13 WS-01
DRAWN BY : M.K ABBASI	CHECKED BY : MUNEER
SCALE : N.T.S	DATE : 09-12-202

	LEGEND	SYMBOLE
1	2" PIPE (PPR) W / LINE	
2	$1\frac{1}{2}$" PIPE (PPR) W / LINE	
3	1" PIPE (PPR) W / LINE	
4	3/4" PIPE (PPR) W / LINE	
5	1/2" PIPE (PPR) W / LINE	
7	WASH BASIN	W.B
8	SHOWER	SH.
9	WATER CLOSET	W.C
10	BIPCOOK	
11	SINK	
12	ELECTRIC GEYSER	



TYP. ENLARGE DETAIL PLAN



FIRST FLOOR PLAN

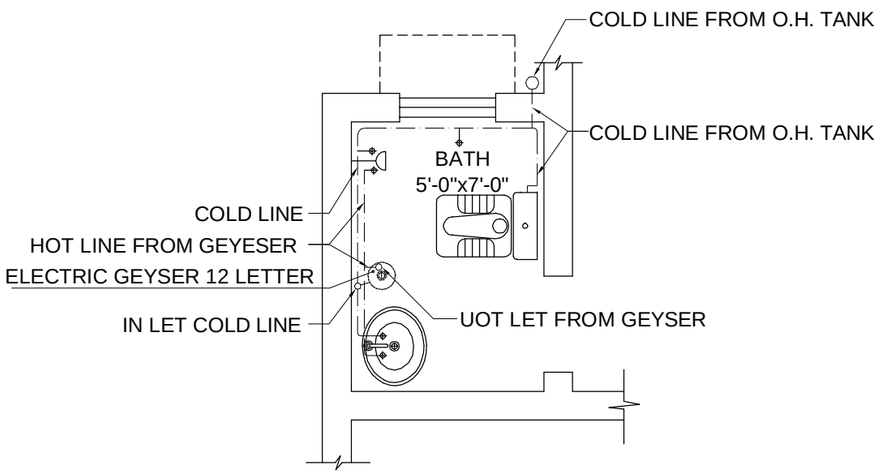
3rd Revision :	---------	Date :	---------
2nd Revision :	---------	Date :	---------
1st Revision :	---------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FIRST FLOOR PLAN WATER SUPPLY SYSTEM
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLTAS CAT-VI	

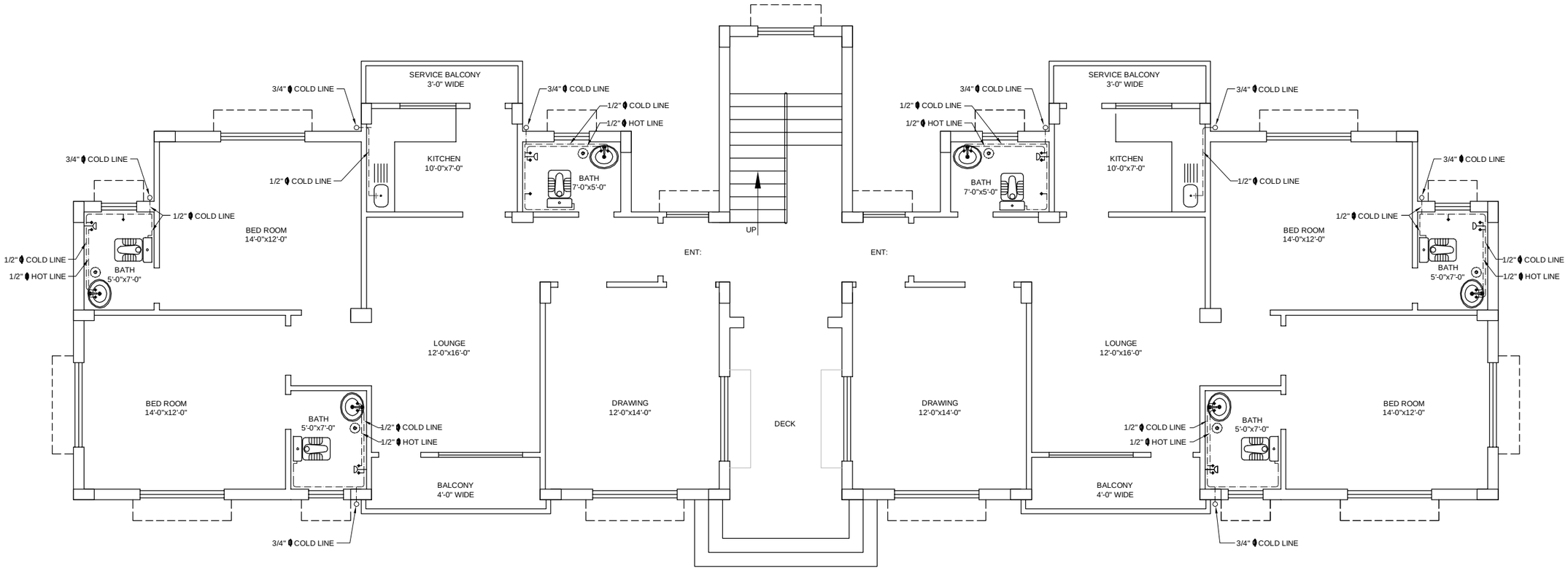
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JOB NO :	303/13
DRG. NO. :	303/13 WS-02
DRAWN BY : M.K ABBASI	CHECKED BY : MUNEER
SCALE : N.T.S	DATE : 09-12-202

	LEGEND	SYMBOLE
1	2" ⌀ PIPE (PPR) W / LINE	
2	1½" ⌀ PIPE (PPR) W / LINE	
3	1" ⌀ PIPE (PPR) W / LINE	
4	3/4" ⌀ PIPE (PPR) W / LINE	
5	1/2" ⌀ PIPE (PPR) W / LINE	
7	WASH BASIN	W.B
8	SHOWER	SH.
9	WATER CLOSET	W.C
10	BIPCOOK	
11	SINK	
12	ELECTRIC GEYSER	



TYP. ENLARGE DETAIL PLAN



GROUND FLOOR PLAN

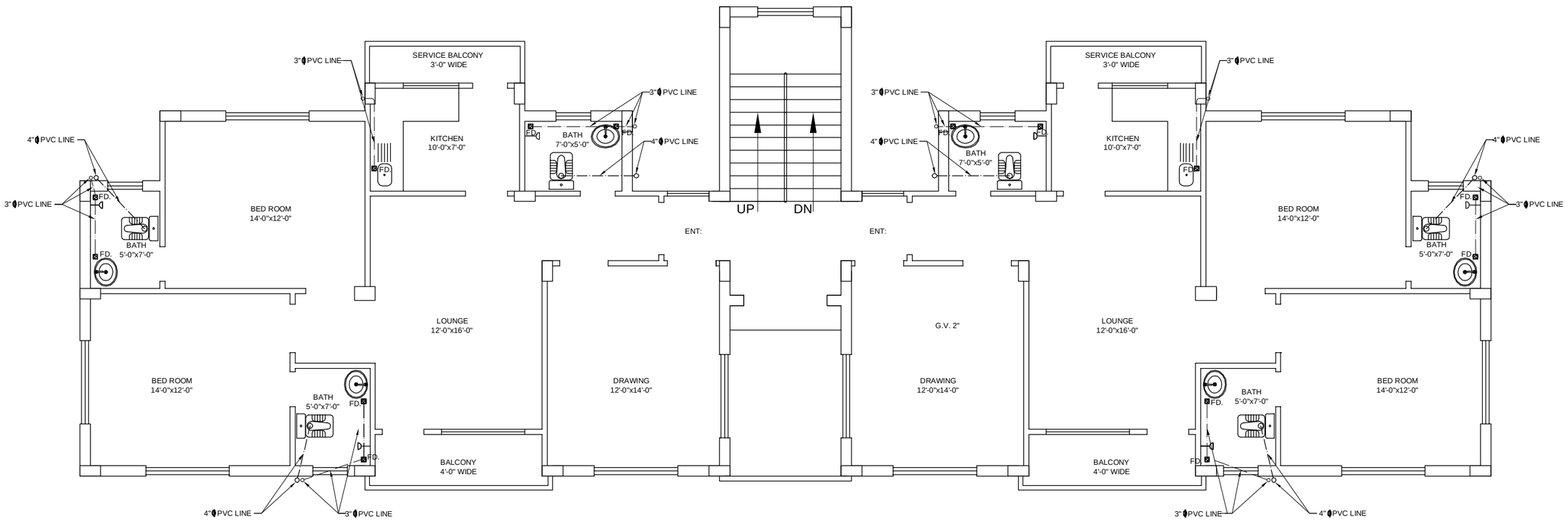
3rd Revision :	---------	**Date :**	---------
2nd Revision :	---------	**Date :**	---------
1st Revision :	---------	**Date :**	---------
ISSUED FOR	TENDER DRAWING	**Date :**	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	**DESCRIPTION :** GROUND FLOOR PLAN WATER SUPPLY SYSTEM
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLTAS CAT-VI	

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JOB NO :	303/13		
DRG. NO. :	303/13 WS-03		
DRAWN BY :	M.K ABBASI	**CHECKED BY :**	MUNEER
SCALE :	N.T.S	**DATE :**	09-12-202

	LEGEND	SYMBOLE
1	8"ϕ PIPE (UP.V.C) SEWER LINE	
2	6"ϕ PIPE (UP.V.C) SEWER LINE	
3	4"ϕ PIPE (UP.V.C) SEWER LINE	
4	3"ϕ PIPE (UP.V.C) SEWER LINE	
5	WASH BASIN	W.B
6	WATER CLOSET	W.C
7	SHOWER	SH.
~~8~~	MAN HOLE	MH.
9	GULLY TRAP	GT.
10	FLOOR DRAIN	FD.



FIRST FLOOR PLAN

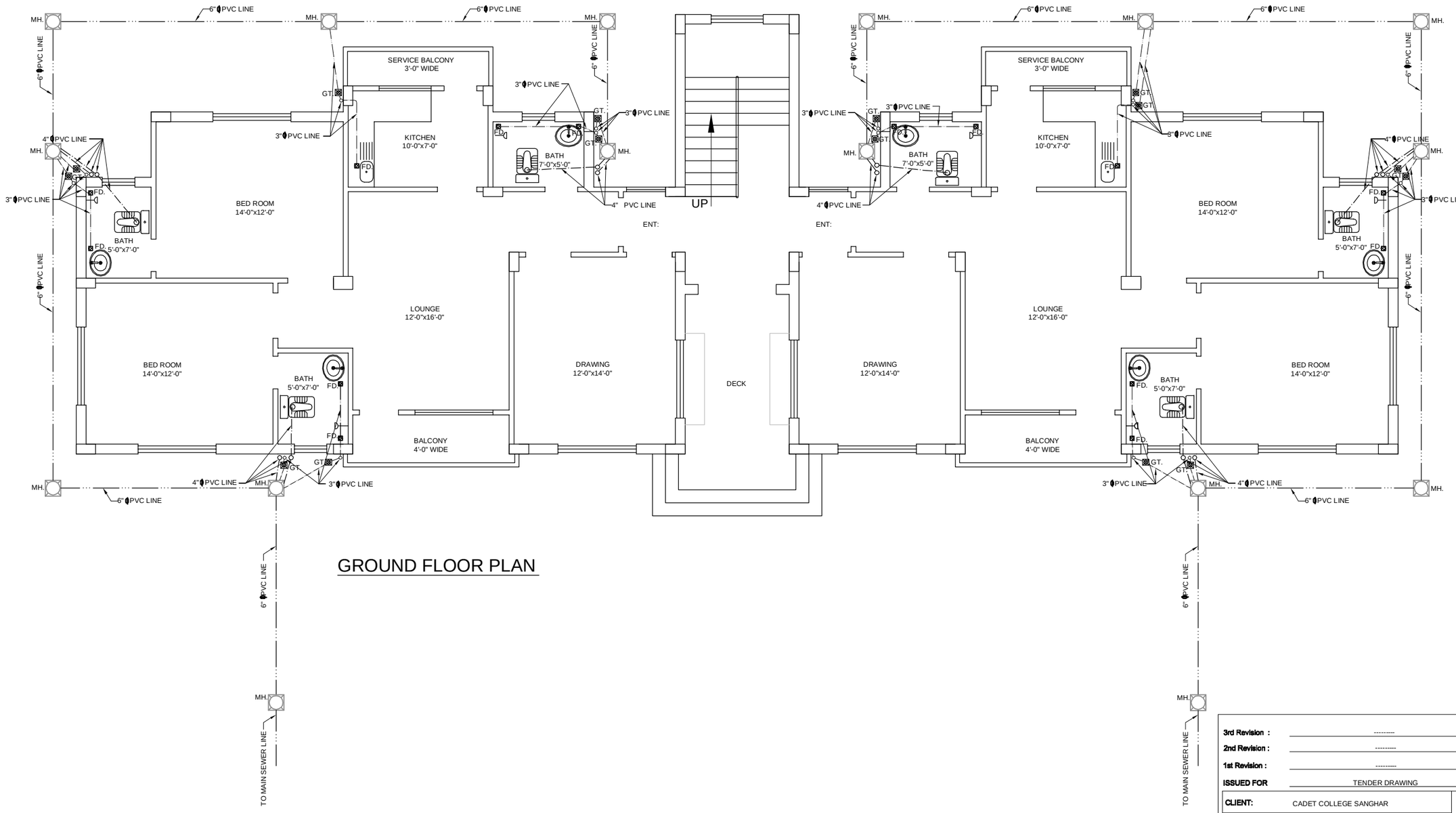
3rd Revision :	--------	**Date :**	--------
2nd Revision :	--------	**Date :**	--------
1st Revision :	--------	**Date :**	--------
ISSUED FOR	TENDER DRAWING	**Date :**	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	**DESCRIPTION :** 1ST. FLOOR PLAN DRAIN SYSTEM
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLTAS CAT-VI	

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E-mail: info@youngassociates.com.pk

JOB NO :	303/13
DRG. NO. :	303/13 DS-01
DRAWN BY : M.K ABBASI	**CHECKED BY :** MUNEER
SCALE : N.T.S	**DATE :** 09-12-202

	LEGEND	SYMBOLS
1	8"ϕ PIPE (UP.V.C) SEWER LINE	
2	6"ϕ PIPE (UP.V.C) SEWER LINE	
3	4"ϕ PIPE (UP.V.C) SEWER LINE	
4	3"ϕ PIPE (UP.V.C) SEWER LINE	
5	WASH BASIN	W.B
6	WATER CLOSET	W.C
7	SHOWER	SH.
8	MAN HOLE	MH.
9	GULLY TRAP	GT.
10	FLOOR DRAIN	FD.



GROUND FLOOR PLAN

3rd Revision :	--------	Date :	--------
2nd Revision :	--------	Date :	--------
1st Revision :	--------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : GROUND FLOOR PLAN DRAIN SYSTEM
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLTAS CAT-VI	

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JOB NO :	303/13
DRG. NO. :	303/13 DS-02
DRAWN BY : M.K ABBASI	CHECKED BY : MUNEER
SCALE : N.T.S	DATE : 09-12-202

ELECTRICAL DRAWINGS

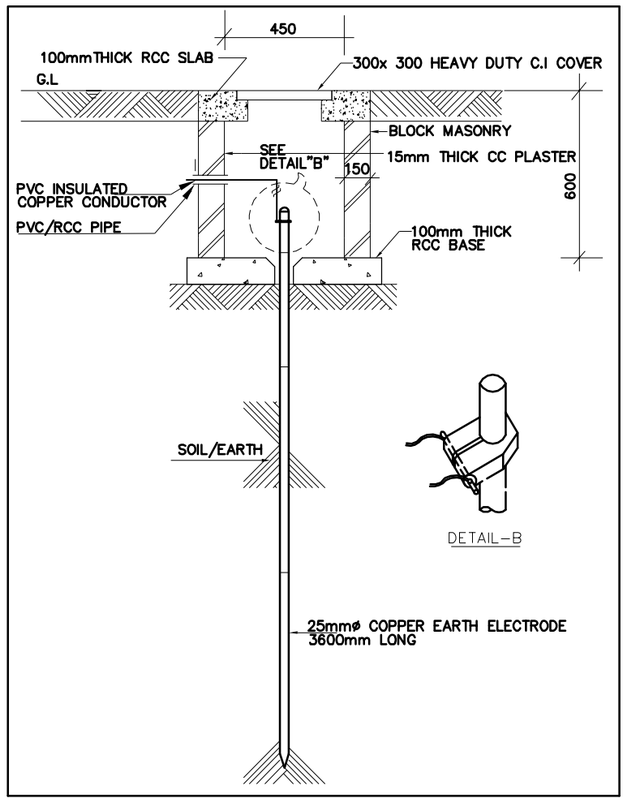
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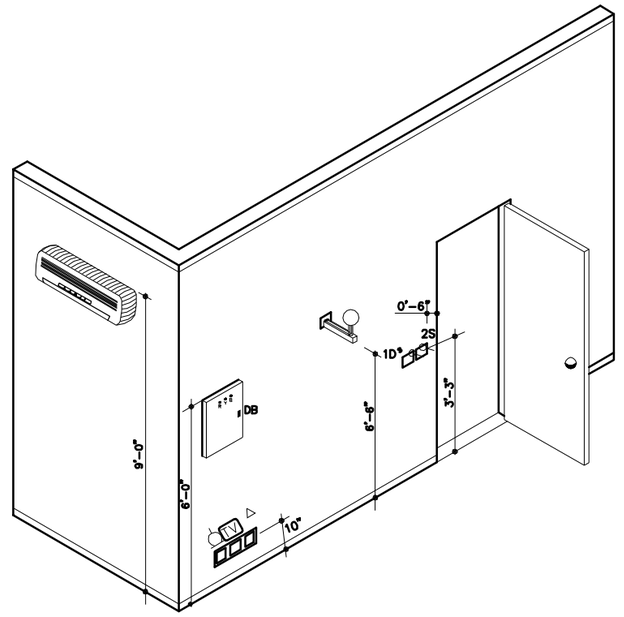
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LEGEND

SYMBOL	DESCRIPTION
	CEILING LIGHT
	WALL BRACKET LIGHT FIXTURE
	EXHAUST FAN
	CEILING FAN
2g / 3g / 4g	10A SWITCH 2, 3 & 4 gang
	FAN SPEED DIMMER
	13 AMP INTERNATIONAL SWITCH SOCKET LOW / ABOVE COUNTER
	15 AMP 3 PIN SWITCH SOCKET LOW / ABOVE COUNTER
	TELEPHONE OUTLET
TV	TV OUTLET
G.I	GATE INTERCOM
DB	DISTRIBUTION BOARD
TJB / TV JB	TELEPHONE & TV JUNCTION BOX
	SPLIT UNIT
MDB	MAIN DISTRIBUTION BOARD
S	SMOKE DETECTOR BATTERY OPERATED
H	HEAT DETECTOR BATTERY OPERATED
	PARAPET WALL LIGHT AT ROOF

EARTHING PIT DETAIL





MOUNTING HEIGHT DETAILS FOR SWITCH SOCKET ETC.

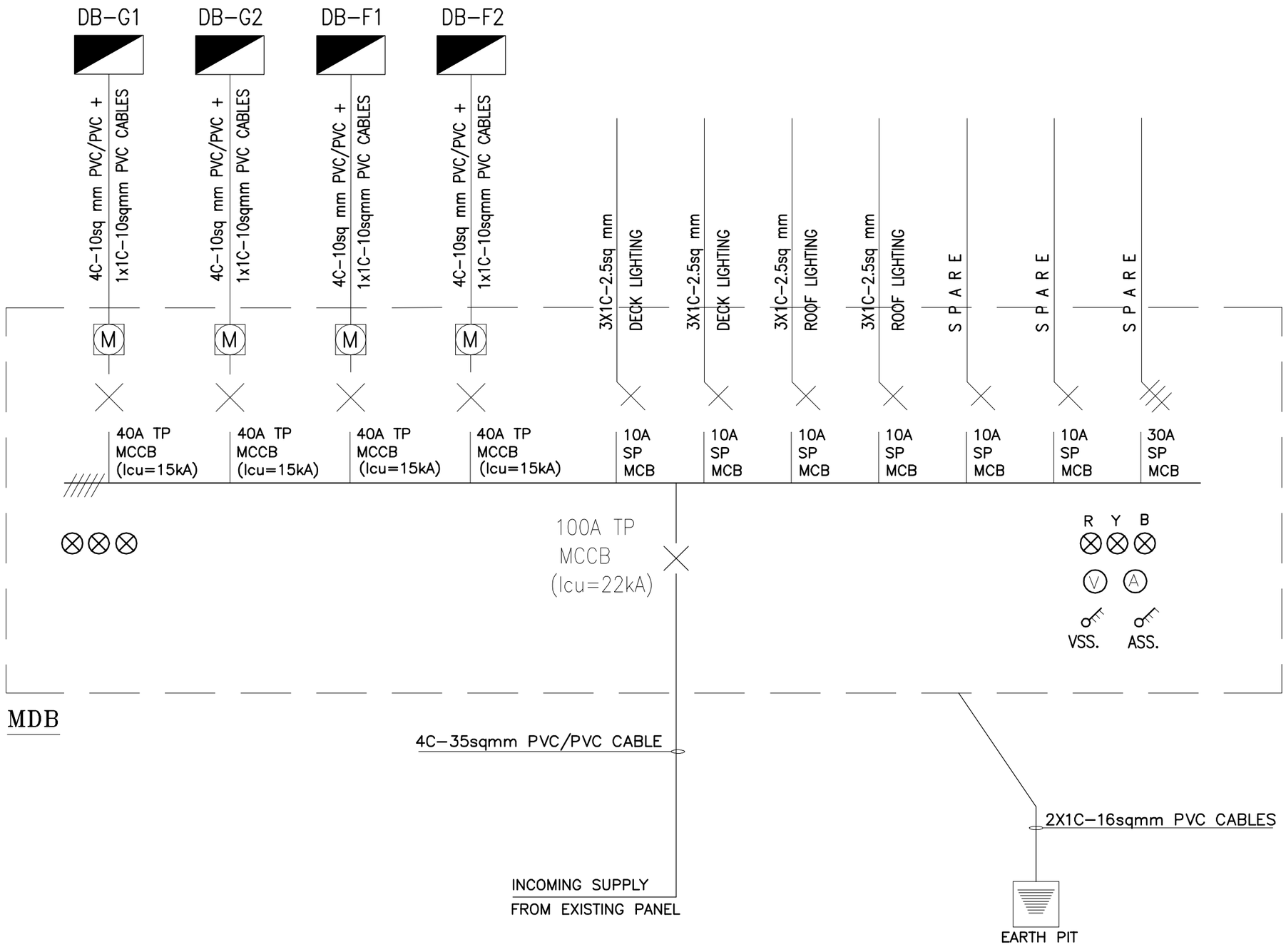
(OR AS DIRECTED BY ARCHITECT)

3rd Revision :	--------	Date :	--------
2nd Revision :	--------	Date :	--------
1st Revision :	--------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : LEGEND & OTHER DETAILS
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-VI	

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JOB NO :	303/13		
DRG. NO. :	E-01		
DRAWN BY :	M.FAISAL	CHECKED BY :	A.H
SCALE :	N.T.S	DATE :	09-12-202

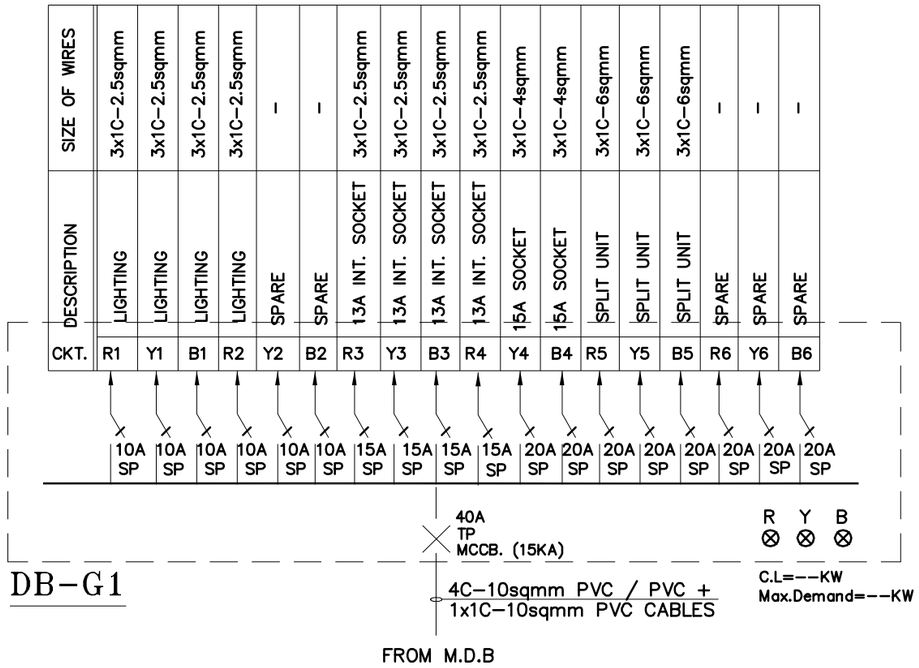


3rd Revision :	--------	Date :	--------
2nd Revision :	--------	Date :	--------
1st Revision :	--------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

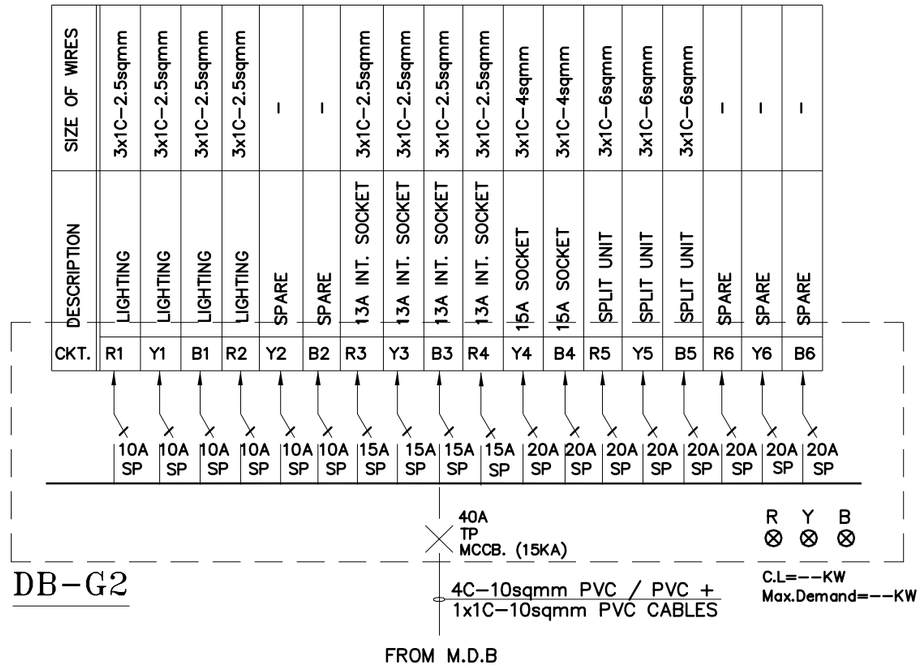
CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : SINGLE LINE DIAGRAM MDB
JOB TITLE : LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-VI	

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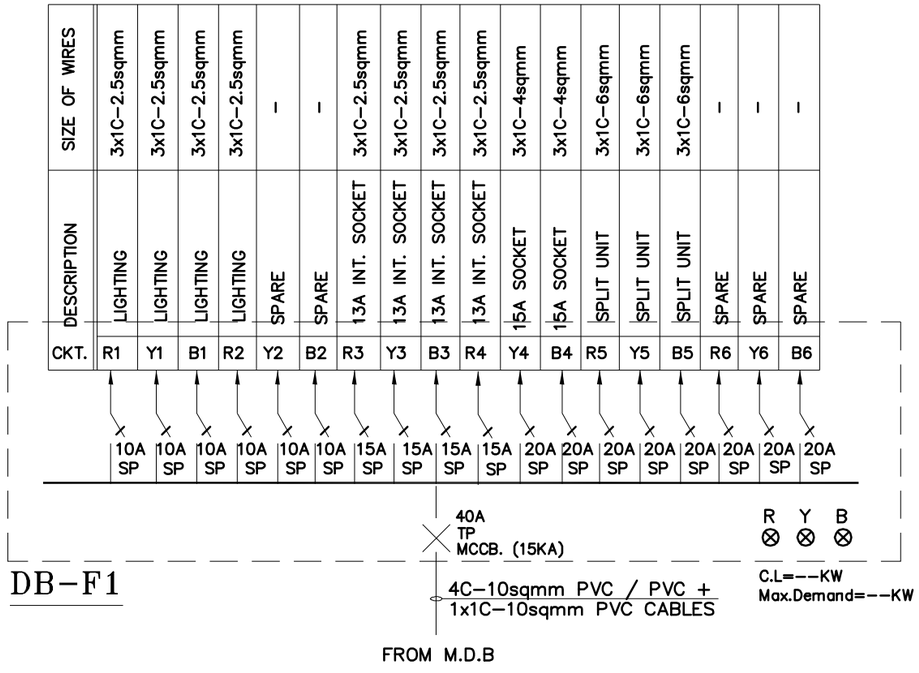
JOB NO :	303/13		
DRG. NO. :	E-02		
DRAWN BY :	M.FAISAL	CHECKED BY :	A.H
SCALE :	N.T.S	DATE :	09-12-202



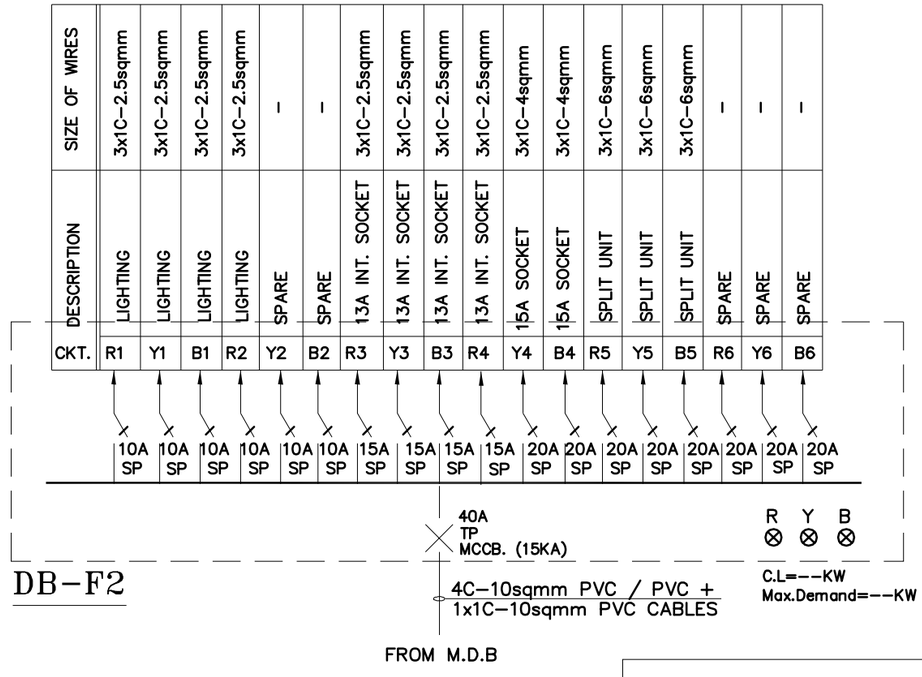
DB–G1



DB–G2



DB–F1



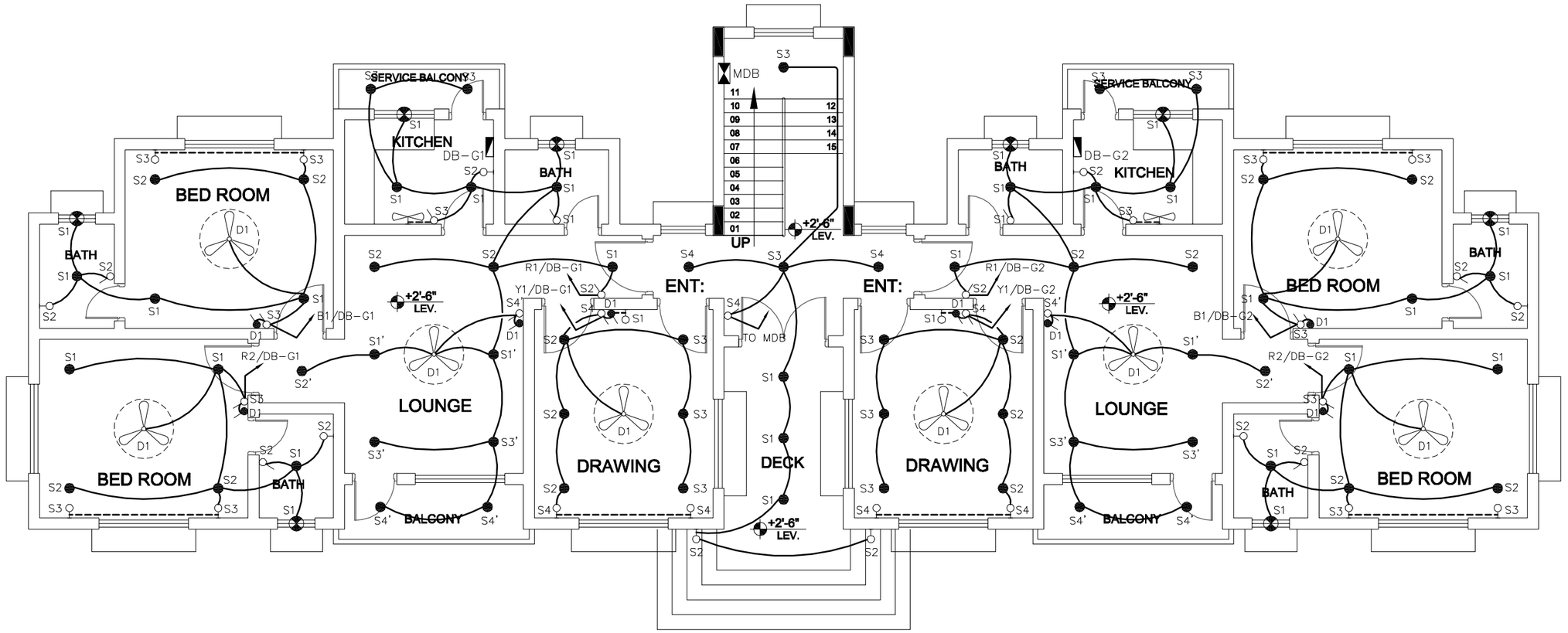
DB–F2

3rd Revision :	--------	Date :	--------
2nd Revision :	--------	Date :	--------
1st Revision :	--------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : SINGLE LINE DIAGRAM DB SCHEDULES
JOB TITLE: LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-VI	

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JOB NO :	303/13
DRG. NO. :	E-03
DRAWN BY : M.FAISAL	CHECKED BY : A.H
SCALE : N.T.S	DATE : 09-12-202



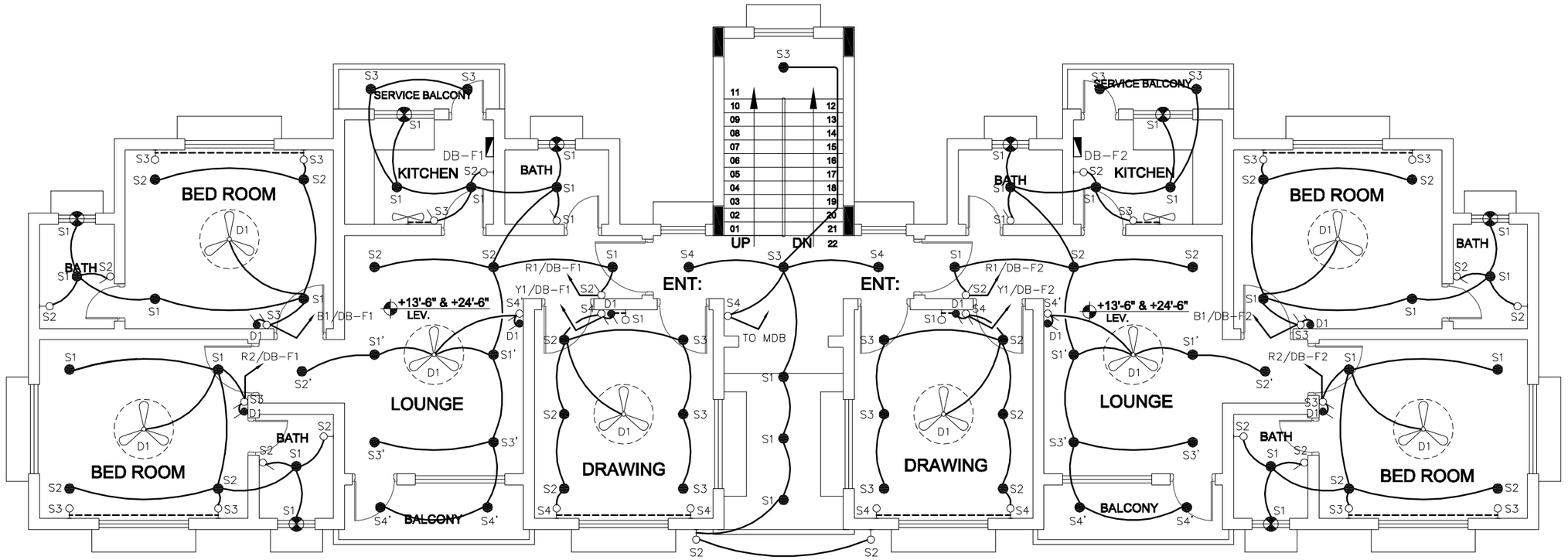
GROUND FLOOR PLAN

3rd Revision :	---------	Date :	---------
2nd Revision :	---------	Date :	---------
1st Revision :	---------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : GROUND FLOOR PLAN LIGHTING LAYOUT
JOB TITLE: LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-VI	

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JOB NO :	303/13
DRG. NO. :	E-04
DRAWN BY : M.FAISAL	CHECKED BY : A.H
SCALE : 1/4"=1'	DATE : 09-12-202



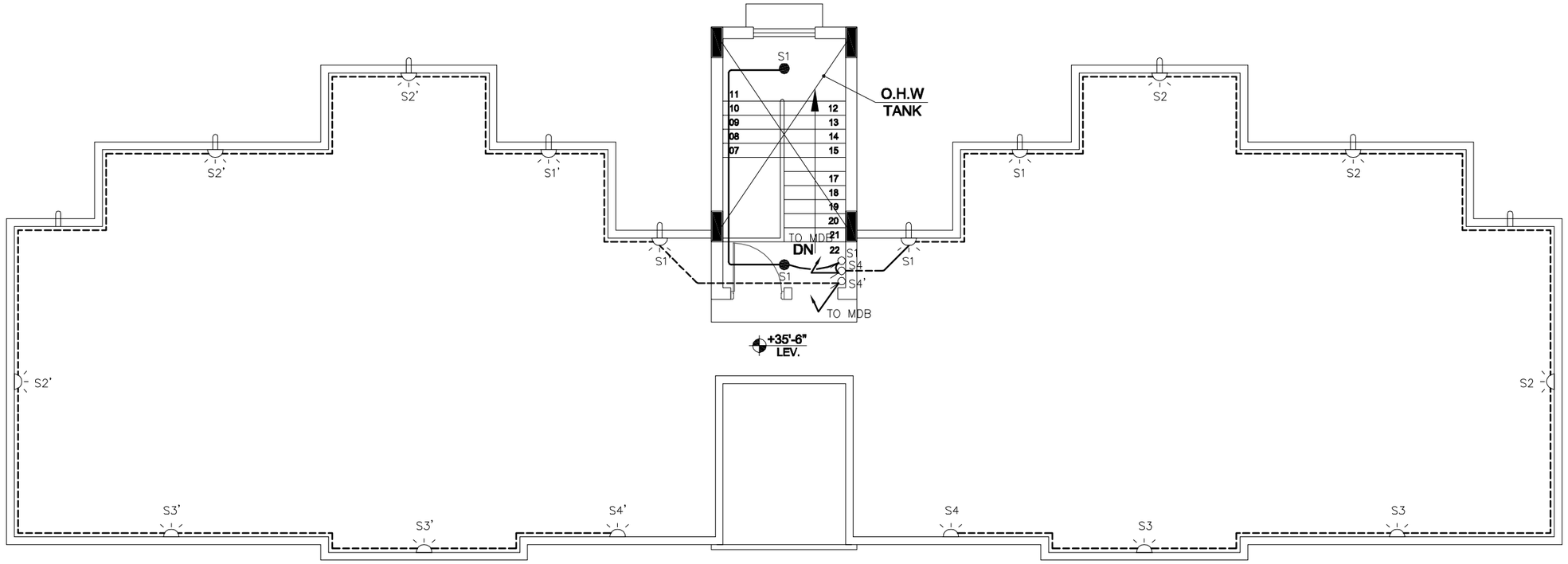
FIRST FLOOR PLAN

3rd Revision :	---------	Date :	---------
2nd Revision :	---------	Date :	---------
1st Revision :	---------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FIRST FLOOR PLAN LIGHTING LAYOUT
JOB TITLE: LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-VI	

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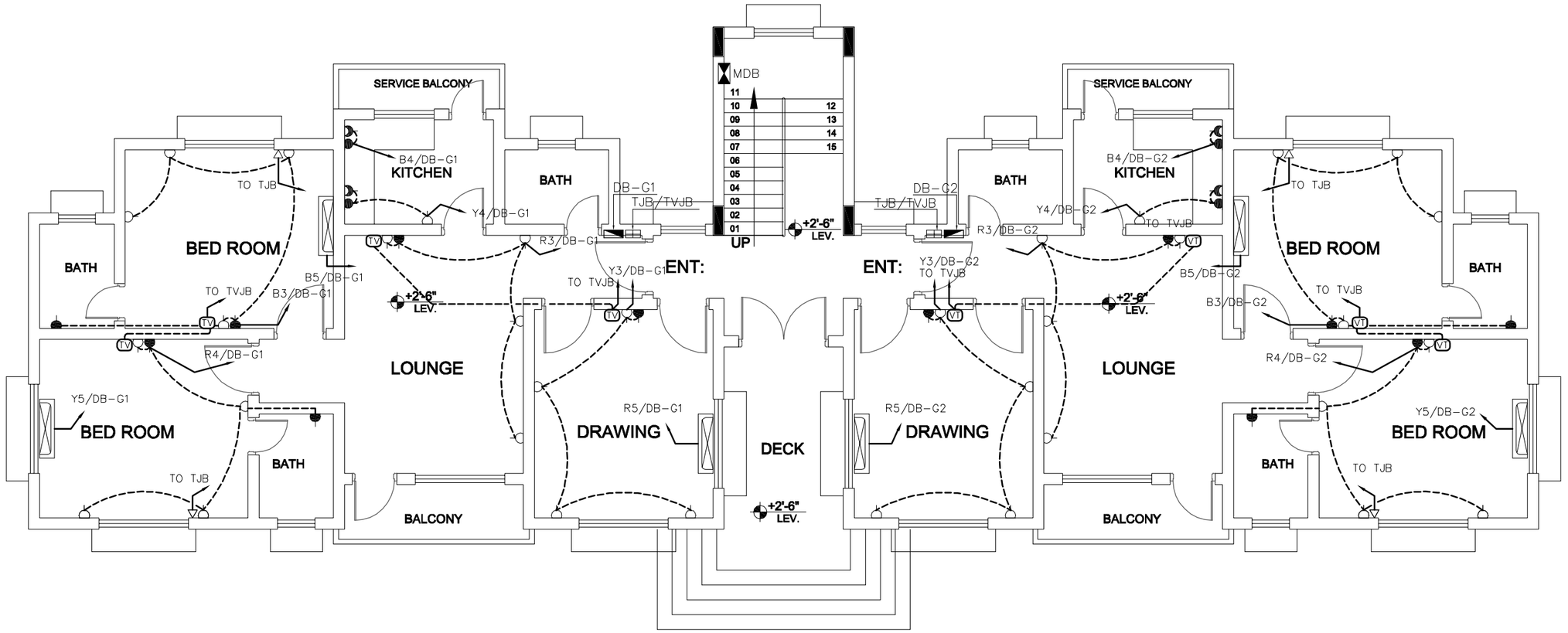
JOB NO :	303/13
DRG. NO. :	E-05
DRAWN BY : M.FAISAL	CHECKED BY : A.H
SCALE : 1/4"=1'	DATE : 09-12-202



ROOF PLAN

3rd Revision :	---------	Date :	---------
2nd Revision :	---------	Date :	---------
1st Revision :	---------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : ROOF PLAN LIGHTING LAYOUT
JOB TITLE: LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-VI	
YOUNG ASSOCIATES CONSULTING ENGINEERS & ARCHITECTS 9-C 24 th Commercial street, Phase 2 (Extn), Defence Housing Authority, Karachi-75500 Tel :021-35396444, 021-35312244 FAX: 021-35883106 E-mail: info@youngassociates.com.pk	JOB NO : 303/13 DRG. NO. : E-06 DRAWN BY : M.FAISAL / CHECKED BY : A.H SCALE : 1/4"=1' / DATE : 29-11-202



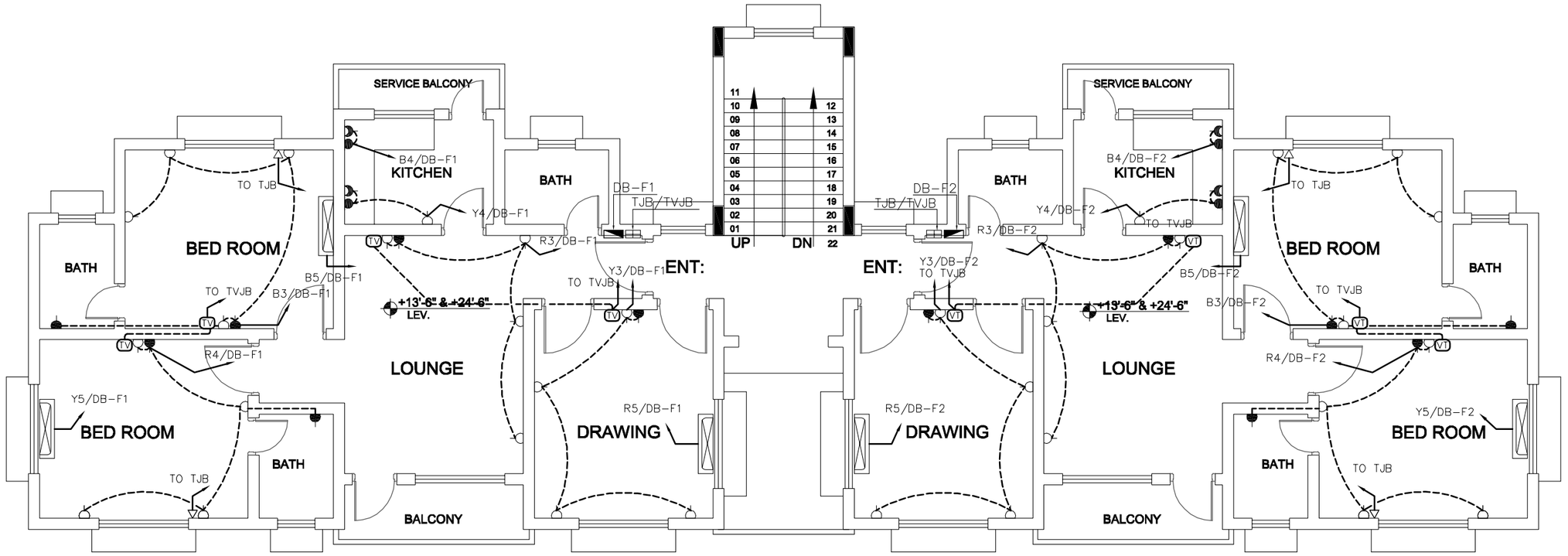
GROUND FLOOR PLAN

3rd Revision :	---------	Date :	---------
2nd Revision :	---------	Date :	---------
1st Revision :	---------	Date :	---------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : GROUND FLOOR PLAN POWER LAYOUT
JOB TITLE: LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-VI	

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JOB NO :	303/13
DRG. NO. :	E-07
DRAWN BY : M.FAISAL	CHECKED BY : A.H
SCALE : 1/4"=1'	DATE : 29-11-202



FIRST FLOOR PLAN

3rd Revision :	--------	Date :	--------
2nd Revision :	--------	Date :	--------
1st Revision :	--------	Date :	--------
ISSUED FOR	TENDER DRAWING	Date :	09-12-2025

CLIENT: CADET COLLEGE SANGHAR	DESCRIPTION : FIRST FLOOR PLAN POWER LAYOUT
JOB TITLE: LOWER STAFF FAMILY QUARTERS / FLATS FOR CAT-VI	

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JOB NO :	303/13		
DRG. NO. :	E-08		
DRAWN BY :	M.FAISAL	CHECKED BY :	A.H
SCALE :	1/4"=1'	DATE :	09-12-202