NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

University Road, Karachi-75270. Ph: 9926 1261-68 Ext 2471 & 2220
Fax: 9926 1255 Email: dp@neduet.edu.pk Web: www.neduet.edu.pk

Director Procurement

"Say No to Corruption"

No. PC/NED/MIV/191597/ 8529/ 963

Dated: 31.12.2025

CORRIGENDUM

Tender No. PC/NED/MIV/Construction 8529/2025	**Construction of Academic Block at NEDUET.**

With reference to above NIT published in Newspapers on 30.12.2025, all concerned are informed that following corrections shall be read and considered as integral part of the bidding documents and NIT:

	Instead of	Should be
1.	**Eligibility in the NIT and Bidding Data** (i) Valid Registration with Pakistan Engineering Council (PEC) in Category C-5 or above and Specialization Codes CE-10, CE-11(ix), EE-02, EE-04, EE-11 or EE-11(vi) and ME-01.	**Eligibility in the NIT and Bidding Data** (i) Valid Registration with Pakistan Engineering Council (PEC) in Category C-4 or above and Specialization Codes CE-10 and EE-11 or EE-11(vi).

However, all other terms & conditions of the tender will remain the same.

Director Procurement
31/12/2025

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
PROCUREMENT CELL

TEL: 99261261-68, Ext: (2220 / 2471), Fax: 99261255, Email: dp@neduet.edu.pk

"Say No to Corruption"

Director Procurement

Ref: DP/M-IV/191597/8529/955
December 29, 2025

Notice Inviting Tender
EPADS

NEDUET invites Sealed Bids on Single Stage One Envelope procedure from Reputable and Well Experienced Firms to carry out the following work:

Name of Work	Estimated Cost (Rs in million)	Bid Security	Time of Completion	Tender Fee
Construction of Academic Block at NEDUET. Tender No. PC/NED/MIV/Construction /8529/2025	**149.202**	**2% of Bid Cost**	**12 Months**	**5,000/-**

ELIGIBILITY:

(i) Valid Registration with Pakistan Engineering Council (PEC) in Category C-5 or above and Specialization Codes CE-10, CE-11(ix), EE-02, EE-04, EE-11 or EE-11(vi) and ME-01.
(ii) Valid Registered License from Electrical Inspector for Electrical Works issued from Government of Sindh.
(iii) Registered with Sindh Revenue Board and FBR and must have active status.
(iv) Last 3 years Audited Financial Statements along-with last 3 years online Annual Returns submitted to FBR.
(v) List of similar assignment along-with cost undertaken over past 5 years; evidence must be attached.
(vi) Affidavit on (non-judicial stamp paper) of no litigation history, non-blacklisting, never indulge in any corrupt, fraudulent and collusive practices, also undertaking that the information and documents provided with are correct. The date of issuance of said stamp paper and bidder signature on it should be later than the date of publication of this NIT.
(vii) Contractors working with NED University must submit a certificate from Project In charge that the work progress and quality of work executed are satisfactory.

BIDDING / TENDER DOCUMENTS

Tender Fee of Rs 5,000/- and Bid Security @ 2% of the bid cost in the shape Pay Order should be in favour of Director Finance, NEDUET. Bidding Documents can be obtained and shall be submitted in EPADS as per following schedule:

(i) **Issuance:** Documents will be issued from **01.01.2026** to **19.01.2026**
(ii) **Submission:** Last Date of Submission of Bids is **20.01.2026** at **10:00 A.M.**
(iii) **Opening:** Bids will be opened on **20.01.2026** at **10:30 A.M.**
(iv) **Place Address:** Office of DDP, Procurement Cell, NED University, Main Campus, Tel: 021-99261261-68 (Ext. 2220)

FUNDING POSITION Funds are available under HEC approved Development Project.

TERMS AND CONDITIONS:

a) **Under the following conditions, Bid can be rejected:**
   i) Bidders are advised that before filling the Bidding Document all papers of Bidding Documents should carefully be rechecked. If any page(s) / Paper(s) of Bidding Documents are missing, that can be downloaded from the Official website of the University and SPPRA. Bid(s) with incomplete Bidding Document will be rejected.
   ii) Incomplete, Conditional and Telegraphic Bids.
   iii) Bids not accompanied by Bid Security of required amount & form.
   iv) Bids received after Specified Date and Time.
   v) Black Listed Firms /Companies.

b) Bid Validity Period: 90 days
c) Bidders are requested to give their best and final price as "No Negotiations" is permitted. Bidding documents containing detailed terms and conditions are available at websites https://www.neduet.edu.pk and https://www.portalsindh.eprocure.gov.pk. The Procuring Agency reserves the right to reject all or any Bid subject to the relevant provisions of Sindh Public Procurement Rules 2010 amended up to date.

Director Procurement
29/Dec/2025

VOLUME - I

CONDITIONS OF CONTRACT

CONSTRUCTION OF ACADEMIC BLOCK AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY



PROJECT OF:

TACE PVT. LTD

www.tace.com.pk

CONSULTANT:

NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY

WWW.TACE.COM.PK

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INVITATION
FOR
BIDS

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
PROCUREMENT CELL

TEL: 99261261-68, Ext: (2220 / 2471), Fax: 99261255, Email: dp@neduet.edu.pk

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(ii) Valid Registered License from Electrical Inspector for Electrical Works issued from Government of Sindh.
(iii) Registered with Sindh Revenue Board and FBR and must have active status.
(iv) Last 3 years Audited Financial Statements along-with last 3 years online Annual Returns submitted to FBR.
(v) List of similar assignment along-with cost undertaken over past 5 years; evidence must be attached.
(vi) Affidavit on (non-judicial stamp paper) of no litigation history, non-blacklisting, never indulge in any corrupt, fraudulent and collusive practices, also undertaking that the information and documents provided with are correct. The date of issuance of said stamp paper and bidder signature on it should be later than the date of publication of this NIT.
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Director Procurement
29/Dec/2025

INSTRUCTIONS
TO BIDDERS
&
BIDDING DATA

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INSTRUCTIONS TO BIDDERS

(Note: These Instructions to Bidders (IB) alongwith Bidding Data will not be part of Contract and will cease to have effect once the Contract is signed).

A. GENERAL

IB.1 Scope of Bid & Source of Funds

1.1 Scope of Bid

The Employer as defined in the Bidding Data (hereinafter called "the Employer") wishes to receive Bids for the Works summarized in the Bidding Data (hereinafter referred to as "the Works").

Bidders must quote for the complete scope of work. Any Bid covering partial scope of work will be rejected as non-responsive.

1.2 Source of Funds

Funds are available under HEC approved Development Project.

IB.2 Eligible Bidders

2.1 Bidding is open to all firms and persons meeting the following requirements:

i) Valid Registration with Pakistan Engineering Council (PEC) in category C-4 & above and Specialization codes CE-10, EE-11 or EE-11(vi).
ii) Contractors working with NED University must submit a certificate from Project In charge that the work progress and quality of work executed are satisfactory.
iii) Affidavit that firm has not been black listed by any Government, Semi Government or Autonomous Bodies on Rs. 100. non-Judicial Stamp Paper.
iv) Last 3 years of Audited Financial Statements along with last 3 years online Annual Returns submitted to FBR.
v) Valid Registered License from Electrical Inspector for Electrical Works issued from Govt. of Sindh.
vi) List of similar assignment along with cost undertaken over past 5 years, evidence must be attached.
vii) Registered with Sindh Revenue Board, FBR and must have active status.

IB.3 Cost of Bidding

3.1 The bidder shall bear all costs associated with the preparation and submission of its bid and the Employer will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

B. BIDDING DOCUMENTS

IB.4 Contents of Bidding Documents

4.1 In addition to Invitation for Bids, the Bidding Documents are those stated below, and should be read in conjunction with any Addendum issued in accordance with Sub-Clause IB.6.1.

1. Instructions to Bidders & Bidding Data
2. Form of Bid & Schedules to Bid
   Schedules to Bid comprise the following:
   (i) Schedule A: Schedule of Prices
   (ii) Schedule B: Specific Works Data
   (iii) Schedule C: Works to be Performed by Subcontractors
   (iv) Schedule D: Proposed Programme of Works
   (v) Schedule E: Method of Performing Works
   (vi) Schedule F: Integrity Pact
3. Conditions of Contract & Contract Data
4. Standard Forms:
   (i) Form of Bid Security
   (ii) Form of Performance Security
   (iii) Form of Contract Agreement
   (iv) Form of Bank Guarantee for Advance Payment
5. Specifications
6. Drawings, if any

IB.5 Clarification of Bidding Documents

5.1 A prospective bidder requiring any clarification(s) in respect of the Bidding Documents may notify the Engineer/Employer at the Employer's/Engineer's address indicated in the Bidding Data.

5.2 The Engineer/Employer will respond to any request for clarification which it receives earlier than ten **(**10) days prior to the deadline for the submission of Bids. Copies of the Engineer/Employer's response will be forwarded to all prospective bidders, at least five (5) days prior to dead line for submission of Bids, who have received the Bidding

Documents including a description of the enquiry but without identifying its source.

IB.6 Amendment of Bidding Documents

6.1 At any time prior to the deadline for submission of Bids, the Employer may, for any reason, whether at his own initiative or in response to a clarification requested by a prospective bidder, modify the Bidding Documents by issuing addendum.

6.2 Any addendum thus issued shall be part of the Bidding Documents pursuant to Sub-Clause 6.1 hereof, and shall be communicated in writing to all purchasers of the Bidding Documents. Prospective bidders shall acknowledge receipt of each addendum in writing to the Employer.

6.3 To afford prospective bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer may at its discretion extend the deadline for submission of Bids.

C. PREPARATION OF BIDS

IB.7 Language of Bid

7.1 The bid prepared by the bidder and all correspondence and documents relating to the Bid, exchanged by the bidder and the Employer shall be written in the English language, provided that any printed literature furnished by the bidder may be written in another language so long as accompanied by an English translation of its pertinent passages in which case, for purposes of interpretation of the Bid, the English translation shall govern.

IB.8 Documents Comprising the Bid

8.1 The bid prepared by the bidder shall comprise the following components:

(a) Covering Letter

(b) Form of Bid duly filled, signed and sealed, in accordance with Sub-Clause IB.14.3.

(c) Schedules (A to F) to Bid duly filled and initialed, in accordance with the instructions contained therein & in accordance with Sub-Clause IB14.3.

(d) Bid Security furnished in accordance with Clause IB.13.

(e) Power of Attorney in accordance with Sub-Clause IB 14.5.

(f) Documentary evidence in accordance with Clause IB.11

(g) Documentary evidence in accordance with Clause IB.12.

IB.9 Sufficiency of Bid

9.1 Each bidder shall satisfy himself before Bidding as to the correctness and sufficiency of his Bid and of the rates and prices entered in the Schedule of Prices, which rates and prices shall except in so far as it is otherwise expressly provided in the Contract, cover all his obligations under the Contract and all matters and things necessary for the proper completion of the Works.

9.2 The bidder is advised to obtain for himself at his own cost and responsibility all information that may be necessary for preparing the bid and entering into a Contract for execution of the Works.

IB.10 Bid Prices, Currency of Bid and Payment

10.1 The bidder shall fill up the Schedule of Prices (Schedule A to Bid) indicating the unit rates and prices of the Works to be performed under the Contract. Prices in the Schedule of Prices shall be entered keeping in view the instructions contained in the Preamble to Schedule of Prices.

10.2 Unless otherwise stipulated in the Conditions of Contract, prices quoted by the bidder shall remain fixed during the bidder's performance of the Contract and not subject to variation on any account.

10.3 The unit rates and prices in the Schedule of Prices shall be quoted by the bidder in the currency as stipulated in Bidding Data.

IB.11 Documents Establishing Bidder's Eligibility and Qualifications

11.1 Pursuant to Clause IB.8, the bidder shall furnish, as part of its bid, documents establishing the bidder's eligibility to bid and its qualifications to perform the Contract if its bid is accepted.

11.2 Bidder/Manufacturer must possess and provide evidence of its capability and the experience as stipulated in Bidding Data and the Qualification Criteria stipulated in the Bidding Documents.

IB.12 Documents Establishing Works' Conformity to Bidding Documents

12.1 The documentary evidence of the Works' conformity to the Bidding Documents may be in the form of literature, drawings and data and the bidder shall furnish documentation as set out in Bidding Data.

12.2 The bidder shall note that standards for workmanship, material and equipment, and references to brand names or catalogue numbers, if any, designated by the Employer in

the Technical Provisions are intended to be descriptive only and not restrictive.

IB.13 Bid Security

13.1 Each bidder shall furnish, as part of his bid, at the option of the bidder, a Bid Security in the amount stipulated in Bidding Data in Pak. Rupees in the form of Deposit at Call or a Bank Guarantee issued by a Scheduled Bank in Pakistan in favour of the Employer valid for a period up to twenty eight (28) days beyond the bid validity date.

13.2 Any bid not accompanied by an acceptable Bid Security shall be rejected by the Employer as non-responsive.

13.3 The bid securities of unsuccessful bidders will be returned upon award of contract to the successful bidder or on the expiry of validity of Bid Security whichever is earlier.

13.4 The Bid Security of the successful bidder will be returned when the bidder has furnished the required Performance Security, pursuant to Clause IB.21 and signed the Contract Agreement, pursuant to Sub-Clauses IB.20.2 & 20.3.

13.5 The Bid Security may be forfeited:

(a) if a bidder withdraws his bid during the period of bid validity; or

(b) if a bidder does not accept the correction of his Bid Price, pursuant to Sub-Clause 16.4 (b) hereof; or

(c) in the case of a successful bidder, if he fails to:

(i) furnish the required Performance Security in accordance with Clause IB.21, or

(ii) sign the Contract Agreement, in accordance with Sub-Clauses IB.20.2 & 20.3.

IB.14 Validity of Bids, Format, Signing and Submission of Bid

14.1 Bids shall remain valid for the period stipulated in the Bidding Data after the date of bid opening.

14.2 All Schedules to Bid are to be properly completed and signed.

14.3 No alteration is to be made in the Form of Bid except in filling up the blanks as directed. If any alteration be made or if these instructions be not fully complied with, the bid may be rejected.

14.4 Each bidder shall prepare Original and number of copies specified in the Bidding Data of the documents comprising the bid as described in Clause IB.8 and clearly mark them "ORIGINAL" and "COPY" as appropriate. In the event of discrepancy between them, the original shall prevail.

14.5 The original and all copies of the bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign (in the case of copies, Photostats are also acceptable). This shall be indicated by submitting a written Power of Attorney authorising the signatory of the bidder to act for and on behalf of the bidder. All pages of the bid shall be initialed and official seal be affixed by the person or persons signing the bid.

14.6 The Bid shall be delivered in person or sent by registered mail at the address to Employer as given in Bidding Data.

D. SUBMISSION OF BID

IB.15 Deadline for Submission, Modification & Withdrawal of Bids

15.1 Bids must be received by the Employer at the address/provided in Bidding Data not later than the time and date stipulated therein.

15.2 Bids submitted through telegraph, telex, fax or e-mail shall not be considered.

15.3 Any bid received by the Employer after the deadline for submission prescribed in Bidding Data will be returned unopened to such bidder.

15.4 Any bidder may modify or withdraw his bid after bid submission provided that the modification or written notice of withdrawal is received by the Employer prior to the deadline for submission of bids.

15.5 Withdrawal of a bid during the interval between the deadline for submission of bids and the expiration of the period of bid validity specified in the Form of Bid may result in forfeiture of the Bid Security pursuant to Sub-Clause IB.13.5(a).

E. BID OPENING AND EVALUATION

IB.16 Bid Opening, Clarification and Evaluation

16.1 The Employer will open the bids, in the presence of bidders' representatives who choose to attend, at the time, date and location stipulated in the Bidding Data.

16.2 The bidder's name, Bid Prices, any discount, the presence or absence of Bid Security, and

such other details as the Employer at its discretion may consider appropriate, will be announced by the Employer at the bid opening. The Employer will record the minutes of the bid opening. Representatives of the bidders who choose to attend shall sign the attendance sheet.

Any Bid Price or discount which is not read out and recorded at bid opening will not be taken into account in the evaluation of bid.

16.3 To assist in the examination, evaluation and comparison of Bids the Engineer/Employer may, at its discretion, ask the bidder for a clarification of its Bid. The request for clarification and the response shall be in writing and no change in the price or substance of the Bid shall be sought, offered or permitted.

16.4 (a) Prior to the detailed evaluation, pursuant to Sub-Clauses IB.16.7 to 16.9, the Engineer/Employer will determine the substantial responsiveness of each bid to the Bidding Documents. For purpose of these Clauses, a substantially responsive bid is one which conforms to all the terms and conditions of the Bidding Documents without material deviations. It will include to determine the requirements listed in Bidding Data.

(b) Arithmetical errors will be rectified on the following basis:

If there is a discrepancy between the unit price and total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected. If there is a discrepancy between the words and figures the amount in words shall prevail. If there is a discrepancy between the Total Bid price entered in Form of Bid and the total shown in Schedule of Prices-Summary, the amount stated in the Form of Bid will be corrected by the Employer in accordance with the Corrected Schedule of Prices.

If the bidder does not accept the corrected amount of Bid, his Bid will be rejected and his Bid Security forfeited.

16.5 A Bid determined as substantially non-responsive will be rejected and will not subsequently be made responsive by the bidder by correction of the non-conformity.

16.6 Any minor informality or non-conformity or irregularity in a Bid which does not constitute a material deviation may be waived by Employer, provided such waiver does not prejudice or affect the relative ranking of any other bidders.

16.7 The Engineer/Employer will evaluate and compare only the bids previously determined to be substantially responsive pursuant to Sub-Clauses IB.16.4 to 16.6 as per requirements given hereunder. Bids will be evaluated for complete scope of works. The prices will be compared on the basis of the Evaluated Bid Price pursuant to Sub-Clause 16.8 herein below.

(a) Technical Evaluation

It will be examined in detail whether the Works offered by the bidder complies with the Technical Provisions of the Bidding Documents. For this purpose, the bidder's data submitted with the bid in Schedule B to Bid will be compared with technical features/criteria of the Works detailed in the Technical Provisions. Other technical information submitted with the bid regarding the Scope of Work will also be reviewed.

(b) Commercial Evaluation

It will be examined in detail whether the bids comply with the commercial/contractual conditions of the Bidding Documents. It is expected that no material deviation/stipulation shall be taken by the bidders.

16.8 Evaluated Bid Price

In evaluating the bids, the Engineer/Employer will determine for each bid in addition to the Bid Price, the following factors (adjustments) in the manner and to the extent indicated below to determine the Evaluated Bid Price:

(i) making any correction for arithmetic errors pursuant to Sub-Clause 16.4 hereof.

(ii) making an appropriate price adjustment for any other acceptable variation or deviation.

(iii) making an appropriate price adjustment for Deviations in terms of Payments (if any and acceptable to the Employer).

(iv) discount, if any, offered by the bidders as also read out and recorded at the time of bid opening.

16.9 Evaluation Methods

Pursuant to Sub-Clause 16.8, Para (ii), and (iii) following evaluation methods for price adjustments will be followed:

(i) Price Adjustment for Technical Compliance

The cost of making good any deficiency resulting from technical non compliance will be added to the Corrected Total Bid Price for comparison purposes only. The adjustments will be applied taking the highest price quoted by other bidders being evaluated in detail in their original Bids for corresponding item. In case of non availability of price from other bidders, the price will be estimated by the Engineer/Employer.

(ii) Price Adjustment for Commercial Compliance

The cost of making good any deficiency resulting from any quantifiable variations and deviations from the Bid Schedules and Conditions of Contract, as determined by the Engineer/Employer will be added to the Corrected Total Bid Price for comparison purpose only. Adjustment for commercial compliance will be added to the Corrected Total Bid Prices.

(iii) Price Adjustment for Deviation in Terms of Payments

Refer to Bidding Data

IB.17 Process to be Confidential

17.1 Subject to Sub-Clause IB.16.3 heretofore, no bidder shall contact Engineer/Employer on any matter relating to its Bid from the time of the Bid opening to the time the bid evaluation result is announced by the Employer. The evaluation result shall be announced at least ten (10) days prior to award of Contract. The announcement to all bidders will include table(s) comprising read out prices, discounted prices, price adjustments made, final evaluated prices and recommendations against all the bids evaluated.

17.2 Any effort by a bidder to influence Engineer/Employer in the Bid evaluation, Bid comparison or Contract Award decisions may result in the rejection of his Bid. Whereas, any bidder feeling aggrieved may lodge a written complaint not later than fifteen (15) days after the announcement of the bid evaluation result, however, mere fact of lodging a complaint shall not warrant suspension of procurement process.

F. AWARD OF CONTRACT

IB.18. Post Qualification

18.1 The Employer, at any stage of the bid evaluation, having credible reasons for or *prima facie* evidence of any defect in supplier's or contractor's capacities, may require the suppliers or contractors to provide information concerning their professional, technical, financial, legal or managerial competence whether already pre-qualified or not:

Provided that such qualification shall only be laid down after recording reasons therefor in writing. They shall form part of the records of that bid evaluation report.

18.2 The determination will take into account the bidder's financial and technical capabilities. It will be based upon an examination of the documentary evidence of the bidders' qualifications submitted under Clause IB.11, as well as such other information required in the Bidding Documents.

IB.19 Award Criteria & Employer's Right

19.1 Subject to Sub-Clause IB.19.2, the Employer will award the Contract to the bidder whose bid has been determined to be substantially responsive to the Bidding Documents and who has offered the lowest evaluated Bid Price, provided that such bidder has been determined to be qualified to satisfactory perform the Contract in accordance with the provisions of Clause IB.18.

19.2 Not with standing Sub-Clause IB.19.1, the Employer reserves the right to accept or reject

any bid, and to annul the bidding process and reject all bids, at any time prior to award of Contract, without thereby incurring any liability to the affected bidders or any obligation to inform the affected bidders of the grounds for the Employer's action except that the grounds for its rejection of all bids shall upon request be communicated, to any bidder who submitted a bid, without justification of the grounds. Notice of the rejection of all the bids shall be given promptly to all the bidders.

IB.20 Notification of Award & Signing of Contract Agreement

20.1 Prior to expiration of the period of bid validity prescribed by the Employer, the Employer will notify the successful bidder in writing ("Letter of Acceptance") that his bid has been accepted.

20.2 Within seven (7) days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the Employer will send the successful bidder the Form of Contract Agreement provided in the Bidding Documents, incorporating all agreements between the parties.

20.3 The formal Agreement between the Employer and the successful bidder shall be executed within seven (7) days of the receipt of Form of Contract Agreement by the successful bidder from the Employer.

IB.21 Performance Security

21.1 The successful bidder shall furnish to the Employer a Performance Security in the form and the amount stipulated in the Conditions of Contract within a period of fourteen (14) days after the receipt of Letter of Acceptance.

21.2 Failure of the successful bidder to comply with the requirements of Sub-Clauses IB.20.2 & 20.3 or 21.1 or Clause IB.22 shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security.

IB.22 Integrity Pact

The Bidder shall sign and stamp the Form of Integrity Pact provided at Schedule-F to Bid in the Bidding Document for all Federal Government procurement contracts exceeding Rupees ten (10) million. Failure to provide such Integrity Pact shall make the bid non-responsive.

BIDDING DATA

(This section should be filled in by the Engineer/Employer before issuance of the Bidding Documents. The following specific data for the Works to be tendered shall complement, amend, or supplement the provisions in the Instructions to Bidders. Wherever there is a conflict, the provisions herein shall prevail over those in the Instructions to Bidders.)

Instructions to Bidders
Clause Reference

1.1 **Name of Employer**
NED University of Engineering and Technology, Karachi.

Brief Description of Works

Construction Of Academic Block at Ned University of Engineering and Technology.

5.1 (a) **Employer's address:**
NED University of Engineering and Technology, Karachi
University Road, Karachi-75270
Tel# 021- 99261261-68 (Ext: 2291)
Email: dp@neduet.edu.pk, pd@neduet.edu.pk

(b) **Engineer's address:**
Messrs. TACE (Pvt.) Limited.
Head Office: R-210, Abid Town, Block-2, Gulshan-e-Iqbal, Karachi.
Tel: (92) 21 34986237 (92) 34964622, Email: info@tace.com.pk

10.3 Bid shall be quoted entirely in Pak. Rupees. The payment shall be made in Pak. Rupees.

11.2 The bidder/manufacturer has the financial, technical and production capability necessary to perform the Contract as follows

i) Valid Registration with Pakistan Engineering Council (PEC) in category C-4 & above and Specialization codes CE-10, EE-11 or EE-11(vi).

ii) Contractors working with NED University must submit a certificate from Project In charge that the work progress and quality of work executed are satisfactory.
iii) Affidavit that firm has not been black listed by any Government, Semi Government or Autonomous Bodies on Rs. 100. non-Judicial Stamp Paper.
iv) Last 3 years of Audited Financial Statements along with last 3 years online Annual Returns submitted to FBR.
v) Valid Registered License from Electrical Inspector for Electrical Works issued from Govt. of Sindh.
vi) List of similar assignment along with cost undertaken over past 5 years, evidence must be attached.
vii) Registered with Sindh Revenue Board, FBR and must have active status.

12.1 (a) **Construction of Academic Block at Ned University of Engineering and Technology**. The works involves Construction of Renewable Energy Laboratories at First Floor at NED University of Engineering and Technology, Main Campus, Karachi, including execution of Civil, Electrical, Plumbing and allied works in accordance with the Design, Drawings, Technical Specifications, Bill of Quantities and instructions of the Client / Consultant with special emphasis on Quantity and Quality control ethics.

(b) Complete set of technical information, description data, literature and drawings as required in accordance with Schedule B to Bid, Specific Works Data. This will include but not be limited to a sufficient number of drawings, photographs, catalogues, illustrations and such other information as is necessary to illustrate clearly the significant characteristics such as general construction dimensions and other relevant information about the works to be performed.

13.1 **Amount of Bid Security**

Minimum 2% of Bid Price in the form of Pay Order / Bank Guarantee

14.1 **Period of Bid Validity**

Bid shall remain valid for the 90 days after the Date of Bid Opening

14.4 **Number of Copies of the Bid to be Submitted**

One original plus 01 copy.

14.6 **(a) Employer's Address for the Purpose of Bid Submission**

The Director Procurement (through EPADS)
NED UET, Admin Block, Karachi.
Phone (92 21) 9926-1261-8 (Ext : 2291) Fax: 9926-1255

15.1 **Deadline for Submission of Bids**

As notified in "Invitation to Bids"

16.1 **Venue, Time, and Date of Bid Opening**

As notified in "Invitation to Bids"

16.4 **Responsiveness of Bids**

(i) the Bid is valid till required period,
(ii) the Bid prices are firm during currency of contract (if it is a fixed price bid)
(iii) completion period offered is within specified limits,
(iv) the Bidder/Manufacturer is eligible to Bid and possesses the requisite experience, capability and qualification.
(v) the Bid does not deviate from basic technical requirements and
(vi) the Bids are generally in order, etc.

16.9 **Price Adjustment:**

(iii) Price Adjustment for Deviations in Terms of Payment

If a bid deviates from the terms of payment/payment conditions as specified in the Conditions of Contract and if such deviation is considered acceptable to the Employer, mark-up earned for any earlier payments involved in the terms outlined in the Bid as compared to those stipulated in the Conditions of Contract shall be calculated at the mark-up rate_____per annum (insert rate) and shall be added to the Corrected Total Bid Price for comparison purposes only.

FORM OF BID AND SCHEDULES TO BID

FORM OF BID

(LETTER OF OFFER)

Bid Reference No. Construction Of Academic Block at NED University of Engineering and Technology.

To:

_____
_____
_____

Gentlemen,

1. Having examined the Bidding Documents including Instructions to Bidders, Bidding Data, Conditions of Contract, Contract Data, Specifications, Drawings, if any, Schedule of Prices and Addenda Nos. _____for the execution of the above-named Works, we, the undersigned, being a company doing business under the name of and address _____ _____ and being duly incorporated under the laws of Pakistan hereby offer to execute and complete such Works and remedy any defects therein in conformity with the said Documents including Addenda thereto for the Total Bid Price of Rs_____(Rupees_____) or such other sum as may be ascertained in accordance with the said Documents.

2. We understand that all the Schedules attached hereto form part of this Bid.

3. As security for due performance of the undertakings and obligations of this Bid, we submit herewith a Bid Security in the amount of _____ _____drawn in your favour or made payable to you and valid for a period of twenty eight (28) days beyond the period of validity of Bid.

4. We undertake, if our Bid is accepted, to commence the Works and to deliver and complete the Works comprised in the Contract within the time(s) stated in Contract Data.

5. We agree to abide by this Bid for the period of _____days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

6. Unless and until a formal Agreement is prepared and executed, this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.

7. We undertake, if our Bid is accepted, to execute the Performance Security referred to in Conditions of Contract for the due performance of the Contract.

8. We understand that you are not bound to accept the lowest or any bid you may receive.

9. We do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other person or persons making a bid for the Works.

Dated this_____day of _____ , 20

Signature _____

in the capacity of _____duly authorized to sign bid for and on behalf of _____
(Name of Bidder in Block Capitals)

(Seal)

Address

_____

_____

_____

Witness:

(Signature)_____

Name:_____
Address: _____
_____

[SCHEDULES TO BID INCLUDE THE FOLLOWING:

- Schedule A to Bid: Schedule of Prices
- Schedule B to Bid: Specific Works Data
- Schedule C to Bid: Works to be Performed by Subcontractors
- Schedule D to Bid: Proposed Programme of Works
- Schedule E to Bid: Method of Performing Works
- Schedule F to Bid: Integrity Pact]

SCHEDULE – A TO BID

SCHEDULE OF PRICES

Sr. No.		Page No.
1.	Preamble to Schedule of Prices	26
2.	Schedule of Prices	29
	*(a) Summary of Bid Prices	
	* (b) Detailed Schedule of Prices	

* [To be prepared by the Engineer/Employer]

PREAMBLE TO SCHEDULE OF PRICES

1. General

1.1 The Schedule of Prices shall be read in conjunction with the Conditions of Contract, Contract Data together with the Specifications and Drawings, if any.

1.2 The Contract shall be for the whole of the Works as described in these Bidding Documents. Bids must be for the complete scope of works.

2. Description

2.1 The general directions and descriptions of works and materials are not necessarily repeated nor summarized in the Schedule of Prices. References to the relevant sections of the Bidding Documents shall be made before entering prices against each item in the Schedule of Prices.

3. Units & Abbreviations

3.1 Units of measurement, symbols and abbreviations expressed in the Bidding Documents shall comply with the Systeme Internationale d' Unites (SI Units).
FPS SYSTEM

4. Rates and Prices

4.1 Except as otherwise expressly provided under the Conditions of Contract, the rates and amounts entered in the Schedule of Prices shall be the rates at which the Contractor shall be paid and shall be the full inclusive value of the works set forth or implied in the Contract; except for the amounts reimbursable, if any to the Contractor under the Contract.

4.2 Unless otherwise stipulated in the Contract Data, the rates and prices entered by the bidder shall not be subject to adjustment during the performance of the Contract.

4.3 All duties, taxes and other levies payable by the Contractor shall be included in the rates and prices.

4.4 The whole cost of complying with the provisions of the Contract shall be included in the items provided in the Schedule of Prices, and where no items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related items of the Works and no separate payment will be made for those items.

The rates, prices and amounts shall be entered against each item in the Schedule of Prices. Any item against which no rate or price is entered by the bidder will not be paid for by the Employer when executed and shall be deemed covered by the rates and prices for other items in the Schedule of Prices.

4.5 (a) The bidder shall be deemed to have obtained all information as to and all requirements related thereto which may affect the bid price.

(b) The Contractor shall be responsible to make complete arrangements for the transportation of the Plant to the Site.

(Employer may modify as appropriate)

4.6 The Contractor shall provide for all parts of the Works to be completed in every respect. Notwithstanding that any details, accessories, etc. required for the complete installation and satisfactory operation of the Works, are not specifically mentioned in the Specifications, such details shall be considered as included in the Contract Price.

5. Bid Prices

5.1 Break-up of Bid Prices

The various elements of Bid Prices shall be quoted as detailed by the Employer in the format of Schedule of Prices.

The bidder shall recognize such elements of the costs which he expects to incur the performance of the Works and shall include all such costs in the rates and amounts entered in the Schedule of Prices.

5.2 Total Bid Price

The total of bid prices in the Schedule of Prices shall be entered in the Summary of Bid Prices.

6. Provisional Sums

6.1 Provisional Sums included and so designated in the Schedule of Prices if any, shall be expended in whole or in part at the direction and discretion of the Engineer/Employer. The Contractor will only receive payment in respect of Provisional Sums if he has been instructed by the Engineer/Employer to utilise such sums.

SCHEDULE OF PRICES – SUMMARY OF BID PRICES

Bill No.	Description	Total Amount (Rs)
1.		
	Total Bid Price (The amount to be entered in Paragraph 1 of the Form of Bid) (In words).	

SCHEDULE - A TO BID

SCHEDULE OF PRICES

Item No.	Description	Quantity	Unit Rate(Rs)	Total Amount (Rs)
1.				
Total (to be carried to Summary of Bid Price)				

SCHEDULE - B TO BID

*SPECIFIC WORKS DATA

(To be prepared and incorporated by the Employer)

*(Note: The Employer shall spell out the information & data required to be filled out by the bidder and to furnish complementary information).

SCHEDULE – C TO BID

WORKS TO BE PERFORMED BY SUBCONTRACTORS

The bidder will do the work with his own forces except the work listed below which he intends to sub-contract.

Items of Works to be Sub-Contracted	Name and address of Sub-Contractors	Statement of similar works previously executed (attach evidence)

Note:

1. No change of Sub-Contractors shall be made by the bidder without prior approval of the Employer.

2. The truthfulness and accuracy of the statement as to the experience of Sub-Contractors is guaranteed by the bidder. The Employer's judgment shall be final as to the evaluation of the experience of Sub-Contractors submitted by the bidder.

3. Statement of similar works shall include description, location & value of works, year completed and name & address of the clients.

SCHEDULE – D TO BID

PROPOSED PROGRAMME OF WORKS

Bidder shall provide a programme in a bar-chart showing the sequence of work items by which he proposes to complete the Works of the entire Contract. The programme should indicate the sequence of work items and the period of time during which he proposes to complete the Works including the activities like designing, schedule of submittal of drawings, ordering and procurement of materials, manufacturing, delivering, construction of civil works, erection, testing and commissioning of Works to be supplied under the Contract.

SCHEDULE – E TO BID

METHOD OF PERFORMING WORKS

The bidder is required to submit a narrative outlining the method of performing the Works. The narrative should indicate in detail and include but not be limited to:

- The sequence and methods in which he proposes to carry out the Works, including the number of shifts per day and hours per shift, he expects to work.
- A list of all major items of constructional and erectional plant, tools and vehicles proposed to be used in delivering/carrying out the Works at Site
- The procedure for installation of equipment and transportation of equipment and materials to the site.
- Organisation chart indicating head office & field office personnel involved in management, supervision and engineering of the Works to be done under the Contract.

SCHEDULE – F TO BID

(INTEGRITY PACT)

DECLARATION OF FEES, COMMISSION AND BROKERAGE ETC. PAYABLE BY THE SUPPLIERS OF GOODS, SERVICES & WORKS IN CONTRACTS WORTH RS. 10.00 MILLION OR MORE

Contract No._____Dated _____
Contract Value: _____
Contract Title: _____

… .....[name of Supplier] hereby declares that it has not obtained or induced the procurement of any contract, right, interest, privilege or other obligation or benefit from Government of Pakistan (GoP) or any administrative subdivision or agency thereof or any other entity owned or controlled by GoP through any corrupt business practice.

Without limiting the generality of the foregoing, [name of Supplier] represents and warrants that it has fully declared the brokerage, commission, fees etc. paid or payable to anyone and not given or agreed to give and shall not give or agree to give to anyone within or outside Pakistan either directly or indirectly through any natural or juridical person, including its affiliate, agent, associate, broker, consultant, director, promoter, shareholder, sponsor or subsidiary, any commission, gratification, bribe, finder's fee or kickback, whether described as consultation fee or otherwise, with the object of obtaining or inducing the procurement of a contract, right, interest, privilege or other obligation or benefit in whatsoever form from GoP, except that which has been expressly declared pursuant hereto.

[name of Supplier] certifies that it has made and will make full disclosure of all agreements and arrangements with all persons in respect of or related to the transaction with GoP and has not taken any action or will not take any action to circumvent the above declaration, representation or warranty.

[name of Supplier] accepts full responsibility and strict liability for making any false declaration, not making full disclosure, misrepresenting facts or taking any action likely to defeat the purpose of this declaration, representation and warranty. It agrees that any contract, right, interest, privilege or other obligation or benefit obtained or procured as aforesaid shall, without prejudice to any other rights and remedies available to GoP under any law, contract or other instrument, be voidable at the option of GoP.

Notwithstanding any rights and remedies exercised by GoP in this regard, [name of Supplier] agrees to indemnify GoP for any loss or damage incurred by it on account of its corrupt business practices and further pay compensation to GoP in an amount equivalent to ten time the sum of any commission, gratification, bribe, finder's fee or kickback given by [name of Supplier] as aforesaid for the purpose of obtaining or inducing the procurement of any contract, right, interest, privilege or other obligation or benefit in whatsoever form from GoP.

Name of Buyer: ……	Name of Seller/Supplier: ……
Signature: ……	Signature: ……
[Seal]	[Seal]

CONDITIONS OF CONTRACT

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CONDITIONS OF CONTRACT

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CONDITIONS OF CONTRACT

1. GENERAL PROVISIONS

1.1 Definitions

In the Contract as defined below, the words and expressions defined shall have the following meanings assigned to them, except where the context requires otherwise:

The Contract

1.1.1 "Contract" means the Contract Agreement and the other documents listed in the Contract Data.

1.1.2 "Specifications" means the document as listed in the Contract Data, including Employer's requirements in respect of design to be carried out by the Contractor (if any), and any Variation to such document.

1.1.3 "Drawings" means the Employer's drawings of the Works as listed in the Contract Data, and any Variation to such drawings.

Persons

1.1.4 "Employer" means the person named in the Contract Data and the legal successors in title to this person, but not (except with the consent of the Contractor) any assignee.

1.1.5 "Contractor" means the person named in the Contract Data and the legal successors in title to this person, but not (except with the consent of the Employer) any assignee.

1.1.6 "Party" means either the Employer or the Contractor.

Dates, Times and Periods

1.1.7 "Commencement Date" means the date fourteen (14) days after the date the Contract comes into effect or any other date named in the Contract Data.

1.1.8 "Day" means a calendar day

1.1.9 "Time for Completion" means the time for completing the Works as stated in the Contract Data (or as extended under Sub-Clause 7.3), calculated from the Commencement Date.

Money and Payments

1.1.10 "Cost" means all expenditure properly incurred (or to be incurred) by the Contractor, whether on or off the Site, including overheads and similar charges but does not include any allowance for profit.

Other Definitions

1.1.11 "Contractor's Equipment" means all machinery, apparatus and other things required for the execution of the Works but does not include Materials or Plant intended to form part of the Works.

1.1.12 "Country" means the Islamic Republic of Pakistan.

1.1.13 "Employer's Risks" means those matters listed in Sub-Clause 6.1.

1.1.14 "Force Majeure" means an event or circumstance which makes performance of a Party's obligations illegal or impracticable and which is beyond that Party's reasonable control.

1.1.15 'Materials" means things of all kinds (other than Plant) to be supplied and incorporated in the Works by the Contractor.

1.1.16 "Plant" means the machinery and apparatus intended to form or forming part of the Works.

1.1.17 "Site" means the places provided by the Employer where the Works are to be executed, and any other places specified in the Contract as forming part of the Site.

1.1.18 "Variation" means a change which is instructed by the Engineer/Employer under Sub-Clause 10.1.

1.1.19 'Works" means any or all the works whether Supply, Installation, Construction etc. and design (if any) to be performed by the Contractor including temporary works and any variation thereof.

1.1.20 "Engineer" means the person notified by the Employer to act as Engineer for the purpose of the Contract and named as such in Contract Data.

1.2 **Interpretation**

Words importing persons or parties shall include firms and organisations. Words importing singular or one gender shall include plural or the other gender where the context requires.

1.3 **Priority of Documents**

The documents forming the Contract are to be taken as mutually explanatory of one another. If an ambiguity or discrepancy is found in the documents, the priority of the documents shall be in accordance with the order as listed in the Contract Data.

1.4 **Law**

The law of the Contract is the relevant Law of Islamic Republic of Pakistan.

1.5 **Communications**

All Communications related to the Contract shall be in English language.

1.6 **Statutory Obligations**

The Contractor shall comply with the Laws of Islamic Republic of Pakistan and shall give all notices and pay all fees and other charges in respect of the Works.

2. THE EMPLOYER

2.1 **Provision of Site**

The Employer shall provide the Site and right of access thereto at the times stated in the Contract Data.

2.2 **Permits etc.**

The Employer shall, if requested by the Contractor, assist him in applying for permits, licenses or approvals which are required for the Works.

2.3 **Engineer's/Employer's Instructions**

The Contractor shall comply with all instructions given by the Employer or the Engineer, if notified by the Employer, in respect of the Works including the suspension of all or part of the Works.

2.4 **Approvals**

No approval or consent or absence of comment by the Engineer/Employer shall affect the Contractor's obligations.

3. ENGINEER'S/EMPLOYER'S REPRESENTATIVES

3.1 **Authorised Person**

The Employer shall appoint a duly authorized person to act for him and on his behalf for the purposes of this Contract. Such authorized person shall be duly identified in the Contract Data or otherwise notified in writing to the Contractor as soon as he is so appointed. In either case the Employer shall notify the Contractor, in writing, the precise scope of the authority of such authorized person at the time of his appointment.

3.2 **Engineer's/Employer's Representative**

The name and address of Engineer's/Employer's Representative is given in Contract Data. However the Contractor shall be notified by the Engineer/Employer, the delegated duties and authority before the Commencement of Works.

4. THE CONTRACTOR

4.1 **General Obligations**

The Contractor shall carry out the Works properly and in accordance with the Contract. The Contractor shall provide all supervision, labour, Materials, Plant and Contractor's Equipment which may be required.

4.2 **Contractor's Representative**

The Contractor shall appoint a representative at site on full time basis to supervise the execution of work and to receive instructions on behalf of the Contractor but only after obtaining the consent of the Employer for such appointment which consent shall not be unreasonable withheld by the Employer. Such authorized representative may be substituted/replaced by the Contractor at any time during the Contract Period but only after obtaining the consent of the Employer as aforesaid.

4.3 **Subcontracting**

The Contractor shall not subcontract the whole of the Works. The Contractor shall not subcontract any part of the Works without the consent of the Employer.

4.4 **Performance Security**

The Contractor shall furnish to the Employer within fourteen (14) days after receipt of Letter of Acceptance a Performance Security at the option of the bidder, in the form of Bank Draft or Bank Guarantee for the amount and validity specified in Contract Data.

5. DESIGN BY CONTRACTOR

5.1 **Contractor's Design**

The Contractor shall carry out design to the extent specified, as referred to in the Contract Data. The Contractor shall promptly submit to the Engineer/Employer all designs prepared by him. Within fourteen (14) days of receipt the Engineer/Employer shall notify any comments or, if the design submitted is not in accordance with the Contract, shall reject it stating the reasons. The Contractor shall not construct any element of the Works designed by him within fourteen (14) days after the design has been submitted to the Engineer/Employer or which has been rejected. Design that has been rejected shall be promptly amended and resubmitted. The Contractor shall resubmit all designs commented on taking these comments into account as necessary.

5.2 **Responsibility for Design**

The Contractor shall remain responsible for his bided design and the design under this Clause, both of which shall be fit for the intended purposes defined in the Contract and he shall also remain responsible for any infringement of any patent or copyright in respect of the same. The Engineer/Employer shall be responsible for

the Specifications and Drawings.

6. EMPLOYER'S RISKS

6.1 The Employer's Risks

The Employer's Risks are:-

a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies, within the Country**;**

b) rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war, within the Country**;**

c) riot, commotion or disorder by persons other than the Contractor's personnel and other employees including the personnel and employees of Sub-Contractors, affecting the Site and/or the Works**;**

d) ionising radiations, or contamination by radio-activity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive, or other hazardous properties of any explosive nuclear assembly or nuclear component of such an assembly, except to the extent to which the Contractor/Sub-Contractors may be responsible for the use of any radio-active material**;**

e) Pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds**;**

f) use or occupation by the Employer of any part of the Works, except as may be specified in the Contract**;**

g) late handing over of sites, anomalies in drawings, late delivery of designs and drawings of any part of the Works by the Employer's personnel or by others for whom the Employer is responsible;

h) a suspension under Sub-Clause 2.3 unless it is attributable to the Contractor's failure; and

i) physical obstructions or physical conditions other than climatic conditions, encountered on the Site during the performance of the Works, for which the Contractor immediately notified to the Employer and accepted by the Employer.

7. TIME FOR COMPLETION

7.1 Execution of the Works

The Contractor shall commence the Works on the Commencement Date and shall proceed expeditiously and without delay and shall complete the Works, subject to Sub-Clause 7.3 below, within the Time for Completion.

7.2 **Programme**

Within the time stated in the Contract Data, the Contractor shall submit to the Engineer/Employer a programme for the Works in the form stated in the Contract Data.

7.3 **Extension of Time**

The Contractor shall, within such time as may be reasonable under the circumstances, notify the Employer/Engineer of any event(s) falling within the scope of Sub-Clause 6.1 or 10.3 of these Conditions of Contract and request the Employer/Engineer for a reasonable extension in the time for the completion of Works. Subject to the aforesaid, the Employer/Engineer shall determine such reasonable extension in the time for the completion of Works as may be justified in the light of the details/particulars supplied by the Contractor in connection with the such determination by the Employer/Engineer within such period as may be prescribed by the Employer/Engineer for the same; and

the Employer shall extend the Time for Completion as determined.

7.4 **Late Completion**

If the Contractor fails to complete the Works within the Time for Completion, the Contractor's only liability to the Employer for such failure shall be to pay the amount stated in the Contract Data for each day for which he fails to complete the Works.

8. **TAKING-OVER**

8.1 **Completion**

The Contractor may notify the Engineer/Employer when he considers that the Works are complete.

8.2 **Taking-Over Notice**

Within fourteen (14) days of the receipt of the said notice of completion from the Contractor the Employer/Engineer shall either takeover the completed Works and issue a Certificate of Completion to that effect or shall notify the Contractor his reasons for not taking-over the Works. While issuing the Certificate of Completion as aforesaid, the Employer/Engineer may identify any outstanding items of work which the Contractor shall undertake during the Maintenances Period.

9. REMEDYING DEFECTS

9.1 **Remedying Defects**

The Contractor shall for a period stated in the Contract Data from the date of issue of the Certificate of Completion carry out, at no cost to the Employer, repair and

rectification work which is necessitated by the earlier execution of poor quality of work or use of below specifications material in the execution of Works and which is so identified by the Employer/Engineer in writing within the said period. Upon expiry of the said period, and subject to the Contractor's faithfully performing his aforesaid obligations, the Employer/Engineer shall issue a Maintenance Certificate whereupon all obligations of the Contractor under this Contract shall come to an end.

Failure to remedy any such defects or complete outstanding work within a reasonable time shall entitle the Employer to carry out all necessary works at the Contractor's cost. However, the cost of remedying defects not attributable to the Contractor shall be valued as a Variation.

9.2 **Uncovering and Testing**

The Engineer/Employer may give instruction as to the uncovering and/or testing of any work. Unless as a result of an uncovering and/or testing it is established that the Contractor's design, Materials, Plant or workmanship are not in accordance with the Contract, the Contractor shall be paid for such uncovering and/or testing as a Variation in accordance with Sub-Clause 10.2.

10. VARIATIONS AND CLAIMS

10.1 **Right to Vary**

The Employer/Engineer may issue Variation Order(s) in writing. Where for any reason it has not been possible for the Employer/Engineer to issue such Variations Order(s), the Contractor may confirm any verbal orders given by the Employer/Engineer in writing and if the same are not refuted/denied by the Employer/Engineer within seven (7) days of the receipt of such confirmation the same shall be deemed to be a Variation Orders for the purposes of this Sub-Clause.

10.2 **Valuation of Variations**

Variations shall be valued as follows:

a) at a lump sum price agreed between the Parties, or

b) where appropriate, at rates in the Contract, or

c) in the absence of appropriate rates, the rates in the Contract shall be used as the basis for valuation, or failing which

d) at appropriate new rates, as may be agreed or which the Engineer/Employer considers appropriate, or

e) if the Engineer/Employer so instructs, at day work rates set out in the Contract Data for which the Contractor shall keep records of hours of labour and Contractor's Equipment, and of Materials, used.

10.3 **Early Warning**

The Contractor shall notify the Engineer/Employer in writing as soon as he is aware of any circumstance which may delay or disrupt the Works, or which may give rise to a claim for additional payment.

To the extent of the Contractor's failure to notify, which results to the Engineer/Employer being unable to keep all relevant records or not taking steps to minimise any delay, disruption, or Cost, or the value of any Variation, the Contractor's entitlement to extension of the Time for Completion or additional payment shall be reduced/rejected.

10.4. **Valuation of Claims**

If the Contractor incurs Cost as a result of any of the Employer's Risks, the Contractor shall be entitled to the amount of such Cost. If as a result of any Employer's Risk, it is necessary to change the Works, this shall be dealt with as a Variation subject to Contractor's notification for intention of claim to the Engineer/Employer within fourteen (14) days of the occurrence of cause.

10.5 **Variation and Claim Procedure**

The Contractor shall submit to the Engineer/Employer an itemised make-up of the value of variations and claims within twenty eight (28) days of the instruction or of the event giving rise to the claim. The Engineer/Employer shall check and if possible agree the value. In the absence of agreement, the Employer shall determine the value.

11. CONTRACT PRICE AND PAYMENT

11.1 (a) **Terms of Payments**

The amount due to the Contractor under any Interim Payment Certificate issued by the Engineer pursuant to this Clause, or to any other terms of the Contract, shall , subject to Clause 47, be paid by the Employer to the Contractor within 30 days after such Interim Payment Certificate has been jointly verified by Employer and Contractor, or, in the case of the Final Certificate referred to in Sub Clause 60.8, within 60 days after such Final Payment Certificate has been jointly verified by Employer and Contractor; Provided that the Interim Payment shall be caused in 42 days and Final Payment in 60 days in case of foreign funded project. In the event of the failure of the Employer to make payment within the times stated, the Employer shall pay to the Contractor compensation at the 28 days rate of KIBOR+2% per annum in local currency and LIBOR+1% for foreign currency, upon all sums unpaid from the date by which the same should have been paid. The provisions of this Sub-Clause are without prejudice to the Contractor's entitlement under Clause 69.

(b) **Valuation of the Works**

The Works shall be valued as provided for in the Contract Data, subject to Clause 10.

11.2 **Monthly Statements**

The Contractor shall be entitled to be paid at monthly intervals:

a) the value of the Works executed; and

b) The percentage of the value of Materials and Plant reasonably delivered to the Site, as stated in the Contract Data, subject to any additions or deductions which may be due.

The Contractor shall submit each month to the Engineer/Employer a statement showing the amounts to which he considers himself entitled.

11.3 **Interim Payments**

Within a period not exceeding seven (7) days from the date of submission of a statement for interim payment by the Contractor, the Engineer shall verify the same and within a period not exceeding thirty (30) days from the said date of submission by the Contractor, the Employer shall pay to the Contractor the sum verified by the Engineer less retention money at the rate stated in the Contract Data.

11.4 **Retention**

Retention money shall be paid by the Employer to the Contractor within fourteen (14) days after either the expiry of the period stated in the Contract Data, or the remedying of notified defects, or the completion of outstanding work, all as referred to in Sub-Clause 9.1, which ever is the later.

11.5 **Final Payment**

Within twenty one (21) days from the date of issuance of the Maintenance Certificate the Contractor shall submit a final account to the Engineer to verify and the Engineer shall verify the same within fourteen (14) days from the date of submission and forward the same to the Employer together with any documentation reasonably required to enable the Employer to ascertain the final contract value.

Within sixty (60) days from the date of receipt of the verified final account from the Engineer, the Employer shall pay to the Contractor any amount due to the Contractor. While making such payment the Employer may, for reasons to be given to the Contractor in writing, withhold any part or parts of the verified amount.

11.6 **Currency**

Payment shall be in the currency stated in the Contract Data.

12. DEFAULT

12.1 **Default by Contractor**

If the Contractor abandons the Works, refuses or fails to comply with a valid instruction of the Engineer/Employer or fails to proceed expeditiously and without delay, or is, despite a written complaint, in breach of the Contract, the Employer may give notice referring to this Sub-Clause and stating the default.

If the Contractor has not taken all practicable steps to remedy the default within fourteen (14) days after receipt of the Employer's notice, the Employer may by a second notice given within a further twenty one (21) days, terminate the Contract. The Contractor shall then demobilise from the Site leaving behind any Contractor's Equipment which the Employer instructs, in the second notice, to be used for the completion of the Works at the risk and cost of the Contractor.

12.2 **Default by Employer**

If the Employer fails to pay in accordance with the Contract, or is, despite a written complaint, in breach of the Contract, the Contractor may give notice referring to this Sub-Clause and stating the default. If the default is not remedied within fourteen (14) days after the Employer's receipt of this notice, the Contractor may suspend the execution of all or parts of the Works.

If the default is not remedied within twenty eight (28) days after the Employer's receipt of the Contractor's notice, the Contractor may by a second notice given within a further twenty one (21) days, terminate the Contract. The Contractor shall then demobilise from the Site.

12.3 **Insolvency**

If a Party is declared insolvent under any applicable law, the other Party may by notice terminate the Contract immediately. The Contractor shall then demobilise from the Site leaving behind, in the case of the Contractor's insolvency, any Contractor's Equipment which the Employer instructs in the notice is to be used for the completion of the Works.

12.4 **Payment upon Termination**

After termination, the Contractor shall be entitled to payment of the unpaid balance of the value of the Works executed and of the Materials and Plant reasonably delivered to the Site, adjusted by the following:

a) any sums to which the Contractor is entitled under Sub-Clause 10.4,

b) any sums to which the Employer is entitled,

c) if the Employer has terminated under Sub-Clause 12.1 or 12.3, the Employer shall be entitled to a sum equivalent to twenty percent (20%) of the value of parts of the Works not executed at the date of the termination, and

d) if the Contractor has terminated under Sub-Clause 12.2 or 12.3, the Contractor shall be entitled to the cost of his demobilisation together with a sum equivalent to ten percent (10%) of the value of parts of the Works not executed at the date of termination.

The net balance due shall be paid or repaid within twenty eight (28) days of the notice of termination.

13. RISKS AND RESPONSIBILITIES

13.1 Contractor's Care of the Works

Subject to Sub-Clause 9.1, the Contractor shall take full responsibility for the care of the Works from the Commencement Date until the date of the Employer's/Engineer's issuance of Certificate of Completion under Sub-Clause 8.2. Responsibility shall then pass to the Employer. If any loss or damage happens to the Works during the above period, the Contractor shall rectify such loss or damage so that the Works conform with the Contract.

Unless the loss or damage happens as a result of any of the Employer's Risks, the Contractor shall indemnify the Employer, or his agents against all claims loss, damage and expense arising out of the Works.

13.2 Force Majeure

If Force Majeure occurs, the Contractor shall notify the Engineer/Employer immediately. If necessary, the Contractor may suspend the execution of the Works and, to the extent agreed with the Employer demobilise the Contractor's Equipment.

If the event continues for a period of eighty four (84) days, either Party may then give notice of termination which shall take effect twenty eight (28) days after the giving of the notice.

After termination, the Contractor shall be entitled to payment of the unpaid balance of the value of the Works executed and of the Materials and Plant reasonably delivered to the Site, adjusted by the following:

a) any sums to which the Contractor is entitled under Sub-Clause 10.4,

b) the cost of his demobilization, and

c) less any sums to which the Employer is entitled.

The net balance due shall be paid or repaid within thirty five (35) days of the notice of termination.

14. INSURANCE

14.1 Arrangements

The Contractor shall, prior to commencing the Works, effect insurances of the types, in the amounts and naming as insured the persons stipulated in the Contract Data except for items (a) to (e) and (i) of the Employer's Risks under Sub-Clause 6.1. The policies shall be issued by insurers and in terms approved by the Employer.

The Contractor shall provide the Engineer/Employer with evidence that any required policy is in force and that the premiums have been paid.

14.2 **Default**

If the Contractor fails to effect or keep in force any of the insurances referred to in the previous Sub-Clause, or fails to provide satisfactory evidence, policies or receipts, the Employer may, without prejudice to any other right or remedy, effect insurance for the cover relevant to such as a default and pay the premiums due and recover the same plus a sum in percentage given in Contractor Data from any other amounts due to the Contractor.

15. RESOLUTION OF DISPUTES

15.1 **Engineer's Decision**

If a dispute of any kind whatsoever arises between the Employer and the Contractor in connection with the Works, the matter in dispute shall, in the first place, be referred in writing to the Engineer, with a copy to the other party. Such reference shall state that it is made pursuant to this Clause. No later than the twenty eight (28) days after the day on which he received such reference, the Engineer shall give notice of his decision to the Employer and the Contractor.

Unless the Contract has already been repudiated or terminated, the Contractor shall, in every case, continue to proceed with the Work with all due diligence, and the Contractor and the Employer shall give effect forthwith to every such decision of the Engineer unless and until the same shall be revised, as hereinafter provided in an arbitral award.

15.2 **Notice of Dissatisfaction**

If a Party is dissatisfied with the decision of the Engineer or if no decision is given within the time set out in Sub-Clause 15.1 hereabove, the Party may give notice of dissatisfaction referring to this Sub-Clause within fourteen (14) days of receipt of the decision or the expiry of the time for the decision. If no notice of dissatisfaction is given within the specified time, the decision shall be final and binding on the Parties. If notice of dissatisfaction is given within the specified time, the decision shall be binding on the Parties who shall give effect to it without delay unless and until the decision of the Engineer is revised by an arbitrator.

15.3 **Arbitration**

A dispute which has been the subject of a notice of dissatisfaction shall be finally settled as per provisions of Arbitration Act 1940 (Act No. X of 1940) and Rules made thereunder and any statutory modifications thereto. Any hearing shall be held at the place specified in the Contract Data and in the language referred to in Sub-Clause 1.5.

16 INTEGRITY PACT

16.1 If the Contractor, or any of his Sub-Contractors, agents or servants is found to have violated or involved in violation of the Integrity Pact signed by the Contractor as Schedule-F to his Bid, then the Employer shall be entitled to:

(a) recover from the Contractor an amount equivalent to ten times the sum of any commission, gratification, bribe, finder's fee or kickback given by the Contractor or any of his Sub-Contractors, agents or servants;

(b) terminate the Contract; and

(c) recover from the Contractor any loss or damage to the Employer as a result of such termination or of any other corrupt business practices of the Contractor or any of his Sub-Contractors, agents or servants.

On termination of the Contract under Sub-Para (b) of this Sub-Clause, the Contractor shall demobilize from the Site leaving behind Contractor's Equipment which the Employer instructs, in the termination notice, to be used for the completion of the Works at the risk and cost of the Contractor. Payment upon such termination shall be made under Sub-Clause 12.4, in accordance with Sub-Para (c) thereof, after having deducted the amounts due to the Employer under Sub-Para (a) and (c) of this Sub-Clause.

CONTRACT DATA

(Note: Except where otherwise indicated, all Contract Data should be filled in by the Employer prior to issuance of the Bidding Documents.)

Sub-Clauses of
Conditions of Contract

1.1.3 Employer's Drawings, if any
(To be listed by the Employer)

1.1.4 **The Employer** means
"Employer" means the person named as such in Part II of these Conditions and the legal successors in title to such person, but not (except with the consent of the Contractor) any assignee of such person.

1.1.5 **The Contractor** means
"Contractor" means the person whose tender has been accepted by the Employer and the legal successors in title to such person, but not (except with the consent of the Employer) any assignee of such person.

1.1.7 **Commencement Date** means the date of issue of Engineer's Notice to Commence which shall be issued within fourteen (14) days of the signing of the Contract Agreement.

1.1.9 **Time for Completion** Twelve (12) Months

1.1.20 **Engineer**
"Engineer" means the person appointed by the Employer to act as Engineer for the purposes of the Contract and named as such in Part II of these Conditions.

1.3 **Documents forming the Contract listed in the order of priority:**

(a) The Contract Agreement
(b) Letter of Acceptance
(c) The completed Form of Bid
(d) Contract Data
(e) Conditions of Contract
(f) The completed Schedules to Bid including Schedule of Prices
(g) The Drawings, if any
(h) The Specifications
(i) Subsequent correspondence
(j) _____
(k)

2.1 **Provision of Site:** On the Commencement Date*

3.1 **Authorised person :Project Coordinator / Civil Engineer**

3.2 **Name and address of Engineer's/Employer's representative**
Messrs. TACE (Pvt.) Limited.
Head Office: R-210, Abid Town, Block-2, Gulshan-e-Iqbal, Karachi.
Tel: (92) 21 34986237 (92) 34964622, Email: info@tace.com.pk

4.4 **Performance Security:**

Amount: 05 % of Contract Price stated in the Letter of Acceptance in the form of Pay Order / Bank Guarantee issued by Scheduled Bank of Pakistan

Validity: The performance security shall be valid until the Contractor has executed and completed the Works and remedied any defects therein in accordance with the Contract. No claim shall be made against such security after the issue of the Defects Liability Certificate in accordance with Sub-Clause 62.1 and such security shall be returned to the Contractor within 14 days of the issue of the said Defects Liability Certificate

(Form: As provided under Standard Forms* of these Documents)

5.1 **Requirements for Contractor's design (if any):**

Specification Clause No's_____

7.2 **Programme:**

Time for submission: Within fourteen (14) days* of the Commencement Date.

Form of programme: _____(Bar Chart/CPM/PERT or other)

7.4 Amount payable due to failure to complete shall be _0.10_ % per day up to a maximum of (10%) * of sum stated in the Letter of Acceptance

9.1 **Period for remedying defects**
180 days from the effective date of Taking Over Certificate.

10.2 (e) **Variation procedure:**

Day work rates_____
_____(details)

11.1 ***(a) Terms of Payments**

Payment of Contract Price shall be made in the following manners**:**

i) Mobilization advance as per clause no. 60.12,

ii) Minimum amount of interim payment certificate shall be Rs. 5.00 million and in accordance with clause 60.10

iii) Half of Five percent (5%) retention money shall be paid on the date of issuance of Certificate of Completion as per Clause 60.3 of Conditions of Contract, and

11.2 (b) **Percentage of value of Materials:**
Materials as per clause no. 60.11

11.3 **Percentage of retention:** five (5%)

11.6 **Currency of payment:** Pak. Rupees

14.1 **Insurances:**

Type of cover

The Works

Amount of cover

The sum stated in the Letter of Acceptance plus fifteen percent (15%)

Type of cover

Contractor's Equipment:

Amount of cover

Full replacement cost

---

* (Employer to amend as appropriate)

Type of cover

Third Party-injury to persons and damage to property as per clause no. 23.2, and minimum Rs. 500,000/-0 per occurrence with number of occurrences unlimited.

14.2 **Amount to be recovered**

Premium plus _____percent (____%).

15.3 **Arbitration**

Place of Arbitration: Karachi, Pakistan.

STANDARD FORMS

(Note: Standard Forms provided in this document for securities are to be issued by a bank. In case the bidder chooses to issue a bond for accompanying his bid or performance of contract or receipt of advance, the relevant format shall be tailored accordingly without changing the spirit of the Forms of securities).

FORM OF BID SECURITY
(Bank Guarantee)

Guarantee No._____
Executed on _____

(Letter by the Guarantor to the Employer)

Name of Guarantor (Scheduled Bank in Pakistan) with address:_____
Name of Principal (Bidder) with address:_____
_____
Penal Sum of Security (express in words and figures):_____
_____
Bid Reference No._____Date of Bid _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bid and at the request of the said Principal, we the Guarantor above-named are held and firmly bound unto the _____, (hereinafter called The "Employer") in the sum stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the accompanying Bid numbered and dated as above for _____(Particulars of Bid) to the said Employer; and

WHEREAS, the Employer has required as a condition for considering the said Bid that the Principal furnishes a Bid Security in the above said sum to the Employer, conditioned as under:

(1) that the Bid Security shall remain valid for a period of twenty eight (28) days beyond the period of validity of the bid;
(2) that in the event of;

(a) the Principal withdraws his Bid during the period of validity of Bid, or

(b) the Principal does not accept the correction of his Bid Price, pursuant to Sub-Clause 16.4 (b) of Instructions to Bidders, or

(c) failure of the successful bidder to

(i) furnish the required Performance Security, in accordance with Sub-Clause IB-21**.**1 of Instructions to Bidders, or

(ii) sign the proposed Contract Agreement, in accordance with Sub-Clauses IB-20.2 & 20.3 of Instructions to Bidders,

the entire sum be paid immediately to the said Employer for delayed completion and

not as penalty for the successful bidder's failure to perform.

NOW THEREFORE, if the successful bidder shall, within the period specified therefore, on the prescribed form presented to him for signature enter into a formal Contract Agreement with the said Employer in accordance with his Bid as accepted and furnish within fourteen (14) days of receipt of Letter of Acceptance, a Performance Security with good and sufficient surety , as may be required, upon the form prescribed by the said Employer for the faithful performance and proper fulfilment of the said Contract or in the event of non-withdrawal of the said Bid within the time specified then this obligation shall be void and of no effect, but otherwise to remain in full force and effect.

PROVIDED THAT the Guarantor shall forthwith pay to the Employer the said sum stated above upon first written demand of the Employer without cavil or argument and without requiring the Employer to prove or to show grounds or reasons for such demand, notice of which shall be sent by the Employer by registered post duly addressed to the Guarantor at its address given above.

PROVIDED ALSO THAT the Employer shall be the sole and final judge for deciding whether the Principal has duly performed his obligations to sign the Contract Agreement and to furnish the requisite Performance Security within the time stated above, or has defaulted in fulfilling said requirements and the Guarantor shall pay without objection the sum stated above upon first written demand from the Employer forthwith and without any reference to the Principal or any other person.

IN WITNESS WHEREOF, the above bounded Guarantor has executed the instrument under its seal on the date indicated above, the name and seal of the Guarantor being hereto affixed and these presents duly signed by its undersigned representative pursuant to authority of its governing body.

_____
Guarantor (Bank)

Witness:

1. _____

_____
Corporate Secretary (Seal)

2. _____

_____
(Name, Title & Address)

1. Signature _____

2. Name _____

3. Title _____

Corporate Guarantor (Seal)

FORM OF PERFORMANCE SECURITY
(Bank Guarantee)

Guarantee No._____
Executed on _____

(Letter by the Guarantor to the Employer)

Name of Guarantor (Scheduled Bank in Pakistan) with

address:_____

Name of Principal (Contractor) with
address:_____

_____

Penal Sum of Security (express in words and
figures)_____

_____

Letter of Acceptance No._____Dated _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bidding Documents and above said Letter of Acceptance (hereinafter called the Documents) and at the request of the said Principal we, the Guarantor above named, are held and firmly bound unto the _____ (hereinafter called the Employer) in the penal sum of the amount stated above, for the payment of which sum well and truly to be made to the said Employer, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has accepted the Employer's above said Letter of Acceptance for _____ _____(Name of Contract) for the _____

_____(Name of Project).

NOW THEREFORE, if the Principal (Contractor) shall well and truly perform and fulfill all the undertakings, covenants, terms and conditions of the said Documents during the original terms of the said Documents and any extensions thereof that may be granted by the Employer, with or without notice to the Guarantor, which notice is, hereby, waived and shall also well and truly perform and fulfill all the undertakings, covenants terms and conditions of the Contract and of any and all modifications of the said Documents that may hereafter be made, notice of which modifications to the Guarantor being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue till all requirements of Clause 9, Remedying Defects, of Conditions of Contract are fulfilled.

Our total liability under this Guarantee is limited to the sum stated above and it is a condition of any liability attaching to us under this Guarantee that the claim for payment in writing shall be received by us within the validity period of this Guarantee, failing which we shall be discharged of our liability, if any, under this Guarantee.

We, _____(the Guarantor), waiving all objections and defences under the Contract, do hereby irrevocably and independently guarantee to pay to the Employer without delay upon the Employer's first written demand without cavil or arguments and without requiring the Employer to prove or to show grounds or reasons for such demand any sum or sums up to the amount stated above, against the Employer's written declaration that the Principal has refused or failed to perform the obligations under the Contract, for which payment will be effected by the Guarantor to Employer's designated Bank & Account Number.

PROVIDED ALSO THAT the Employer shall be the sole and final judge for deciding whether the Principal (Contractor) has duly performed his obligations under the Contract or has defaulted in fulfilling said obligations and the Guarantor shall pay without objection any sum or sums up to the amount stated above upon first written demand from the Employer forthwith and without any reference to the Principal or any other person.

IN WITNESS WHEREOF, the above bounded Guarantor has executed this Instrument under its seal on the date indicated above, the name and corporate seal of the Guarantor being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

_____
Guarantor (Bank)

Witness:

1. _____

_____
Corporate Secretary (Seal)

2. _____

_____
(Name, Title & Address)

1. Signature _____
2. Name _____
3. Title _____

_____
Corporate Guarantor (Seal)

FORM OF CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT (hereinafter called the "Agreement") made on the day of _____ 200 ____ between _____(hereinafter called the "Employer") of the one part and _____(hereinafter called the "Contractor") of the other part.

WHEREAS the Employer is desirous that certain Works, viz _____ should be executed by the Contractor and has accepted a Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein.

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 after incorporating addenda, if any except those parts relating to Instructions to Bidders, shall be deemed to form and be read and construed as part of this Agreement, viz:

   (a) The Letter of Acceptance;
   (b) The completed Form of Bid alongwith Schedules to Bid;
   (c) Conditions of Contract & Contract Data;
   (d) The priced Schedule of Prices;
   (e) The Specifications; and
   (f) The Drawings

3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy defects therein in conformity and in all respects within the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor, in consideration of the execution and completion of the Works as per provisions of the Contract, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS WHEREOF the parties hereto have caused this Contract Agreement to be executed on the day**,** month and year first before written in accordance with their respective laws.

Signature of the Contactor	Signature of the Employer
_____	_____
(Seal)	(Seal)

Signed, Sealed and Delivered in the presence of:

Witness:	Witness:
_____	_____
(Name, Title and Address)	(Name, Title and Address)

FORM OF BANK GUARANTEE FOR ADVANCE PAYMENT

Guarantee No._____

Executed on_____

(Letter by the Guarantor to the Employer)

WHEREAS the _____ (hereinafter called the Employer) has entered into a Contract for _____

_____

_____ (Particulars of Contract), with

_____

_____(hereinafter called the Contractor).

AND WHEREAS the Employer has agreed to advance to the Contractor, at the Contractor's request, an amount of Rs._____ Rupees _____) which amount shall be advanced to the Contractor as per provisions of the Contract.

AND WHEREAS the Employer has asked the Contractor to furnish Guarantee to secure the advance payment for the performance of his obligations under the said Contract.

AND WHEREAS _____ (Scheduled Bank) (hereinafter called the Guarantor) at the request of the Contractor and in consideration of the Employer agreeing to make the above advance to the Contractor, has agreed to furnish the said Guarantee.

NOW THEREFORE the Guarantor hereby guarantees that the Contractor shall use the advance for the purpose of above-mentioned Contract and if he fails, and commits default in fulfillment of any of his obligations for which the advance payment is made, the Guarantor shall be liable to the Employer for payment not exceeding the aforementioned amount.

Notice in writing of any default, of which the Employer shall be the sole and final judge, as aforesaid, on the part of the Contractor, shall be given by the Employer to the Guarantor, and on such first written demand payment shall be made by the Guarantor of all sums then due under this Guarantee without any reference to the Contractor and without any objection.

This Guarantee shall come into force as soon as the advance payment has been credited to the account of the Contractor.

This Guarantee shall expire not later than _____

by which date we must have received any claims by registered letter, telegram, telex or telefax.

It is understood that you will return this Guarantee to us on expiry or after settlement of the total amount to be claimed hereunder.

_____
Guarantor (Scheduled Bank)

Witness:

1. _____

_____
Corporate Secretary (Seal)

2. _____

_____
(Name, Title & Address)

1. Signature _____
2. Name _____
3. Title _____

_____
Corporate Guarantor (Seal)

PRICE ADJUSTMENT UNDER CLAUSE 70.1 OF CONDITIONS OF CONTRACT

The source of indices and the weightages or coefficients for use in the adjustment formula under Clause 70 shall be as follows:

Cost Element	Description		Weightages	Applicable index
1	2		3	4
(i)	Fixed Portion		0.350	--
(ii)	Local Labour		0.100	Government of Pakistan (GP) Federal Bureau of Statistics (FBS) Monthly Statistical Bulletin.
(iii)	Cement – in bags		0.100	" " "
(iv)	Reinforcing Steel		0.100	" " "
(v)	High Speed Diesel (HSD)		0.100	" " "
(vi)	Porcelain Tiles		0.100	" " "
(vii)	Aluminum doors, windows, ventilators		0.100	
(viii)	Armourd copper conductor, main electrical cable.		0.050	
	Total		1.000	" " "

Notes:

1) Indices for "(ii)" to "(vi)" are taken from the Government of Pakistan Federal Bureau of Statistics, Monthly Statistical Bulletin. The base cost indices or prices shall be those applying 28 days prior to the latest day for submission of bids. Current indices or prices shall be those applying 28 days prior to the last day of the billing period.

2) Any fluctuation in the indices or prices of materials other than those given above shall not be subject to adjustment of the Contract Price.

3) Fixed portion shown here is for typical road project, Employer to determine the weightage of Fixed Portion considering only those cost elements having cost impact of seven (7) percent or more on his specific project.

(Employers using this price adjustment provisions may add or delete any elements as deemed appropriate to the project.)


FIDIC

FEDERATION INTERNATIONAL DES INGENIEURS-CONSEILS

CONSTRUCTION CONDITIONS OF CONTRACT FOR WORKS OF CIVIL ENGINEERING CONSTRUCTION

PART I GENERAL CONDITIONS
WITH FORMS OF TENDER AND AGREEMENT

FOURTH EDITION 1987
Reprinted 1988 with editorial amendments
Reprinted in 1992 with further amendments

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PART I - GENERAL CONDITIONS

Definitions and Interpretation

1.1 **Definitions**

In the Contract (as hereinafter defined) the following words and expressions shall have the meanings hereby assigned to them, except where the context otherwise requires:

(a) (i) "Employer" means the person named as such in Part II of these Conditions and the legal successors in title to such person, but not (except with the consent of the Contractor) any assignee of such person.

(ii) "Contractor" means the person whose tender has been accepted by the Employer and the legal successors in title to such person, but not (except with the consent of the Employer) any assignee of such person.

(iii) "Subcontractor" means any person named in the Contract as a Subcontractor for a part of the Works or any person to whom a part of the Works has been subcontracted with the consent of the Engineer and the legal successors in title to such person, but not any assignee of any such person.

(iv) "Engineer" means the person appointed by the Employer to act as Engineer for the purposes of the Contract and named as such in Part II of these Conditions.

(v) "Engineer's Representative" means a person appointed from time to time by the Engineer under Sub-Clause 2.2.

(b) (i) "Contract" means these Conditions (Parts I and II), the Specification, the Drawings, the Bill of Quantities, the Tender, the Letter of Acceptance, the Contract Agreement (if completed) and such further documents as may be expressly incorporated in the Letter of Acceptance or Contract Agreement (if completed).

(ii) "Specification" means the specification of the Works included in the Contract and any modification thereof or addition thereto made under Clause 51 or submitted by the Contractor and approved by the Engineer.

(iii) "Drawings" means all drawings, calculations and technical information of a like nature provided by the Engineer to the Contractor under the Contract and all drawings, calculations, samples, patterns, models, operation and maintenance manuals and other technical information of a like nature submitted by the Contractor and approved by the Engineer.

(iv) "Bill of Quantities" means the priced and completed bill of quantities forming part of the Tender.

(v) "Tender" means the Contractor's priced offer to the Employer for the

execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract, as accepted by the Letter of Acceptance.

(vi) "Letter of Acceptance" means the formal acceptance by the Employer of the Tender.

(vii) "Contract Agreement" means the contract agreement (if any) referred to in Sub-Clause 9.1.

(viii) "Appendix to Tender" means the appendix comprised in the form of Tender annexed to these Conditions.

(c) (i) "Commencement Date" means the date upon which the Contractor receives the notice to commence issued by the Engineer pursuant to Clause 41.

(ii) "Time for Completion" means the time for completing the execution of and passing the Tests on Completion of the Works or any Section or part thereof as stated in the Contract (or as extended under Clause 44) calculated from the Commencement Date.

(d) (i) "Tests on Completion" means the tests specified in the Contract or otherwise agreed by the Engineer and the Contractor which are to be made by the Contractor before the Works of any Section or part thereof are taken over by the Employer.

(ii) "Taking-Over Certificate" means a certificate issued pursuant to Clause 48.

(e) (i) "Contract Price" means the sum stated in the Letter of Acceptance as payable to the Contractor for the execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract.

(ii) "Retention Money" means the aggregate of all monies retained by the Employer pursuant to Sub-Clause 60.2(a).

(iii) “Interim Payment Certificate” means any certificate of payment issued by the Engineer other than the Final Payment Certificate.

(iv) “Final Payment Certificate” means the certificate of payment issued by the Engineer pursuant to Sub-Clause 60.8.

(f) (i) "Works" means the Permanent Works and the Temporary Works or either of them as appropriate.

(ii) "Permanent Works" means the permanent works to be executed (including Plant) in accordance with the Contract

(iii) "Temporary Works" means all temporary works of every kind (other than Contractor's Equipment) required in or about the execution and completion of the Works and the remedying of any defects therein.

(iv) "Plant" means machinery, apparatus and the like intended to form or forming part of the Permanent Works.

(v) "Contractor's Equipment" means all appliances and things of whatsoever nature (other than Temporary Works) required for the execution and completion of the Works and the remedying of any defects therein, but does not include Plant, materials or other things intended to form or forming part of the Permanent Works.

(vi) "Section" means a part of the Works specifically identified in the Contract as a Section.

(vii) "Site" means the places provided by the Employer where the Works are to be executed and any other places as may be specifically designated in the Contract as forming part of the Site.

(g) (i) "cost" means all expenditure properly incurred or to be incurred, whether, on or off the Site, including overhead and other charges properly allocable thereto but does not include any allowance for profit.

(ii) "day" means calendar day.

(iii) "foreign currency" means a currency of a country other than that in which the Works are to be located.

(iv) "writing" means any hand-written, type-written, or printed communication, including telex, cable and facsimile transmission.

1.2 **Headings and Marginal Notes**

The headings and marginal notes in these Conditions shall not be deemed part thereof or be taken into consideration in the interpretation or construction thereof or of the Contract.

1.3 **Interpretation**

Words importing persons or parties shall include firms and corporations and any organization having legal capacity.

1.4 **Singular and Plural**

Words importing the singular only also include the plural and vice versa where the context requires.

1.5 **Notices, Consents, Approvals, Certificates and Determinations**

Wherever in the Contract provision is made for the giving or issue of any notice, consent, approval, certificate or determination by any person, unless otherwise specified such notice, consent, approval, certificate or determination shall be in writing and the words "notify", "certify or "determine" shall be construed

accordingly. Any such consent, approval, certificate or determination shall not unreasonably be withheld or delayed.

Engineer and Engineer's Representative

2.1 Engineer's Duties and Authority

(a) The Engineer shall carry out the duties specified in the Contract.

(b) The Engineer may exercise the authority specified in or necessarily to be implied from the Contract, provided, however, that if the Engineer is required, under the terms of his appointment by the Employer, to obtain the specific approval of the Employer before exercising any such authority, particulars of such requirements shall be set out in Part II of these Conditions. Provided further that any requisite approval shall be deemed to have been given by the Employer for any such authority exercised by the Engineer.

(c) Except as expressly stated in the Contract, the Engineer shall have no authority to relieve the Contractor of any of his obligations under the Contract.

2.2 Engineer's Representative

The Engineer's Representative shall be appointed by and be responsible to the Engineer and shall carry out such duties and exercise such authority as may be delegated to him by the Engineer under Sub-Clause 2.3.

2.3 Engineer's Authority to Delegate

The Engineer may from time to time delegate to the Engineer's Representative any of the duties and authorities vested in the Engineer and he may at any time revoke such delegation. Any such delegation or revocation shall be in writing and shall not take effect until a copy thereof has been delivered to the Employer and the Contractor.

Any communication given by the Engineer's Representative to the Contractor in accordance with such delegation shall have the same effect as though it had been given by the Engineer. Provided that:

(a) any failure of the Engineer's Representative to disapprove any work, materials or Plant shall not prejudice the authority of the Engineer to disapprove such work, materials or Plant and to give instructions for the rectification thereof; and

(b) if the Contractor questions any communication of the Engineer's Representative he may refer the matter to the Engineer who shall confirm, reverse or vary the contents of such communication.

2.4 Appointment of Assistants

The Engineer or the Engineer's Representative may appoint any number of persons to assist the Engineer's Representative in the carrying out of his duties under Sub-Clause 2.2. He shall notify to the Contractor the names, duties and scope of authority of such persons. Such assistants shall have no authority to issue any instructions to the Contractor save in so far as such instructions may be necessary to enable them to carry out their duties and to secure their acceptance of materials, Plant or workmanship as being in accordance with the Contract, and any instructions given by any of them for those purposes shall be deemed to have been given by the Engineer's Representative.

2.5 **Instructions in Writing**

Instructions given by the Engineer shall be in writing, provided that if for any reason the Engineer considers it necessary to give any such instruction orally, the Contractor shall comply with such instruction. Confirmation in writing of such oral instruction given by the Engineer, whether before or after the carrying out of the instruction, shall be deemed to be an instruction within the meaning of this Sub-Clause. Provided further that if the Contractor, within 7 days, confirms in writing to the Engineer any oral instruction of the Engineer and such confirmation is not contradicted in writing within 7 days by the Engineer, it shall be deemed to be an instructions of the Engineer.

The provisions of this Sub-Clause shall equally apply to instructions given by the Engineer's Representative and any assistants of the Engineer or the Engineer's Representative appointed pursuant to Sub-Clause 2.4.

2.6 **Engineer to Act Impartially**

Wherever, under the Contract, the Engineer is required to exercise his discretion by:
(a) giving his decision, opinion or consent,
(b) expressing his satisfaction or approval,
(c) determining value, or

(d) otherwise taking action which may affect the rights and obligations of the Employer or the Contractor

he shall exercise such discretion impartially within the terms of the Contract and having regard to all the circumstances. Any such decision, opinion, consent expression of satisfaction, or approval, determination of value or action may be opened up, reviewed or revised as provided in Clause 67.

Assignment and Subcontracting

3.1 **Assignment of Contract**

The Contractor shall not, without the prior consent of the Employer (which consent, notwithstanding the provisions of Sub-Clause 1.5, shall be at the sole discretion of the Employer), assign the Contract or any part thereof, or any benefit or interest therein or thereunder, otherwise than by:

(a) a charge in favour of the Contractor's bankers of any monies due or to become due under the Contract, or

(b) assignment to the Contractor's insurers (in cases where the insurers have discharged the Contractor's loss or liability) of the Contractor's right to obtain relief against any other party liable.

4.1 **Subcontracting**

The Contractor shall not subcontract the whole of the Works. Except where otherwise provided by the Contract, the Contractor shall not subcontract any part of the Works without the prior consent of the Engineer. Any such consent shall 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 Subcontractor, his agents, servants or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents servants or workmen.

Provided that the Contractor shall not be required to obtain such consent for:

(a) the provision of labour,

(b) the purchase of materials which are in accordance with the standards specified in the Contract,

(c) the subcontracting of any part of the Works for which the Subcontractor is named in the Contract.

4.2 **Assignment of Subcontractors' Obligations**

In the event of a Subcontractor having undertaken towards the Contractor in respect of the work executed, or the goods, materials, Plant or services supplied by such Subcontractor, any continuing obligation extending for a period exceeding that of the Defects Liability Period under the Contract, the Contractor shall at any time, after the expiration of such Period, assign to the Employer, at the Employer's request and cost, the benefit of such obligation for the unexpired duration thereof.

Contract Documents

5.1 **Language/s and Law**

There is stated in Part II of these Conditions:

(a) the language or languages in which the Contract documents shall be drawn up, and

(b) the country or state the law of which shall apply to the Contract and according to which the Contract shall be construed.

If the said documents are written in more than one language, the language according to which the Contract shall be construed and interpreted is also stated in Part II of these Conditions, being therein

designated the "Ruling Language".

5.2 **Priority of Contract Documents**

The several documents forming the 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 Engineer who shall thereupon issue to the Contractor instructions thereon and in such event, unless otherwise provided in the Contract, the priority of the documents forming the Contract shall be as follows:

(1) The Contract Agreement (if completed);
(2) The Letter of Acceptance;
(3) The Tender;
(4) Part II of these Conditions;
(5) Part I of these Conditions; and
(6) Any other document forming part of the Contract.

6.1 **Custody and Supply of Drawings and Documents**

The Drawings shall remain in the sole custody of the Engineer, but two copies thereof shall be provided to the Contractor free of charge. The Contractor shall make at his own cost any further copies required by him. Unless it is strictly necessary for the purposes of the Contract, the Drawings, Specification and other documents provided by the Employer or the Engineer shall not, without the consent of the Engineer, be used or communicated to a third party by the Contractor. Upon issue of the Defects Liability Certificate, the Contractor shall return to the Engineer all Drawings, Specification and other documents provided under the Contract.

The Contractor shall supply to the Engineer four copies of all Drawings, specification and other documents submitted by the Contractor and approved by the Engineer in accordance with Clause 7, together with a reproducible copy of any material which cannot be reproduced to an equal standard by photocopying. In addition the Contractor shall supply such further copies of such Drawings, Specification and other documents as the Engineer may request in writing for the use of the Employer, who shall pay the cost thereof.

6.2 **One Copy of Drawings to be Kept on Site**

One copy of the Drawings, provided to or supplied by the Contractor as aforesaid, shall be kept by the Contractor on the Site and the same shall at all reasonable times be available for inspection and use by the Engineer and by any other person authorised by the Engineer in writing.

6.3 **Disruption of Progress**

The Contractor shall give notice to the Engineer, with a copy to the Employer, whenever planning or execution of the Works is likely to be delayed or disrupted unless any further drawing or instruction is issued by the Engineer within a reasonable time. The notice shall include details of the drawing or instruction required and of why and by when it is required and of any delay or disruption likely to be suffered if it is late.

6.4 **Delay and Cost of Delay of Drawings**

If, by reason of any failure or inability of the Engineer to issue, within a time reasonable in all the circumstances, any drawing or instruction for which notice has been given by the Contractor in accordance with Sub-Clause 6.3, the Contractor suffers delay and/or incurs costs then the Engineer shall, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and

(b) the amount of such costs, which shall be added to the Contract Price, and shall notify the Contractor accordingly, with a copy to the Employer.

6.5 **Failure by Contractor to Submit Drawings**

If the failure or inability of the Engineer to issue any drawings or instructions is caused in whole or in part by the failure of the Contractor to submit Drawings, Specification or other documents which he is required to submit under the Contract, the Engineer shall take such failure by the Contractor into account when making his determination pursuant to Sub-Clause 6.4.

7.1 **Supplementary Drawings and Instructions**

The Engineer shall have authority to issue to the Contractor, from time to time, such supplementary Drawings and instructions as shall be necessary for the purpose of the proper and adequate execution and completion of the Works and the remedying of any defects therein. The Contractor shall carry out and be bound by the same.

7.2 **Permanent Works Designed by Contractor**

Where the Contract expressly provides that part of the Permanent Works shall be designed by the Contractor, he shall submit to the Engineer, for approval:

(a) such drawings, specifications, calculations and other information as shall be necessary to satisfy the Engineer as to the suitability and adequacy of that design, and

(b) operation and maintenance manuals together with drawings of the Permanent Works as completed, in sufficient detail to enable the Employer to operate, maintain, dismantle, reassemble and adjust the Permanent Works incorporating that design. The Works shall not be considered to be completed for the purposes of taking over in accordance with Clause 48 until such operation and maintenance manuals together with drawings on completion have been submitted to and approved by the Engineer.

7.3 **Responsibility Unaffected by Approval**

Approval by the Engineer, in accordance with Sub-Clause 7.2, shall not relieve the Contractor of any of his responsibilities under the Contract.

General Obligations

8.1 Contractor's General Responsibilities

The Contractor shall, with due care and diligence, design (to the extent provided for by the Contract), execute and complete the Works and remedy any defects therein in accordance with the provisions of the Contract. The Contractor shall provide all superintendance, labour, material, Plant, Contractor's Equipment and all other things, whether of a temporary or permanent nature, required in and for such design, execution, completion and remedying of any defects, so far as the necessity for providing the same is specified in or is reasonably to be inferred from the Contract.

8.2 Site Operations and Methods of Construction

The Contractor shall take full responsibility for the adequacy, stability and safety of all Site operations and methods of construction. Provided that the Contractor shall not be responsible (except as stated hereunder or as may be otherwise agreed) for the design or specification of Permanent Works, or for the design or specification of any Temporary Works not prepared by the Contractor. Where the Contract expressly provides that part of the Permanent Works shall be designed by the Contractor, he shall be fully responsible for that part of such Works, notwithstanding any approval by the Engineer.

9.1 Contract Agreement

The Contractor shall, if called upon so to do, enter into and execute the Contract Agreement, to be prepared and completed at the cost of the Employer, in the form annexed to these Conditions with such modification as may be necessary.

10.1 Performance Security

If the Contract requires the Contractor to obtain security for his proper performance of the Contract, he shall obtain and provide to the Employer, such security within 28 days after the receipt of the Letter of Acceptance, in the sum stated in the Appendix to Tender. When providing such security to the Employer, the Contractor shall notify the Engineer of so doing. Such security shall be in the form annexed to these Conditions or in such other form as may be agreed between the Employer and the Contractor. The institution providing such security shall be subject to the approval of the Employer. The cost of complying with the requirements of this Clause shall be borne by the Contractor, unless the Contract otherwise provides.

10.2 Period of Validity of Performance Security

The performance security shall be valid until the Contractor has executed and completed the Works and remedied any defects therein in accordance with the Contract. No claim shall be made against such security after the issue of the Defects Liability Certificate in accordance with Sub-Clause 62.1 and such security shall be returned to the Contractor within 14 days of the issue of the said Defects Liability Certificate.

10.3 **Claims under Performance Security**

Prior to making a claim under the performance security the Employer shall, in every case, notify the Contractor stating the nature of the default in respect of which the claim is to be made.

11.1 **Inspection of Site**

The Employer shall have made available to the Contractor, before the submission by the Contractor of the Tender, such data on hydrological and sub-surface conditions as have been obtained by or on behalf of the Employer from investigations undertaken relevant to the Works but the Contractor shall be responsible for his own interpretation thereof.

The Contractor shall be deemed to have inspected and examined the Site and its surroundings and information available in connection therewith and to have satisfied himself (so far as is practicable, having regard to considerations of cost and time) before submitting his Tender, as to:

(a) the form and nature thereof, including the sub-surface conditions,

(b) the hydrological and climatic conditions,

(c) the extent and nature of work and materials necessary for the execution and completion of the Works and the remedying of any defects therein, and

(d) the means of access to the Site and the accommodation he may require,

and, in general, shall be deemed to have obtained all necessary information, subject as above mentioned, as to risks, contingencies and all other circumstances which may influence or affect his Tender.

The Contractor shall be deemed to have based his Tender on the data made available by the Employer and on his own inspection and examination, all as aforementioned.

12.1 **Sufficiency of Tender**

The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Tender and of the rates and prices stated in the Bill of Quantities, all of which shall, except insofar as it is otherwise provided in the Contract, cover all his obligations under the Contract (including those in respect of the supply of goods, materials, Plant or services or of contingencies for which there is a Provisional Sum) and all matters and things necessary for the proper execution and completion of the Works and the remedying of any defects therein.

12.2 **Not Foreseeable Physical Obstructions or Conditions**

If, however, during the execution of the Works the Contractor encounters physical obstructions or physical conditions, other than climatic conditions on the Site, which obstructions or conditions were, in his opinion, not foreseeable by an experienced contractor, the Contractor shall forthwith give notice thereof to the Engineer, with a

copy to the Employer. On receipt of such notice, the Engineer shall if in his opinion such obstructions or conditions could not have been reasonably foreseen by an experienced contractor, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and

(b) the amount of any costs which may have been incurred by the Contractor by reason of such obstructions or conditions having been encountered, which shall be added to the Contract Price,

and shall notify the Contractor accordingly, with a copy to the Employer. Such determination shall take account of any instruction which the Engineer may issue to the Contractor in connection therewith, and any proper and reasonable measures acceptable to the Engineer which the Contractor may take in the absence of specific instructions from the Engineer.

13.1 **Work to be in Accordance with Contract**

Unless it is legally or physically impossible, the Contractor shall execute and complete the Works and remedy any defects therein in strict accordance with the Contract to the satisfaction of the Engineer. The Contractor shall comply with and adhere strictly to the Engineer's instructions on any matter, whether mentioned in the Contract or not, touching or concerning the Works. The Contractor shall take instructions only from the Engineer (or his delegate).

14.1 **Programme to be Submitted**

The Contractor shall, within the time stated in Part II of these Conditions after the date of the Letter of Acceptance, submit to the Engineer for his consent a programme, in such form and detail as the Engineer shall reasonably prescribe, for the execution of the Works. The Contractor shall, whenever required by the Engineer, also provide in writing for his information a general description of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works.

14.2 **Revised Programme**

If at any time it should appear to the Engineer that the actual progress of the Works does not conform to the programme to which consent has been given under Sub-Clause 14.1, the Contractor shall produce, at the request of the Engineer, a revised programme showing the modifications to such programme necessary to ensure completion of the Works within the Time for Completion.

14.3 **Cash Flow Estimate to be Submitted**

The Contractor shall, within the time stated in Part II of these Conditions after the date of the Letter of Acceptance, provide to the Engineer for his information a detailed cash flow estimate, in quarterly periods, of all payments to which the

Contractor will be entitled under the Contract and the Contractor shall subsequently supply revised cash flow estimates at quarterly intervals, if required to do so by the Engineer.

14.4 **Contractor not Relieved of Duties or Responsibilities**

The submission to and consent by the Engineer of such programmes or the provision of such general descriptions or cash flow estimates shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

15.1 **Contractor's Superintendence**

The Contractor shall provide all necessary superintendence during the execution of the Works and as long thereafter as the Engineer may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. The Contractor, or a competent and authorised representative approved of by the Engineer, which approval may at any time be withdrawn, shall give his whole time to the superintendence of the Works. Such authorised representative shall receive, on behalf of the Contractor, instructions from the Engineer.

If approval of the representative is withdrawn by the Engineer, the Contractor shall, as soon as is practicable, having regard to the requirement of replacing him as hereinafter mentioned, after receiving notice of such withdrawal, remove the representative from the Works and shall not thereafter employ him again on the Works in any capacity and shall replace him by another representative approved by the Engineer.

16.1 **Contractor's Employees**

The Contractor shall provide on the Site in connection with the execution and completion of the Works and the remedying of any defects therein:

(a) only such technical assistants as are skilled and experienced in their respective callings and such foremen and leading hands as are competent to give proper superintendence of the Works, and

(b) such skilled, semi skilled and unskilled labour as is necessary for the proper and timely fulfilling of the Contractor's obligations under the Contract.

16.2 **Engineer at Liberty to Object**

The Engineer shall be at liberty to object to and require the Contractor to remove forthwith from the Works any person provided by the Contractor who, in the opinion of the Engineer, misconducts himself, or is incompetent or negligent in the proper performance of his duties, or whose presence on Site is otherwise considered by the Engineer to be undesirable, and such person shall not be again allowed upon the Works without the consent of the Engineer. Any person so removed from the Works shall be replaced as soon as possible.

17.1 **Setting-out**

The Contractor shall be responsible for:

(a) the accurate setting-out of the Works in relation to original points, lines and levels of reference given by the Engineer in writing,

(b) the correctness, subject as above mentioned of the position, levels dimensions and alignment of all parts of the Works, and

(c) the provision of all necessary instruments, appliances and labour in connection with the foregoing responsibilities.

If, at any time during the execution of the Works, any error appears in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required so to do by the Engineer, shall, at his own cost, rectify such error to the satisfaction of the Engineer, unless such error is based on incorrect data supplied in writing by the Engineer, in which case the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer.

The checking of any setting-out or of any line or level by the Engineer shall not in any way relieve the Contractor of his responsibility for the accuracy thereof and the Contractor shall carefully protect and preserve all bench-marks, sight-rails, pegs and other things used in setting-out the Works.

18.1 **Boreholes and Exploratory Excavation**

If, at any time during the execution of the Works, the Engineer requires the Contractor to make boreholes or to carry out exploratory excavation, such requirement shall be the subject of an instruction in accordance with Clause 51, unless an item or a Provisional Sum in respect of such work is included in the Bill of Quantities.

19.1 **Safety, Security and Protection of the Environment**

The Contractor shall, throughout the execution and completion of the Works and the remedying of any defects therein:

(a) have full regard for the safety of all persons entitled to be upon the Site and keep the Site (so far as the same is under his control) and the Works (so far as the same are not completed or occupied by the Employer) in an orderly state appropriate to the avoidance of danger to such persons,

(b) provide and maintain at his own cost all lights, guards, fencing, warning signs and watching, when and where necessary or required by the Engineer or by any duly constituted authority, for the protection of the Works or for the safety and convenience of the public or others, and

(c) take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his

methods of operation.

19.2 **Employer's Responsibilities**

If under Clause 31 the Employer shall carry out work on the Site with his own workmen he shall, in respect of such work:

(a) have full regard to the safety of all persons entitled to be upon the Site, and

(b) keep the Site in an orderly state appropriate to the avoidance of danger to such persons.

If under Clause 31 the Employer shall employ other contractors on the Site he shall require them to have the same regard for safety and avoidance of danger.

20.1 **Care of Works**

The Contractor shall take full responsibility for the care of the Works and materials and Plant for incorporation therein from the Commencement Date until the date of issue of the Taking-Over Certificate for the whole of the Works, when the responsibility for the said care shall pass to the Employer. Provided that:

(a) if the Engineer issues a Taking-Over Certificate for any Section or part of the Permanent Works the Contractor shall cease to be liable for the care of that Section or part from the date of issue of the Taking-Over Certificate, when the responsibility for the care of that Section or part shall pass to the Employer, and

(b) the Contractor shall take full responsibility for the care of any outstanding Works and materials and Plant for incorporation therein which he undertakes to finish during the Defects Liability Period until such outstanding Works have been completed pursuant to Clause 49.

20.2 **Responsibility to Rectify Loss or Damage**

If any loss or damage happens to the Works, or any part thereof, or materials or Plant for incorporation therein, during the period for which the Contractor is responsible for the care thereof, from any cause whatsoever, other than the risks defined in Sub-Clause 20.4, the Contractor shall, at his own cost, rectify such

loss or damage so that the Permanent Works conform in every respect with the provisions of the Contract to the satisfaction of the Engineer. The Contractor shall also be liable for any loss or damage to the Works occasioned by him in the course of any operations carried out by him for the purpose of complying with his obligations under Clauses 49 and 50.

20.3 **Loss or Damage Due to Employer's Risks**

In the event of any such loss or damage happening from any of the risks defined in Sub-Clause 20.4, or in combination with other risks, the Contractor shall, if and to the extent required by the Engineer, rectify the loss or damage and the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 and shall

notify the Contractor accordingly, with a copy to the Employer. In the case of a combination or risks causing loss or damage any such determination shall take into account the proportional responsibility of the Contractor and the Employer.

20.4 **Employer's Risks**

The Employer's risks are:

(a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,

(b) rebellion, revolution, insurrection, or military or usurped power, or civil war,

(c) ionising radiations, or contamination by radio-activity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive, or other hazardous properties of any explosive nuclear assembly or nuclear component thereof,

(d) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds,

(e) riot, commotion or disorder, unless solely restricted to employees of the Contractor or of his Subcontractor and arising from the conduct of the Works,

(f) loss or damage due to the use or occupation by the Employer of any Section or part of the Permanent Works, except as may be provided for in the Contract,

(g) loss or damage to the extent that it is due to the design of the Works, other than any part of the design provided by the Contractor or for which the Contractor is responsible, and

(h) any operation of the forces of nature against which an experienced contractor could not reasonably have been expected to take precautions.

21.1 **Insurance of Works and Contractor's Equipment**

The Contractor shall, without limiting his or the Employer's obligations and responsibilities under Clause 20, insure:

(a) the Works, together with materials and Plant for incorporation therein, to the full replacement cost (the term “cost” in this context shall include profit),
(b) an additional sum of 15 per cent of such replacement cost, or as may be specified in Part II of these Conditions, to cover any additional costs of and incidental to the rectification of loss or damage including professional fees and the cost of demolishing and removing any part of the Works and of removing debris of whatsoever nature, and

(c) the Contractor's Equipment and other things brought onto the Site by the Contractor, for a sum sufficient to provide for their replacement at the Site.

21.2 **Scope of Cover**

The insurance in paragraphs (a) and (b) of Sub-Clause 21.1 shall be in the joint names of the Contractor and the Employer and shall cover:

(a) the Employer and the Contractor against all loss or damage from whatsoever cause arising, other than as provided in Sub-Clause 21.4, form the start of work at the Site until the date of issue of the relevant Taking-Over Certificate in respect of the Works or any Section or part thereof as the case may be, and

(b) the Contractor for his liability:

(i) during the Defects Liability Period for loss or damage arising from a cause occurring prior to the commencement of the Defects Liability Periods, and

(ii) for 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 under Clauses 49 and 50.

21.3 **Responsibility for Amounts not Recovered**

Any amounts not insured or not recovered from the insurers shall be borne by the Employer or the Contractor in accordance with their responsibilities under Clause 20.

21.4 **Exclusions**

There shall be no obligation for the insurances in Sub-Clause 21.1 to include loss or damage caused by:

(a) war, hostilities (where war be declared or not), invasion, act of foreign enemies,

(b) rebellion, revolution, insurrection, or military or usurped power, or civil war,

(c) ionising, radiations, or contamination by radio-activity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof, or

(d) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds.

22.1 **Damage to Persons and Property**

The Contractor shall, except if and so far as the Contract provides otherwise, indemnify the Employer against all losses and claims in respect of:

(a) death of or injury to any person, or

(b) loss of or damage to any property (other than the Works),

which may arise out of or in consequence of the execution and completion of the Works and the remedying of any defects therein, and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto, subject to the exceptions defined in Sub-Clause 22.2.

22.2 **Exceptions**

The "exceptions" referred to in Sub-Clause 22.1 are:

(a) the permanent use or occupation of land by the Works, or any part thereof,

(b) the right of the Employer to execute the Works, or any part thereof, on, over, under, is or through any land,

(c) damage to property which is the unavoidable result of the execution and completion of the Works, or the remedying of any defects therein, in accordance with the Contract, and

(d) death of or injury to persons or loss of or damage to property resulting from any act or neglect of the Employer, his agents servants or other contractors, not being employed by the Contractor, or in respect of any claims, proceedings, damages, costs, charges and expenses in respect thereof or in relation thereto or, where the injury or damage was contributed to by the Contractor, his servants or agents, such part of the said injury or damage as may be just and equitable having regard to the extent of the responsibility of the Employer, his servants or agents or other contractors for the injury or damage.

22.3 **Indemnity by Employer**

The Employer shall indemnify the Contractor against all claims, proceedings, damages, costs, charges and expenses in respect of the matters referred to in the exceptions defined in Sub-Clause 22.2

23.1 **Third Party Insurance (including Employer's Property)**

The Contractor shall, without limiting his or the Employer's obligation and responsibilities under Clause 22, insure, in the joint names of the Contractor and the Employer, against liabilities for death of or injury to any person (other than as provided in Clause 24) or loss of or damage to any property (other than the Works) arising out of the performance of the Contract, other than the exceptions defined in paragraphs (a), (b) and (c) of Sub-Clause 22.2.

23.2 **Minimum Amount of Insurance**

Such insurance shall be for at least the amount stated in the Appendix to Tender.

23.3 **Cross Liabilities**

The insurance policy shall include a cross liability clause such that the insurance

shall apply to the Contractor and to the Employer as separate insureds.

24.1 **Accident or Injury to Workmen**

The Employer shall not be liable for or in respect of any damages or compensation payable to any workman or other person in the employment of the Contractor or any Subcontractor, other than death or injury resulting from any act or default of the Employer, his agents or servants. The Contractor shall indemnify and keep indemnified the Employer against all such damages and compensation, other than those for which the Employer is liable as aforesaid, and against all claims, proceedings, damages, costs, charges, and expenses whatsoever in respect thereof or in relation thereto.

24.2 **Insurance Against Accident to Workmen**

The Contractor shall insure against such liability and shall continue such insurance during the whole of the time that any persons are employed by him on the Works. Provided that, in respect of any persons employed by any Subcontractor, the Contractor's obligations to insure as aforesaid under the Sub-Clause shall be satisfied if the Subcontractor shall have insured against the liability in respect of such persons in such manner that the Employer is indemnified under the policy, but the Contractor shall require such Subcontractor to produce to the Employer, when required, such policy of insurance and the receipt for the payment of the current premium.

25.1 **Evidence and Terms of Insurances**

The Contractor shall provide evidence to the Employer prior to the start of work at the Site that the insurances required under the Contract have been effected and shall, within 84 days of the Commencement Date, provide the insurance policies to the Employer. When providing such evidence and such policies to the Employer, the Contractor shall notify the Engineer of so doing. Such insurance policies shall be consistent with the general terms agreed prior to the issue of the Letter of Acceptance. The Contractor shall effect all insurances for which he is responsible with insurers and in terms approved by the Employer.

25.2 **Adequacy of Insurances**

The Contractor shall notify the insurers of changes in the nature, extent or programme for the execution of the Works and ensure the adequacy of the insurances at all times in accordance with the terms of the Contract and shall, when required, produce to the Employer the insurance policies in force and the receipts for payment of the current premiums.

25.3 **Remedy on Contractor's Failure to Insure**

If the Contractor fails to effect and keep in force any of the insurances required under the Contract, or fails to provide the policies to the Employer within the period required by Sub-Clause 25.1, then and in any such case the Employer may effect and keep in force any such insurances and pay any premium as may be necessary for that purpose and from time to time deduct the amount so paid from any monies due or to become due to the Contractor, or recover the same as a debt due from the Contractor.

25.4 **Compliance with Policy Conditions**

In the event that the Contractor or the Employer fails to comply with conditions imposed by the insurance policies effected pursuant to the Contract, each shall indemnify the other against all losses and claims arising from such failure.

26.1 **Compliance with Statutes, Regulations**

The Contractor shall conform in all respects, including by the giving of all notices and the paying of all fees, with the provisions of:

(a) any National or State Statute, Ordinance, or other Law, or any regulation, or bye-law of any local or other duly constituted authority in relation to the execution and completion of the Works and the remedying of any defects therein, and

(b) the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Works,

and the Contractor shall keep the Employer indemnified against all penalties and liability of every kind for breach of any such provisions. Provided always that the Employer shall be responsible for obtaining any planning, zoning or other similar permission required for the Works to proceed and shall indemnify the Contractor in accordance with Sub-Clause 22.3.

27.1 **Fossil**

All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the Site shall, as between the Employer and the Contractor, be deemed to be the absolute property of the Employer. The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing or damaging any such article or thing and shall, immediately upon discovery thereof and before removal, acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same. If, by reason of such instructions, the Contractor suffers delay and/or incurs costs then the Engineer shall, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and
(b) the amount of such costs, which shall be added to the Contract Price,

and shall notify the Contractor accordingly, with a copy to the Employer.

28.1 **Patent Rights**

The Contractor shall save harmless and indemnify the Employer from and against all claims and proceedings for or on account of infringement of any patent rights, design trademark or name or other protected rights in respect of any Contractor's

Equipment, materials or Plant used for or in connection with or for incorporation in the Works and from and against all damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto, except where such infringement results from compliance with the design or Specification provided by the Engineer.

28.2 **Royalties**

Except where otherwise stated, the Contractor shall pay all tonnage and other

royalties, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials required for the Works.

29.1 **Interference with Traffic and Adjoining Properties**

All operations necessary for the execution and completion of the Works and the remedying of any defects therein shall, so far as compliance with the requirements of the Contract permits, be carried on so as not to interfere unnecessarily or improperly with:

(a) the convenience of the public, or

(b) the access to, use and occupation of public or private roads and footpaths to or of properties whether in the possession of the Employer or of any other person.

The Contractor shall save harmless and indemnify the Employer in respect of all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of, or in relation to, any such matters insofar as the Contractor is responsible therefor.

30.1 **Avoidance of Damage to Roads**

The Contractor shall use every reasonable means to prevent any of the roads or bridges communicating with or on the routes to the Site from being damaged or injured by any traffic of the Contractor or any of his Subcontractors and, in particular, shall select routes, choose and use vehicles and restrict and distribute loads so that any such extraordinary traffic as will inevitably arise from the moving of materials, Plant, Contractor's Equipment or Temporary Works from and to the Site shall be limited, as far as reasonably possible, and so that no unnecessary damage or injury may be occasioned to such roads and bridges.

30.2 **Transport of Contractor's Equipment or Temporary Works**

Save insofar as the Contract otherwise provides, the Contractor shall be responsible for and shall pay the cost of strengthening any bridges or altering or improving any road communicating with or on the routes to the Site to facilitate the movement of Contractor's Equipment or Temporary Works and the Contractor shall indemnify and keep indemnified the Employer against all claims for damage to any such road or bridge caused by such movement, including such claims as may be made directly against the Employer, and shall negotiate and pay all claims arising solely out of such damage.

30.3 **Transport of Materials or Plant**

If, notwithstanding Sub-Clause 30.1, any damage occurs to any bridge or road

communicating with or on the routes to the Site arising from the transport of materials or Plant, the Contractor shall notify the Engineer with a copy to the Employer, as soon as he becomes aware of such damage or as soon as he receives any claim from the authority entitled to make such claim. Where under any law or regulation the haulier of such materials or Plant is required to indemnify the road authority against damage the Employer shall not be liable for any costs, charges or expenses in respect thereof or in relation thereto. In other cases the Employer shall negotiate the settlement of and pay all sums due in respect of such claim and shall indemnify the Contractor in respect thereof and in respect of all claims, proceedings damages, costs, charges and expenses in relation thereto. Provided that if and so far as any such claim or part thereof is, in the opinion of the Engineer, due to any failure on the part of the Contractor to observe and perform his obligations under Sub-Clause 30.1, then the amount determined by the Engineer, after due consultation with the Employer and the Contractor, to be due to such failure shall be recoverable from the Contractor by the Employer and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer. Provided also that the Employer shall notify the Contractor whenever a settlement is to be negotiated and, where any amount may be due from the Contractor, the Employer shall consult with the Contractor before such settlement is agreed.

30.4 **Waterborne Traffic**

Where the nature of the Works is such as to require the use by the Contractor of waterborne transport the foregoing provisions of this Clause shall be construed as though "road" included a lock, dock, sea wall or other structure related to a waterway and "vehicle" included craft, and shall have effect accordingly.

31.1 **Opportunities for Other Contractors**

The Contractor shall, in accordance with the requirements of the Engineer, afford all reasonable opportunities for carrying out their work to:

(a) any other contractors employed by the Employer and their workmen,

(b) the workmen of the Employer, and

(c) the workmen of any duly constituted authorities who may be employed in the execution on or near the Site of any work not included in the Contract or of any contract which the Employer may enter into in connection with or ancillary to the Works.

31.2 **Facilities for Other Contractors**

If, however, pursuant to Sub-Clause 31.1 the Contractor shall, on the written request of the Engineer:

(a) make available to any other contractor, or to the Employer or any such authority, any roads or ways for the maintenance of which the Contractor is responsible,

(b) permit the use, by any such, of Temporary Works or Contractor's Equipment on the Site, or

(c) provide any other service of whatsoever nature for any such,

the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer.

32.1 **Contractor to Keep Site Clear**

During the execution of the Works the Contractor shall keep the Site reasonably free from all unnecessary obstruction and shall store or dispose of any Contractor's Equipment and surplus materials and clear away and remove from the Site any wreckage, rubbish or Temporary Works no longer required.

33.1 **Clearance of Site on Completion**

Upon the issue of any Taking-Over Certificate the Contractor shall clear away and remove from that part of the Site to which such Taking-Over Certificate relates all Contractor's Equipment, surplus materials, rubbish and Temporary Works of every kind, and leave such part of the Site and Works clean and in a workmanlike condition to the satisfaction of the Engineer. Provided that the Contractor shall be entitled to retain on Site, until the end of the Defects Liability Period, such materials, Contractor's Equipment and Temporary Works as are required by him for the purpose of fulfilling his obligations during the Defects Liability Period.

Labour

34.1 **Engagement of Staffs and Labour**

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

35.1 **Returns of Labour and Contractor's Equipment**

The Contractor shall, if required by the Engineer, deliver to the Engineer a return in detail, in such form and at such intervals as the Engineer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such information respecting Contractor's Equipment as the Engineer may require.

Materials, Plant and Workmanship

36.1 Quality of Materials, Plant and Workmanship

All materials, Plant and workmanship shall be:

(a) of the respective kinds described in the Contract and in accordance with the Engineer's instructions, and

(b) subjected from time to time to such tests as the Engineer may require at the place of manufacture, fabrication or preparation, or on the Site or at such other place or places as may be specified in the Contract, or at all or any of such places.

The Contractor shall provide such assistance, labour, electricity, fuels, stores, apparatus and instruments as are normally required for examining, measuring and testing any materials or Plant and shall supply samples of materials, before incorporation in the Works, for testing as may be selected and required by the Engineer.

36.2 Cost of Samples

All samples shall be supplied by the Contractor at his own cost if the supply thereof is clearly intended by or provided for in the Contract.

36.3 Cost of Tests

The cost of making any test shall be borne by the Contractor if such test is:

(a) clearly intended by or provided for in the Contract, or

(b) particularised in the Contract (in cases only for a test under load or of a test to ascertain whether the design of any finished or partially finished work is appropriate for the purposes which it was intended to fulfil) in sufficient detail to enable the Contractor to price or allow for the same in his Tender.

36.4 Cost of Tests not Provided for

If any test required by the Engineer which is:

(a) not intended by or provided for,

(b) (in the cases above mentioned) not so particularised, or

(c) (through so intended or provided for) required by the Engineer to be carried out at any place other than the Site or the place of manufacture, fabrication or preparation of the materials or Plant tested,

shows the materials, Plant or workmanship not to be in accordance with the provisions of the Contract to the satisfaction of the Engineer, then the cost of such

test shall be borne by the Contractor, but in any other case Sub-Clause 36.5 shall apply.

36.5 **Engineer's Determination where Tests not Provided for**

Where, pursuant to Sub-Clause 36.4, this Sub-Clause applies the Engineer shall, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time of which the Contractor is entitled under Clause 44, and

(b) the amount of such costs, which shall be added to the Contract Price,

and shall notify the Contractor accordingly, with a copy to the Employer.

37.1 **Inspection of Operations**

The Engineer, and any person authorised by him, shall at all reasonable times have access to the Site and to all workshops and places where materials or Plant are being manufactured, fabricated or prepared for the Works and the Contractor shall afford every facility for and every assistance in obtaining the right to such access.

37.2 **Inspection and Testing**

The Engineer shall be entitled, during manufacture, fabrication or preparation to inspect and test the materials and Plant to be supplied under the Contract. If materials or Plant are being manufactured, fabricated or prepared in workshops or places other than those of the Contractor, the Contractor shall obtain permission for the Engineer to carry out such inspection and testing in those workshops or places. Such inspection or testing shall not release the Contractor from any obligation under the Contract.

37.3 **Dates for Inspection and Testing**

The Contractor shall agree with the Engineer on the time and place for the inspection or testing of any materials or Plant as provided in the Contract. The Engineer shall give the Contractor not less than 24 hours notice of his intention to carry out the inspection or to attend the tests. If the Engineer, or his duly authorised representative, does not attend on the date agreed, the Contractor may, unless otherwise instructed by the Engineer, proceed with the tests, which shall be deemed to have been made in the presence of the Engineer. The Contractor shall forthwith forward to the Engineer duly certified copies of the tests readings. If the Engineer has not attended the tests, he shall accept the said readings as accurate.

37.4 **Rejection**

If, at the time and place agreed in accordance with Sub-Clause 37.3, the materials or Plant are not ready for inspection or testing or if, as a result of the inspection or testing referred to in this Clause, the Engineer determines that the materials or Plant are defective or otherwise not in accordance with the Contract, he may reject the materials or Plant and shall notify the Contractor thereof immediately. The notice shall state the Engineer's objections with reasons. The Contractor shall then

promptly make good the defect or ensure that rejected materials or Plant comply with the Contract. If the Engineer so requests, the tests of rejected materials or Plant shall be made or repeated under the same terms and conditions. All costs incurred by the Employer by the repetition of the test shall after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer and may be deducted from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

37.5 **Independent Inspection**

The Engineer may delegate inspection and testing of materials or Plant to an independent inspector. Any such delegation shall be effected in accordance with Sub-Clause 2.4 and for this purpose such independent inspector shall be considered as an assistant of the Engineer. Notice of such appointment (not being less than 14 days) shall be given by the Engineer to the Contractor.

38.1 **Examination of Work before Covering up**

No part of the works shall be covered up or put out of view without the approval of the Engineer and the Contractor shall afford full opportunity for the Engineer to examine and measure any such part of the Works which is about to be covered up or put out of view and to examine foundations before any part of the Works is placed thereon. The Contractor shall give notice to the Engineer whenever any such part of the Works or foundations is or are ready or about to be ready for examination and the Engineer shall, without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such part of the Works or of examining such foundations.

38.2 **Uncovering and Making Openings**

The Contractor shall uncover any part of the Works or make openings in or through the same as the Engineer may from time to time instruct and shall reinstate and make good such part. If any such part has been covered up or put out of view after compliance with the requirement of Sub-Clause 38.1 and is found to be executed in accordance with the Contract, the Engineer shall, after due consultation with the Employer and the Contractor, determine the amount the Contractor's costs in respect of such of uncovering, making openings in or through, reinstating and making good the same, which shall be added to the Contract Price, and shall notify the Contractor accordingly, with a copy to the Employer. In any other case all costs shall be borne by the Contractor.

39.1 **Removal of Improper Work, Materials or Plant**

The Engineer shall have authority to issue instructions from time to time, for:

(a) the removal from the Site, within such time or times as may be specified in the instruction, of any materials or Plant which, in the opinion of the Engineer, are not in accordance with the Contract,

(b) the substitution of proper and suitable materials or Plant, and

(c) the removal and proper re-execution, notwithstanding any previous test thereof or interim payment therefor, of any work which, in respect of

(i) materials, Plant or workmenship, or

(ii) design by the Contractor or for which he is responsible,

is not, in the opinion of the Engineer, in accordance with the Contract.

39.2 **Default of Contractor in Compliance**

In case of default on the part of Contractor in carrying out such instruction within the time specified therein or, if none, within a reasonable time, the Employer shall be entitled to employ and pay other persons to carry out the same and all costs consequent thereon or incidental thereto shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

Suspension

40.1 **Suspension of Work**

The Contractor shall, on the instructions of the Engineer, suspend the progress of the Works or any part thereof for such time and in such manner as the Engineer may consider necessary and shall, during such suspension, properly protect and secure the Works or such part thereof so far as is necessary in the opinion of the Engineer. Unless such suspension is:

(a) otherwise provided for in the Contract,
(b) necessary by reason of some default of or breach of contract by the Contractor or for which he is responsible,

(c) necessary by reason of climatic conditions of the Site, or
(d) necessary for the proper execution of the Works or for the safety of the Works or any part thereof (save to the extent that such necessity arises from any act or default by the Engineer or the Employer or from any of the risks defined in Sub-Clause 20.4),
Sub-Clause 40.2 shall apply.

40.2 **Engineer's Determination following Suspension**

Where, pursuant to Sub-Clause 40.1, this Sub-Clause applies the Engineer shall, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and

(b) the amount, which shall be added to the Contract Price, in respect of the cost incurred by the Contractor by reason of such suspension,

and shall notify the Contractor accordingly, with a copy to the Employer.

40.3 **Suspension lasting more than 84 Days**

If the progress of the Works or any part thereof is suspended on the written instructions of the Engineer and if permission to resume work is not given by the Engineer within a period for 84 days from the date of suspension then, unless such suspension is within paragraph (a), (b), (c) or (d) of Sub-Clause 40.1, the Contractor may give notice to the Engineer requiring permission, within 28 days from the receipt thereof, to proceed with the Works or that part thereof in regard to which progress is suspended. If, within the said time, such permission is not granted, the Contractor may, but is not bound to, elect to treat the suspension, where it affects part only of the Works, as an omission of such part under Clause 51 by giving a further notice to the Engineer to that effect, or, where it affects the whole of the Works, treat the suspension as an event of default by the Employer and terminates his employment under the Contract in accordance with the provisions of Sub-Clause 69.1, whereupon the provisions of Sub-Clause 69.2 and 69.3 shall apply.

Commencement and Delays

41.1 Commencement of Works

The Contractor shall commence the Works as soon as is reasonably possible after the receipt by him of notice to this effect from the Engineer, which notice shall be issued within the time stated in the Appendix to Tender after the date of the Letter of Acceptance. Thereafter, the Contractor shall proceeded with the Works with due expedition and without delay.

42.1 **Possession of Site and Access Thereto**

Save insofar as the Contract may prescribe:

(a) the extent of portions of the Site of which the Contractor is to be given possession from time to time,

(b) the order in which such portions shall be made available to the Contractor,

and, subject to any requirement in the Contract as to the order in which the Works shall be executed, the Employer will, with the Engineer's notice to commence the Works, give to the Contractor possession of

(c) so much of the Site, and

(d) such access as, in accordance with the Contract, is to be provided by the Employer as may be required to enable the Contractor to commence and proceed

with the execution of the Works in accordance with the programme referred to in Clause 14, if any, and otherwise in accordance with such reasonable proposals as the Contractor shall, by notice to the Engineer with a copy to the Employer, make. The Employer will, from time to time as the Works proceed, give to the Contractor possession of such further portions of the Site as may be required to enable the Contractor to proceed with the execution of the Works with due dispatch in accordance with such programme or proposals, as the case may be.

42.2 **Failure to Give Possession**

If the Contractor suffers delay and/or incurs costs from failure on the part of the Employer to give possession in accordance with the terms of Sub-Clause 42.1, the Engineer shall, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and

(b) the amount of such costs, which shall be added to the Contract Price,

and shall notify the Contractor accordingly, with a copy to the Employer.

42.3 **Rights of Way and Facilities**

The Contractor shall bear all costs and charges for special or temporary wayleaves required by him in connection with access to the Site. The Contractor shall also provide at his own cost any additional facilities outside the Site required by him for the purposes of the Works.

43.1 **Time for Completion**

The whole of the Works and, if applicable, any Section required to be completed within a particular time as stated in the Appendix to Tender, shall be completed, in accordance with the provisions of Clause 48, within the time stated in the Appendix to Tender for the whole of the Works or the Section (as the case may be), calculated from the Commencement Date, or such extended time as may be allowed under Clause 44.

44.1 **Extension of Time for Completion**

In the event of:

(a) the amount or nature of extra or additional work,

(b) any cause of delay referred to in these Conditions,

(c) exceptionally adverse climatic conditions,

(d) any delay, impediment or prevention by the Employer, or

(e) other special circumstances which may occur, other than through a default of or breach of contract by the Contractor or for which he is responsible,

being such as fairly to entitle the Contractor to an extension of the Time for Completion of the Works, or any Section or part thereof, the Engineer shall, after due consultation with the Employer and the Contractor, determine the amount of such extension and shall notify the Contractor accordingly, with a copy to the Employer.

44.2 **Contractor to Provide Notification and Detailed Particulars**

Provided that the Engineer is not bound to make any determination unless the Contractor has

(a) within 28 days after such event has first arisen notified the Engineer with a copy to the Employer, and

(b) within 28 days or such other reasonable time as may be agreed by the Engineer, after such notification submitted to the Engineer detailed particulars of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time.

44.3 **Interim Determination of Extension**

Provided also that where an event has a continuing effect such that it is not

practicable for the Contractor to submit detailed particulars within the period of 28 days referred to in Sub-Clause 44.2(b), he shall nevertheless be entitled to an extension of time provided that he has submitted to the Engineer interim particulars at intervals of not more than 28 days and final particulars within 28 days of the end of the effects resulting from the event. On receipt of such interim particulars, the Engineer shall, without undue delay, make an interim determination of extension of time and, on receipt of the final particulars, the Engineer shall review all the circumstances and shall determine an overall extension of time in regard to the event. In both such cases the Engineer shall make his determination after due consultation with the Employer and the Contractor and shall notify the Contractor of the determination, with a copy to the Employer. No final review shall result in a decrease of any extension of time already determined by the Engineer.

45.1 **Restriction on Working Hours**

Subject to any provision to the contrary contained in the Contract, none of the Works shall, save as hereinafter provided, be carried on during the night or on locally recognised days of rest without the consent of the Engineer, except when work is unavoidable or absolutely necessary for the saving of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer. Provided that the provisions of this Clause shall not be applicable in the case of any work which it is customary to carry out by multiple shifts.

46.1 **Rate of Progress**

If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the Works or any Section is at any time, in the opinion of the Engineer, too slow to comply with the Time for Completion, the Engineer shall so

notify the Contractor who shall thereupon take such steps as are necessary, subject to the consent of the Engineer, to expedite progress so as to comply with the Time for Completion. The Contractor shall not be entitled to any additional payment for taking such steps. If, as a result of any notice given by the Engineer under this Clause, the Contractor considers that it is necessary to do any work at night or on locally recognised days of rest, he shall be entitled to seek the consent of the Engineer so to do. Provided that if any steps, taken by the Contractor in meeting his obligations under this Clause, involve the Employer in additional supervision costs, such cost shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

47.1 **Liquidated Damages for Delay**

If the Contractor fails to comply with the Time for Completion in accordance with Clause 48, for the whole of the Works or, if applicable, any Section within the relevant time prescribed by Clause 43, then the Contractor shall pay to the Employer the relevant sum stated in the Appendix to Tender as liquidated damages for such default and not as a penalty (which sum shall be the only monies due from the Contractor for such default) for every day or part of a day which shall elapse between the relevant Time for Completion and the date stated in a Taking-Over Certificate of the whole of the Works or the relevant Section, subject to the applicable limit stated in the Appendix to Tender. The Employer may, without prejudice to any other method of recovery, deduct the amount of such damages from any monies due or to become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the Contract.

47.2 **Reduction of Liquidated Damages**

If, before the Time for Completion of the whole of the Works or, if applicable, any Section, a Taking-Over Certificate has been issued for any part of the Works or of a Section, the liquidated damages for delay in completion of the remainder of the Works or of that Section shall, for any period of delay after the date stated in such Taking-Over Certificate, and in the absence of Alternative provisions in the Contract, be reduced in the proportion which the value of the part so certified bears to the value of the whole of the Works or Section, as applicable. The provisions of this Sub-Clause shall only apply to the rate of liquidated damages and shall not affect the limit thereof.

48.1 **Taking-Over Certificate**

When the whole of the Works have been substantially completed and have satisfactorily passed any Tests on Completion prescribed by the Contract, the Contractor may give a notice to that effect to the Engineer with a copy to the Employer, accompanied by a written undertaking to finish with due expedition any outstanding work during the Defects Liability Period. Such notice and undertaking shall be deemed to be a request by the Contractor for the Engineer to issue a Taking-Over Certificate in respect of the Works. The Engineer shall within 21 days of the

date of delivery of such notice, either issue to the Contractor, with a copy to the Employer, a Taking-Over Certificate, stating the date on which, in his opinion, the Works were substantially completed in accordance with the Contract, or give instructions in writing to the Contractor specifying all the work which, in the Engineer's opinion, is required to be done by the Contractor before the issue of such Certificate. The Engineer shall also notify the Contractor of any defects in the Works affecting substantial completion that may appear after such instructions and before completion of the Woks specified therein. The Contractor shall be entitled to receive such Taking-Over Certificate within 21 days of completion, to the satisfaction of the Engineer, of the Works so specified and remedying any defects so notified.

48.2 **Taking Over of Sections or Parts**

Similarly, in accordance with the procedure set out in Sub-Clause 48.1, the Contractor may request and the Engineer shall issue a Taking-Over Certificate in respect of:
(a) any Section in respect of which a separate Time for Completion is provided in the Appendix to Tender,

(b) any substantial part of the Permanent Works which has been both completed to the satisfaction of the Engineer and, otherwise than as provided for in the Contract, occupied or used by the Employer, or

(c) any part of the Permanent Works which the Employer has elected to occupy or use prior to completion (where such prior occupation or use is not provided for in the Contract or has not been agreed by the Contractor as a temporary measure).

48.3 **Substantial Completion of Parts**

If any part of the Permanent Works has been substantially completed and has satisfactorily passed any Tests on Completion prescribed by the Contractor, the Engineer may issue a Taking-Over Certificate in respect of that part of the Permanent Works before completion of the whole of the Works and, upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete with due expedition any outstanding work in that part of the Permanent Works during the Defects Liability Period.

48.4 **Surfaces Requiring Reinstatement**

Provided that a Taking-Over Certificate given in respect of any Section or part of the Permanent Works before completion of the whole of the Works shall not be deemed to certify completion of any ground or surfaces requiring reinstatement, unless such Taking-Over Certificate shall expressly so state.

Defects Liability

49.1 **Defects Liability Period**

In these Conditions the expression "Defects Liability Period" shall mean the defects liability period named in the Appendix to Tender, calculated from:

(a) the date of completion of the Works certified by the Engineer in accordance with Clause 48, or

(b) in the event of more than one certificate having issued by the Engineer under Clause 48, the respective dates so certified,
and in relation to the Defects Liability Period the expression "the Works" shall be construed accordingly.

49.2 **Completion of Outstanding Work and Remedying Defects**

To the intent that the Works shall, at or as soon as practicable after the expiration of the Defects Liability Period, be delivered to the Employer in the condition required by the Contract, fair wear and tear excepted, to the satisfaction of the Engineer, the Contractor shall:

(a) complete the work, if any, outstanding on the date stated in the Taking-Over Certificate as soon as practicable after such date, and

(b) execute all such work of amendment, reconstruction, and remedying defects, shrinkages or other faults as the Engineer may, during the Defects Liability Period or within 14 days after its expiration, as a result of an inspection made by or on behalf of the Engineer prior to its expiration, instruct the Contractor to execute.

49.3 **Cost of Remedying Defects**

All work referred to in Sub-Clause 49.2(b) shall be executed by the Contractor at his own cost if the necessity thereof is, in the opinion of the Engineer, due to:

(a) the use of materials, Plant or workmanship not in accordance with the Contract,
(b) where the Contractor is responsible for the design of part of the Permanent Works, any fault in such design, or
(c) the neglect or failure on the part of the Contractor to comply with any obligation, expressed or implied, on the Contractor's part under the Contract.

If, in the opinion of the Engineer, such necessity is due to any other cause, he shall determine an addition to the Contract Price in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer.

49.4 **Contractor's Failure to Carry Out Instructions**

In case of default on the part of the Contractor in carrying out such instruction within a reasonable time, the Employer shall be entitled to employ and pay other persons to carry out the same and if such work is work which, in the opinion of the Engineer, the Contractor was liable to do at his own cost under the Contract, then all cost consequent thereon or incidental thereto shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

50.1 **Contractor to Search**

If any defect, shrinkage or other fault in the Works appears at any time prior to the

end of the Defects Liability Period, the Engineer may instruct the Contractor, with a copy to the Employer, to search under the directions of the Engineer for the cause thereof. Unless such defect, shrinkage or other fault is one for which the Contractor is liable under the Contract, the Engineer shall, after due consultation with the Employer and the Contractor, determine the amount in respect of the costs of such search incurred by the Contractor, which shall be added to the Contract Price and shall notify the Contractor accordingly, with a copy to the Employer. If such defect, shrinkage or other fault is one for which the Contractor is liable, the cost of the work carried out in searching as aforesaid shall be borne by the Contractor and he shall in such case remedy such defect, shrinkage or other fault at his own cost in accordance with the provisions of Clause 49.

Alterations, Additions and Omissions

51.1 **Variations**

The Engineer shall make any variation of the form, qualify 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 appropriate, he shall have the authority to instruct the Contractor to do and the Contractor shall do any of the following:

(a) increase or decrease the quantity of any work included in the Contract,
(b) omit any such work (but not if the omitted work is to be carried out by the Employer or by another contractor),
(c) change the character or quality or kind of any such work,
(d) change the levels, lines, position and dimensions of any part of the Works,
(e) execute additional work of any kind necessary for the completion of the Works, or
(f) change any specified sequence or timing of construction of any part of the Works.

No such variation shall in any way vitiate or invalidate the Contract, but the effect, if any, of all such variations shall be valued in accordance with Clause 52. Provided that where the issue of an instruction to vary the Works is necessitated by some default of or breach of contract by the Contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the Contractor.

51.2 **Instructions for Variations**

The Contractor shall not make any such variation without an instruction of the Engineer. Provided that no instruction shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an instruction given under this Clause, but is the result of the quantities exceeding or being less than those stated in the Bill of Quantities.

52.1 **Valuation of Variations**

All variations referred to in Clause 51 and any additions to the Contract Price which are required to be determined in accordance with Clause 52 (for the purposes of this Clause referred to as "varied work"), shall be valued at the rates and prices set out in the Contract if, in the opinion of the Engineer, the same shall be applicable. If the

Contract does not contain any rates or prices applicable to the varied work, the rates and prices in the Contract shall be used as the basis for valuation so far as may be reasonable, failing which, after due consultation by the Engineer with the Employer and the Contractor, suitable rates or prices shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such rates or prices as are, in his opinion, appropriate and shall notify the Contractor accordingly, with a copy to the Employer. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on-account payments to be included in certificates issued in accordance with Clause 60.

52.2 **Power of Engineer to Fix Rates**

Provided that if the nature or amount of any varied work relative to the nature or amount of the whole of the Works or to any part thereof, is such that, in the opinion of the Engineer, the rate or price contained in the Contract for any item of the Works is, by reason of such varied work, rendered inappropriate or inapplicable, then, after due consultation by the Engineer with the Employer and the Contractor, a suitable rate or price shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such other rate or price as is, in his opinion, appropriate and shall notify the Contractor accordingly, with a copy to the Employer. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on-account payments to be included in certificates issued in accordance with Clause 60.

Provided also that no varied work instructed to be done by the Engineer pursuant to Clause 51 shall be valued under Sub-Clause 52.1 or under this Sub-Clause unless, within 14 days of the date of such instruction and, other than in the case of omitted work, before the commencement of the varied work, notice shall have been given either:

(a) by the Contractor to the Engineer of his intention to claim extra payment or a varied rate or price, or
(b) by the Engineer to the Contractor of his intention to vary a rate or price.

52.3 **Variations Exceeding 15 per cent**

If, on the issue of the Taking-Over Certificate for the whole of the Works, it is found that as a result of:

(a) all varied work valued under Sub-Clauses 52.1 and 52.2, and
(b) all adjustments upon measurement of the estimated quantities set out in the Bill of Quantities, excluding Provisional Sums, dayworks and adjustment of price made under Clause 70.

but not from any other cause, there have been additions to or deductions from the Contract Price which taken together are in excess of 15 per cent of the "Effective Contract Price" (which for the purposes of this Sub-Clause shall mean the Contract Price, excluding Provisional Sums and allowance for dayworks, if any) then and in such event (subject to any action already taken under any other Sub-Clause of this

Clause), after due consultation by the Engineer with the Employer and the Contractor, there shall be added to or deducted from the Contract Price such further sums as may be agreed between the Contractor and the Engineer or, failing agreement, determined by the Engineer having regard to the Contractor's Site and general overhead costs of the Contract. The Engineer shall notify the Contractor of any determination made under this Sub-Clause, with a copy to the Employer. Such sum shall be based only on the amount by which such additions or deductions shall be in excess of 15 per cent of the Effective Contract Price.

52.4 **Daywork**

The Engineer may, if in his opinion it is necessary or desirable, issue an instruction that any varied work shall be executed on a daywork basis. The Contractor shall then be paid for such varied work under the terms set out in the daywork schedule included in the Contract and at the rates and prices affixed thereto by him in the Tender.

The Contractor shall furnish to the Engineer such receipts or other vouchers as may be necessary to provide the amounts paid and, before ordering material, shall submit to the Engineer quotations for the same for his approval.

In respect of such of the Works executed on a daywork basis , the Contractor shall during the continuance of such work, deliver each day to the Engineer an exact list in duplicate of the names, occupation and time of all workmen employed on such work and a statement, also in duplicate, showing the description and quantity of all materials and Contractor's Equipment used thereon or therefor other than Contractor's Equipment which is included in the percentage addition in accordance with such daywork schedule. One copy of each list and statement will, if correct, or when agreed, be signed by the Engineer and returned to the Contractor.

At the end of each month the Contractor shall deliver to the Engineer a priced statement of the labour, materials and Contractor's Equipment, except as aforesaid, used and the Contractor shall not be entitled to any payment unless such lists and statements have been fully and punctually rendered. Provided always that if the Engineer considers that for any reason the sending of such lists or statements by the Contractor, in accordance with the foregoing provision, was impracticable he shall nevertheless be entitled to authorise payment for such work, either as daywork, on being satisfied as to the time employed and the labour, materials and Contractor’s Equipment used on such work, or at such value therefor as shall, in his opinion, be fair and reasonable.

Procedure for Claims

53.1 **Notice of Claims**

Notwithstanding any other provision of the Contract, if the Contractor intends to claim any additional payment pursuant to any Clause of these Conditions or

otherwise, he shall give notice of his intention to the Engineer with a copy to the Employer, within 28 days after the event giving rise to the claim has first arisen.

53.2 **Contemporary Records**

Upon the happening of the event referred to in Sub-Clause 53.1, the Contractor shall keep such contemporary records as may reasonably be necessary to support any claim he may subsequently wish to make. Without necessarily admitting the Employer's liability, the Engineer shall, on receipt of a notice under Sub-Clause 53.1, inspect such contemporary records and may instruct the Contractor to keep any further contemporary records as are reasonable and may be material to the claim of which notice has been given. The Contractor shall permit the Engineer to inspect all records kept pursuant to this Sub-Clause and shall supply him with copies thereof as and when the Engineer so instructs.

53.3 **Substantiation of Claims**

Within 28 days, or such other reasonable time as may be agreed by the Engineer, of giving notice under Sub-Clause 53.1, the Contractor shall send to the Engineer an account giving detailed particulars of the amount claimed and the grounds upon which the claim is based. Where the event giving rise to the claim has a continuing effect, such account shall be considered to be an interim account and the Contractor shall, at such intervals as the Engineer may reasonably require, send further interim accounts giving the accumulated amount of the claim and any further grounds upon which it is based. In cases where interim accounts are sent to the Engineer, the Contractor shall send a final account within 28 days of the end of the effects resulting from the event. The Contractor shall, if required by the Engineer so to do, copy to the Employer all accounts sent to the Engineer pursuant to this Sub-Clause.

53.4 **Failure to Comply**

If the Contractor fails to comply with any of the provisions of this Clause in respect of any claim which he seeks to make, his entitlement to payment in respect thereof shall not exceed such amount as the Engineer or any arbitrator or arbitrators appointed pursuant to Sub-Clause 67.3 assessing the claim considers to be verified by contemporary records (whether or not such records were brought to the Engineer's notice as required under Sub-Clause 53.2 and 53.3).

53.5 **Payment of Claims**

The Contractor shall be entitled to have included in any interim payment certified by the Engineer pursuant to Clause 60 such amount in respect of any claim as the Engineer, after due consultation with the Employer and the Contractor, may consider due to the Contractor provided that the Contractor has supplied sufficient particulars to enable the Engineer to determine the amount due. If such particulars are insufficient to substantiate the whole of the claim, the Contractor shall be entitled to payment in respect of such part of the claim as such particulars may substantiate to the satisfaction of the Engineer. The Engineer shall notify the Contractor of any determination made under this Sub-Clause, with a copy to the Employer.

Contractor's Equipment, Temporary Works and Materials

54.1 **Contractor's Equipment, Temporary Works and Materials; Exclusive Use for the Works**

All Contractor's Equipment, Temporary Works and materials provided by the Contractor shall, when brought on to the Site, be deemed to be exclusively intended for the execution of the Works and the Contractor shall not remove the same or any part thereof, except for the purpose of moving it from one part of the Site to another, without the consent of the Engineer. Provided that consent shall not be required for vehicles engaged in transporting any staff, labour, Contractor's Equipment, Temporary Works, Plant or materials to or from the Site.

54.2 **Employer not Liable for Damage**

The Employer shall not at any time be liable, save as mentioned in Clauses 20 and 65, for the loss of or damage to any of the said Contractor's Equipment, Temporary Works or materials.

54.3 **Customs Clearance**

The Employer will use his best endeavours in assisting the Contractor, where required, in obtaining clearance through the Customs of Contractor's Equipment, materials and other things required for the Works.

54.4 **Re-export of Contractor's Equipment**

In respect of any Contractor's Equipment which the Contractor has imported for the purposes of the Works, the Employer will use his best endeavours to assist the Contractor, where required, in procuring any necessary Government consent to the re-export of such Contractor's Equipment by the Contractor upon the removal thereof pursuant to the terms of Contract.

54.5 **Conditions of Hire of Contractor's Equipment**

With a view to securing, in the event of termination under Clause 63, the continued availability, for the purpose of executing the Works, of any hired Contractor's Equipment, the Contractor shall not bring on to the Site any hired Contractor's Equipment unless there is an agreement for hire thereof (which agreement shall be deemed not to include an agreement for hire purchase) which contains a provision that the owner thereof will, on request in writing made by the Employer within 7 days after the date on which any termination has become effective, and on the Employer undertaking to pay all hire charges in respect thereof from such date, hire such Contractor's Equipment to the Employer on the same terms in all respect as the same was hired to the Contractor save that the Employer shall be entitled to permit the use thereof by any other contractor employed by him for the purpose of execution and completing the Works and remedying any defects therein, under the terms of the said Clause 63.

54.6 **Costs for the Purpose of Clause 63**

In the event of the Employer entering into any agreement for the hire of

Contractor's Equipment pursuant to Sub-Clause 54.5, all sums properly paid by the Employer under the provision of any such agreement and all costs incurred by him (including stamp duties) in entering into such agreement shall be deemed, for the purpose of Clause 63, to be part of the cost of executing and completing the Works and the remedying of any defects therein.

54.7 **Incorporation of Clause in Subcontracts**

The Contractor shall, where entering into any subcontract for the execution of any part of the Works, incorporate in such subcontract (by reference or otherwise) the provisions of this Clause in relation to Contractor's Equipment, Temporary Works or materials brought on to the Site by the Subcontractor.

54.8 **Approval of Materials not Implied**

The operation of this Clause shall not be deemed to imply any approval by the Engineer of the materials or other matters referred to therein nor shall it prevent the rejection of any such materials at any time by the Engineer.

Measurement

55.1 **Quantities**

The quantities set out in the Bill of Quantities are the estimated quantities for the Works, and they are not to be taken as the actual and correct quantities of the Works to be executed by the Contractor in fulfillment of his obligations under the Contract.

56.1 **Works to be Measured**

The Engineer shall, except as otherwise stated, ascertain and determine by measurement the value of the Works in accordance with the Contract and the Contractor shall be paid that value in accordance with Clause 60. The Engineer shall, when he requires any part of the Works to be measured, give reasonable notice to the Contractor's authorised agent, who shall:

(a) forthwith attend or send a qualified representative to assist the Engineer in making such measurement, and

(b) supply all particulars required by the Engineer.

Should the Contractor not attend, or neglect or omit to send such representative, then the measurement made by the Engineer or approved by him shall be taken to be the correct measurement of such part of the Works. For the purpose of measuring such Permanent Works as are to be measured by records and drawings, the Engineer shall prepare records and drawings as the work proceeds and the Contractor, as and when called upon to do so in writing, shall, within 14 days, attend to examine and agree such records and drawings with the Engineer and shall sign the same when so agreed. If the Contractor does not attend to examine and agree such records and drawings, they shall be taken to be correct. If, after examination of such records and drawings, the Contractor does not agree the same

or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Contractor, within 14 days of such examination, lodges with the Engineer notice of the respects in which such records and drawings are claimed by him to be incorrect. On receipt of such notice, the Engineer shall review the records and drawings and either confirm or vary them.

57.1 **Method of Measurement**

The Works shall be measured net, notwithstanding any general or local custom, except where otherwise provided for in the Contract.

57.2 **Breakdown of Lump Sum Items**

For the purposes of statements submitted in accordance with Sub-Clause 60.1, the Contractor shall submit to the Engineer, within 28 days after the receipt of the Letter of Acceptance, a breakdown for each of the lump sum items contained in the Tender. Such breakdowns shall be subject to the approval of the Engineer.

Provisional Sums

58.1 **Definition of "Provisional Sum"**

"Provisional Sum" means a sum included in the Contract and so designated in the Bill of Quantities for the execution of any part of the Works or for the supply of goods, materials, Plant or services, or for contingencies, which sum may be used, in whole or in part, or not at all, on the instructions of the Engineer. The Contractor shall be entitled to only such amounts in respect of the work, supply or contingencies to which such Provisional Sums relate as the Engineer shall determine in accordance with this Clause. The Engineer shall notify the Contractor of any determination made under this Sub-Clause, with a copy to the Employer.

58.2 **Use of Provisional Sums**

In respect of every Provisional Sum the Engineer shall have authority to issue instructions for the execution of work or for the supply of goods, material, Plant or services by:

(a) the Contractor, in which case the Contractor shall be entitled to an amount equal to the value thereof determined in accordance with Clause 52, and

(b) a nominated Subcontractor, as hereinafter defined, in which case the sum to be paid to the Contractor therefor shall be determined and paid in accordance with Sub-Clause 59.4.

58.3 Production of Vouchers

The Contractor shall produce to the Engineer all quotations, invoices, vouchers and accounts or receipts in connection with expenditure in respect of Provisional Sums, except where work is valued in accordance with rates or prices set out in the Tender.

Nominated Subcontractors

59.1 **Definition of "Nominated Subcontractors"**

All specialists, merchants, tradesmen and others executing any work or supplying any goods, materials, Plant or services for which Provisional Sums are included in the Contract, who may have been or be nominated or selected or approved by the Employer or the Engineer, and all persons to whom by virtue of the provisions of the Contract the Contractor is required to subcontract shall, in the execution of such work or the supply of such goods, materials, Plant or services, be deemed to be subcontractors to the Contractor and are referred to in this Contract as "nominated Subcontractors".

59.2 **Nominated Subcontractors; Objection to Nomination**

The Contractor shall not be required by the Employer or the Engineer, or be deemed to be under any obligation, to employ any nominated Subcontractor against whom the Contractor may raise reasonable objection, or who declines to enter into subcontract with the Contractor containing provisions:

(a) that in respect of the work, goods, materials, Plant or services the subject of the subcontract, the nominated Subcontractor will undertake towards the Contractor such obligations and liabilities as will enable the Contractor to discharge his own obligations and liabilities towards the Employer under the terms of the Contract and will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in connection therewith, or arising out of or in connection with any failure to perform such obligations or to fulfill such liabilities, and

(b) that the nominated Subcontractor will save harmless and indemnity the Contractor from and against any negligence by the nominated Subcontractor, his agents, workmen and servants and from and against any misuse by him or them of any Temporary Works provided by the Contractor for the purposes of the Contract and from all claims as aforesaid.

59.3 **Design Requirements to be Expressly Stated**

If in connection with any Provisional Sum the services to be provided include any matter of design or specification of any part of the Permanent Works or of any Plant to be incorporated therein, such requirement shall be expressly stated in the Contract and shall be included in any nominated Subcontract. The nominated Subcontract shall specify that the nominated Subcontractor providing such services will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in connection with any failure to perform such obligations or to fulfill such liabilities.

59.4 **Payments to Nominated Subcontractors**

For all work executed or goods, materials, Plant or services supplied by any nominated Subcontractor, the Contractor shall be entitled to:

(a) the actual price paid or due to be paid by the Contractor, on the instructions of the Engineer, and in accordance with the subcontract;

(b) in respect of labour supplied by the Contractor, the sum, if any,

entered in the Bill of Quantities or, if instructed by the Engineer pursuant to paragraph (a) of Sub-Clause 58.2, as may be determined in accordance with Clause 52; and

(c) in respect of all other charges and profit, a sum being a percentage rate of the actual price paid or due to be paid calculated, where provision has been made in the Bill of Quantities for a rate to be set against the relevant Provisional Sum, at the rate inserted by the Contractor against that item or, where no such provision has been made, at the rate inserted by the Contractor in the Appendix to Tender and repeated where provision for such is made in a special item provided in the Bill of Quantities for such purpose.

59.5 **Certification of Payments to Nominated Subcontractors**

Before issuing, under Clause 60 any certificate, which includes any payment in respect of work done or goods, materials, Plant or services supplied by any nominated Subcontractor, the Engineer shall be entitled to demand from the Contractor reasonable proof that all payments, less retentions, included in previous certificates in respect of the work or goods, materials, Plant or services of such nominated Subcontractor have been paid or discharged by the Contractor. If the Contractor fails to supply such proof then, unless the Contractor:
(a) satisfies the Engineer in writing that he has reasonable cause for withholding or refusing to make such payment, and

(b) produces to the Engineer reasonable proof that he has so informed such nominated Subcontractor in writing,

the Employer shall be entitled to pay to such nominated Subcontractor direct, upon the certificate of the Engineer, all payments, less retention, provided for in the nominated Subcontract, which the Contractor has failed to make to such nominated Subcontractor and to deduct by way of set-off the amount so paid by the Employer from any sums due or to become due from the Employer to the Contractor.

Provided that, where the Engineer has certified and the Employer has paid direct as aforesaid, the Engineer shall in issuing any further certificate in favour of the Contractor, deduct from the amount thereof the amount so paid, direct as aforesaid, but shall not withhold or delay the issue of the certificate itself when due to be issued under the terms of the Contract.

Certificates and Payment

60.1 **Monthly Statements**

The Contractor shall submit to the Engineer after the end of each month six copies, each signed by the Contractor's representative approved by the Engineer in accordance with the Sub-Clause 15.1, of a statement, in such form

as the Engineer may from time to time prescribe, showing the amounts to which the Contractor considers himself to be entitled up to the end of the month in respect of:

(a) the value of the Permanent Works executed,

(b) any other items in the Bill of Quantities including those for Contractor's Equipment, Temporary Works, dayworks and the like,

(c) the percentage of the invoice value of listed materials, all as stated in the Appendix to Tender, and Plant delivered by the Contractor on the Site for incorporation in the Permanent Works but not incorporated in such Works,

(d) adjustments under Clause 70, and
(e) any other sum to which the Contractor may be entitled under the Contract or otherwise.

60.2 **Monthly Payments**

The Engineer shall, within 28 days of receiving such statement, certify to the Employer the amount of payment to the Contractor which he considers due and payable in respect thereof, subject:

(a)firstly, to the retention of the account calculated by applying the Percentage of Retention stated in the Appendix to Tender, to the amount to which the Contractor is entitled under paragraph (a), (b), (c) and (e) of Sub-Clause 60.1 until the amount so retained reaches the Limit of Retention Money stated in the Appendix to Tender, and

(b) secondly, to the deduction, other than pursuant to Clause 47, of any sums which may have become due and payable by the Contractor to the Employer.

Provided that the Engineer shall not be bound to certify any payment under this Sub-Clause if the net amount thereof, after all retentions and deductions, would be less than the Minimum Amount of Interim Payment Certificates stated in the Appendix to Tender.

Notwithstanding the terms of this Clause or any other Clause of the Contract no amount will be certified by the Engineer for payment until the performance security, if required under the Contract, has been provided by the Contractor and approved by the Employer.

60.3 **Payment of Retention Money**

(a)Upon the issue of the Taking-Over Certificate with respect to the whole of the Works, one half of the Retention Money, or upon the issue of a Taking-Over

Certificate with respect to a Section or part of the Permanent

Works only such proportion thereof as the Engineer determines having regard to the relative value of such Section or part of the Permanent Works, shall be certified by the Engineer for payment to the Contractor.

(b) Upon the expiration of the Defects Liability Period for the Works the other half of the Retention Money shall be certified by the Engineer for payment to the Contractor. Provided that, in the event of different Defects Liability Periods having become applicable to different Sections or part of the Permanent Works pursuant to Clause 48, the expression "expiration of the Defects Liability Period" shall, for the purposes of this Sub-Clause, be deemed to mean the expiration of the latest of such periods. Provided also that if at such time, there shall remain to be executed by the Contractor any work instructed, pursuant to Clause 49 and 50, in respect of the Works, the Engineer shall be entitled to withhold certification until completion of such work of so much of the balance of the Retention Money as shall, in the opinion of the Engineer, represent the cost of the work remaining to be executed.

60.4 **Correction of Certificates**

The Engineer may by any Interim Payment Certificate make any correction or modification in any previous certificate which shall have been issued by him and shall have authority, if any work is not being carried out to his satisfaction, to omit or reduce the value of such work in any Interim Payment Certificate.

60.5 **Statement at Completion**

Not later than 84 days after the issue of the Taking-Over Certificate in respect of the whole of the Works, the Contractor shall submit to the Engineer a Statement at Completion with supporting documents showing in detail, in the form approved by the Engineer:

(a) the final value of all work done in accordance with the Contract up to the date stated in such Taking-Over Certificate,

(b) any further sums which the Contractor considers to be due, and

(c) an estimate of amounts which the Contractor considers will become due to him under the Contract.

The estimated amounts shall be shown separately in such Statement at Completion. The Engineer shall verify payment in accordance with Sub-Clause 60.2.

60.6 **Final Statement**

Not later than 56 days after the issue of the Defects Liability Certificate pursuant to Sub-Clause 62.1, the Contractor shall submit to the Engineer for consideration a draft final statement with supporting documents showing in detail, in the form approved by the Engineer:

(a) the value of all work done in accordance with the Contract, and
(b) any further sums which the Contractor considers to be due to him under the Contract.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the final statement as agreed (for the purposes of these Conditions referred to as the "Final Statement").

If, following discussions between the Engineer and the Contractor and any changes to the draft final statement which may be agreed between them, it becomes evident that a dispute exists, the Engineer shall deliver to the Employer an Interim Payment Certificate for those parts of the draft final statement, if any, which are not in dispute. The dispute may then be settled in accordance with Clause 67.

60.7 **Discharge**

Upon submission of the Final Statement, the Contractor shall give to the Employer, with a copy to the Engineer, a written discharge confirming that the total of the Final Statement represents full and final settlement of all monies due to the Contractor arising out of or in respect of the Contract. Provided that such discharge shall become effective only after payment due under the Final Payment Certificate issued pursuant to Sub-Clause 60.8 has been made and the performance security referred to in Sub-Clause 10.1, if any, has been returned to the Contractor.

60.8 **Final Payment Certificate**

Within 28 days after receipt of the Final Statement, and the written discharge, the Engineer shall issue to the Employer (with a copy to the Contractor) a Final Payment Certificate stating:

(a) the amount which, in the opinion of the Engineer, is finally due under the Contract or otherwise, and

(b) after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled other than under Clause 47, the balance, if any, due from the Employer to the Contractor or from the Contractor to the Employer as the case may be.

60.9 **Cessation of Employer's Liability**

The Employer shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or execution of the Works, unless the Contractor shall have included a claim in respect thereof in his Final Statement and (except in respect of matters or things arising after the issue of the Taking-Over Certificate in respect of the whole of the Works) in the Statement at Completion referred to in Sub-Clause 60.5.

60.10 **Time for Payment**

The amount due to the Contractor under any Interim Payment Certificate issued by

the Engineer pursuant to this Clause, or to any other term of the Contract, shall, subject to Clause 47, be paid by the Employer to the Contractor within 28 days after such Interim Payment Certificate has been delivered to the Employer, or, in the case of the Final Payment Certificate referred to in Sub-Clause 60.8, within 56 days, after such Final Payment Certificate has been delivered to the Employer. In the event of the failure of the Employer to make payment within the times stated, the Employer shall pay to the Contractor interest at the rate stated in the Appendix to Tender upon all sums unpaid from the date by which the same should have been paid. The provisions of this Sub-Clause are without prejudice to the Contractor's entitlement under Clause 69 or otherwise.

61.1 **Approval only by Defects Liability Certificate**

Only the Defects Liability Certificate, referred to in Clause 62, shall be deemed to constitute approval of the Works.

62.1 **Defects Liability Certificate**

The Contract shall not be considered as completed until a Defects Liability Certificate shall have been signed by the Engineer and delivered to the Employer, with a copy to the Contractor, stating the date on which the Contractor shall have completed his obligations to execute and complete the Works and remedy any defects therein to the Engineer's satisfaction. The Defects Liability Certificate shall be given by the Engineer within 28 days after the expiration of the Defects Liability Period, or, if different defects liability periods shall become applicable to different Sections or parts of the Permanent Works, the expiration of the latest such period, or as soon thereafter as any works instructed, pursuant to Clause 49 and 50, have been completed to the satisfaction of the Engineer. Provided that the issue of the Defects Liability Certificate shall not be a condition precedent to payment to the Contractor of the second portion of the Retention Money in accordance with the conditions set out in Sub-Clause 60.3.

62.2 **Unfulfilled Obligations**

Notwithstanding the issue of the Defects Liability Certificate the Contractor and the Employer shall remain liable for the fulfillment of any obligation incurred under the provisions of the Contract prior to the issue of the Defects Liability Certificate which remains unperformed at the time of such Defects Liability Certificate is issued and, for the purposes of determining the nature and extent of any such obligation, the Contract shall be deemed to remain in force between the parties to the Contract.

Remedies

63.1 **Default of Contractor**

If the Contractor is deemed by law unable to pay his debts as they fall due, or enters into voluntary or involuntary bankruptcy, liquidation or dissolution (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), or becomes insolvent, or makes an arrangement with, or assignment in favour of, his creditors, or agrees to carry out the Contract under a committee of inspection of

his creditors, or if a receiver, administrator, trustee or liquidator is appointed over any substantial part of his assets, or if, under any law or regulation relating to reorganization, arrangement or readjustment of debts, proceedings are commenced against the Contractor or resolutions passed in connection with dissolution or liquidation or if any steps are taken to enforce any security interest over a substantial part of the assets of the Contractor, or if any act is done or event occurs with respect to the Contractor or his assets which, under any applicable law has a substantially similar effect to any of the foregoing acts or events, or if the Contractor has contravened Sub-Clause 3.1, or has an execution levied on his goods, or Contract, if the Engineer certifies to the Employer, with a copy to the Contractor, that, in his opinion, the Contractor:

(a) has repudiated the Contract, or

(b) without reasonable excuse has failed

(i) to commence the Works in accordance with Sub-Clause 41.1,
(ii) to proceed with the Works, or any Section thereof, within 28 days after receiving notice pursuant to Sub-Clause 46.1,

(c) has failed to comply with a notice issued pursuant to Sub-Clause 37.4 or an instruction issued pursuant to Sub-Clause 39.1 within 28 days after having received it

(d) despite previous warning from the Engineer, in writing, is otherwise persistently or flagrantly neglecting to comply with any of his obligations under the Contract, or

(e) has contravened Sub-Clause 4.1,
then the Employer may, after giving 14 days' notice to the Contractor, enter upon the Site and the Works and terminate the employment of the Contractor without thereby releasing the Contractor from any of his obligations or liabilities under the Contract, or affecting the rights and authorities conferred on the Employer or the Engineer by the Contract, and may himself complete the Works or may employ any other contractor to complete the Works. The Employer or such other contractor may use for such completion so much of the Contractor's Equipment, Temporary Works and materials as he or they may think proper.

63.2 **Valuation at Date of Termination**

The Engineer shall, as soon as may be practicable after any such entry and termination by the Employer, fix and determine ex parte, or by or after reference to the parties or after such investigation or enquiries as he may think fit to make or institute, and shall certify:

(a) what amount (if any) had, at the time of such entry and termination, been reasonably earned by or would reasonably accrue to the Contractor in respect of work then actually done by him under the Contract, and

(b) the value of any of the said unused or partially used materials, any Contractor's Equipment and any Temporary Works.

63.3 **Payment after Termination**

If the Employer terminates the Contractor's employment under this Clause, he shall not be liable to pay to the Contractor any further amount (including damages) in respect of the Contract until the expiration of the Defects Liability Period and thereafter until the costs of execution, completion and remedying of any defects, damages for delay in completion (if any) and all other expenses incurred by the Employer have been ascertained and the amount thereof certified by the Engineer. The Contractor shall then be entitled to receive only such sum (if any) as the Engineer may certify would have been payable to him upon due completion by him after deducting the said amount. If such amount exceeds the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the Employer the amount of such excess and it shall be deemed a debt due by the Contractor to the Employer and shall be recoverable accordingly.

63.4 **Assignment of Benefit of Agreement**

Unless prohibited by law, the Contractor shall, if so instructed by the Engineer within 14 days of such entry and termination referred to in Sub-Clause 63.1, assign to the Employer the benefit of any agreement for the supply of any goods or materials or services and/or for the execution of any work for the purposes of the Contract, which the Contractor may have entered into.

64.1 **Urgent Remedial Work**

If, by reason of any accident, or failure, or other event occurring to, in, or in connection with the Works, or any part thereof, either during the execution of the Works, or during the Defects Liability Period, any remedial or other work is, in the opinion of the Engineer, urgently necessary for the safety of the Works and the Contractor is unable or unwilling at once to do such work, the Employer shall be entitled to employ and pay other persons to carry out such work as the Engineer may consider necessary. If the work or repair so done by the Employer is work which, in the opinion of the Engineer, the Contractor was liable to do at his own cost under the Contract, then all costs consequent thereon or incidental thereto shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer. Provided that the Engineer shall, as soon after the occurrence of any such emergency as may be reasonably practicable, notify the Contractor thereof.

Special Risks

65.1 **No Liability for Special Risks**

The Contractor shall be under no liability whatsoever in consequence of any of the special risks referred to in Sub-Clause 65.2, whether by way of indemnity or otherwise, for or in respect of:

(a) destruction of or damage to the Works, save to work condemned under the provisions of Clause 39 prior to the occurrence of any of the said special risks,
(b) destruction of or damage to property, whether of the Employer or third parties, or
(c) injury or loss of life.

65.2 **Special Risks**

The Special Risks are:

(a) the risks defined under paragraphs (a), (c), (d) and (e) of Sub-Clause 20.4, and
(b) the risks defined under paragraph (b) of Sub-Clause 20.4 insofar as these relate to the country in which the Works are to be executed.

65.3 **Damage to Works by Special Risks**

If the Works or any materials or Plant on or near or in transit to the Site, or any of the Contractor's Equipment, sustain destruction or damage by reason of any of the said special risks, the Contractor shall be entitled to payment in accordance with the Contract for any Permanent Works duly executed and for any materials or Plant so destroyed or damaged and, so far as may be required by the Engineer or as may be necessary for the completion of the Works, to payment for:

(a) rectifying any such destruction or damage to the Works, and
(b) replacing or rectifying such materials or Contractor's Equipment,

and the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 (which shall in the case of the cost of replacement of Contractor's Equipment include the fair market value thereof as determined by the Engineer) and shall notify the Contractor accordingly, with a copy to the Employer.

65.4 **Projectile, Missile**

Destruction, damage, injury or loss of life caused by the explosion or impact, whenever and wherever occurring, of any mine, bomb, shell, grenade, or other projectile, missile, munition, or explosive of war, shall be deemed to be a consequence of the said special risks.

65.5 **Increased Costs arising from Special Risks**

Save to the extent that the Contractor is entitled to payment under any other provision of the Contract, the Employer shall repay to the Contractor any costs of the execution of the Work (other than such as may be attributable to the cost of reconstructing work condemned under the provisions of Clause 39 prior to the

occurrence of any special risk) which are howsoever attributable to or consequent on or the result of or in any way whatsoever connected with the said special risks, subject however to the provisions in this Clause hereinafter contained in regard to outbreak of war, but the Contractor shall, as soon as any such cost comes to his knowledge, forthwith notify the Engineer thereof. The Engineer shall, after due consultation with the Employer and the Contractor, determine the amount of the Contractor's costs in respect thereof which shall be added to the Contract Price and shall notify the Contractor accordingly, with a copy to the Employer.

65.6 **Outbreak of War**

If, during the currency of the Contract, there is an outbreak of war, whether war is declared or not, in any part of the world which, whether financially or otherwise, materially affects the execution of the Works, the Contractor shall, unless and untill the Contract is terminated under the provisions of this Clause, continue to use his best endeavour to complete the execution of the Works. Provided that the Employer shall be entitled, at any time after such outbreak of war, to terminate the Contract by giving notice to the Contractor and, upon such notice being given, the Contract shall, except as to the rights of

the parties under this clause and Clause 67, terminate, but without prejudice to the rights of either party in respect of any antecedent breach thereof.

65.7 **Removal of Contractor's Equipment on Termination**

If the Contract is terminated under the provisions of Sub-Clause 65.6, the Contractor shall, with all reasonable dispatch, remove from the Site all Contractor's Equipment and shall give similar facilities to his Subcontractors to do so.

65.8 **Payment if Contract Terminated**

If the Contract is terminated as aforesaid, the Contractor shall be paid by the Employer, insofar as such amounts or items have not already been covered by payments on account made to the Contractor, for all work executed prior to the date of termination at the rates and prices provided in the Contract and in addition:

(a)the amounts payable in respect of any preliminary items referred to in the Bill of Quantities, so far as the work or service comprised therein has been carried out or performed, and a proper portion of any such items which have been partially carried out or performed;

(b) the cost of materials, Plant or goods reasonably ordered for the Works which have been delivered to the Contractor or of which the Contractor is legally liable to accept delivery, such materials, Plant or goods becoming the property of the Employer upon such payments being made by him;

(c)a sum being the amount of any expenditure reasonably incurred by the Contractor in the expectation of completing the whole of the Works insofar as such expenditure has not been covered by any other payments referred to in this Sub-Clause;

(d) any additional sum payable under the provisions of Sub-Clauses 65.3 and 65.5;

(e) such proportion of the cost as may be reasonable, taking into account payments made or to be made for work executed, of removal of Contractor's Equipment under Sub-Clause 65.7 and, if required by the Contractor, return thereof to the Contractor's main plant yard in his country of registration or to other destination, at no greater cost; and

(f) the reasonable cost of repatriation of all the Contractor's staff and workmen employed on or in connection with the Works at the time of such termination.

Provided that against any payment due from the Employer under this Sub-Clause, the Employer shall be entitled to be credited with any outstanding

balances due from the Contractor for advances in respect of Contractor's Equipment, materials and Plant and any other sums which, at the date of termination, were recoverable by the Employer from the Contractor under the terms of Contract. Any sums payable under this Sub-Clause shall, after due consultation with the Employer and the Contractor, be determined by the Engineer who shall notify the Contractor accordingly, with a copy to the Employer.

Release from Performance

66.1 **Payment in Event of Release from Performance**

If any circumstance outside the control of both parties arises after the issue of the Letter of Acceptance which renders it impossible or unlawful for either party to fulfill his or their contractual obligations, or under the law governing the Contract the parties are released from further performance, then the parties shall be discharged from the Contract, except as to their rights under this Clause and Clause 67 and without prejudice to the rights of either party in respect of any antecedent breach of the Contract, and the sum payable by the Employer to the Contractor in respect of the work executed shall be the same as that which would have been payable under Clause 65 if the Contract had been terminated under the provisions of Clause 65.

Settlement of Disputes

67.1 **Engineer's Decision**

If a dispute of any kind whatsoever arises between the Employer and the Contractor in connection with, or arising out of, the Contract or the execution of the Works, whether during the execution of the Works or after their completion and whether before or after repudiation or other termination of the Contract, including any dispute as to any opinion, instruction, determination, certificate or valuation of the Engineer, the matter in dispute shall, in the first place, be referred

in writing to the Engineer, with a copy to the other party. Such reference shall state that it is made pursuant to this Clause. No later than the eighty-fourth day after the day on which he received such reference the Engineer shall give notice of his decision to the Employer and the Contractor. Such decision shall state that it is made pursuant to this Clause.

Unless the Contract has already been repudiated or terminated, the Contractor shall, in every case, continue to proceed with the Works with all due diligence and the Contractor and the Employer shall give effect forthwith to every such decision of the Engineer unless and until the same shall be revised, as hereinafter provided, in an amicable settlement or an arbitral award.

If either the Employer or the Contractor be dissatisfied with any decision of the Engineer, or if the Engineer fails to give notice of his decision on or before

the eighty-fourth day on which he received the reference, then either the Employer or the Contractor may, on or before the seventieth day after the day on which he received notice of such decision, or on or before the seventieth day after the day on which the said period of 84 days expired, as the case may be, give notice to the other party, with a copy for information to the Engineer, of his intention to commence arbitration, as hereinafter provided, as to the matter in dispute. Such notice shall establish the entitlement of the party giving the same to commence arbitration, as hereinafter provided, as to such dispute and, subject to Sub-Clause 67.4, no arbitration in respect thereof may be commenced unless such notice is given.

If the Engineer has given notice of his decision as to a matter in dispute to the Employer and the Contractor and no notice of intention to commence arbitration as to such dispute has been given by either the Employer or the Contractor on or before the seventieth day after the day on which the parties received notice as to such decision from the Engineer, the said decision shall become final and binding upon the Employer and the Contractor.

67.2 **Amicable Settlement**

Where notice of intention to commence arbitration as to a dispute has been given in accordance with Sub-Clause 67.1, the parties shall attempt to settle such dispute amicably before the commencement of arbitration. Provided that, unless the parties otherwise agree, arbitration may be commenced on or after the fifty-sixth day after the day on which notice of intention to commence arbitration of such dispute was given, even if no attempt at amicable settlement thereof has been made.

67.3 **Arbitration**

Any dispute in respect of which:

(a) the decision, if any, of the Engineer has not become final and binding pursuant to Sub-Clause 67.1, and

(b) amicable settlement has not been reached within the period stated in Sub-Clause 67.2,

shall be finally settled, unless otherwise specified in the Contract, under the Rules of Conciliation and Arbitration of the International Chamber of Commerce by one or more arbitrators appointed under such Rules. The said arbitrator/s shall have full power to open up, review and revise any decision, opinion, instruction, determination, certificate or valuation of the Engineer related to the dispute.

Neither party shall be limited in the proceedings before such arbitrator/s to the evidence or arguments put before the Engineer for the purpose of obtaining his said decision pursuant to Sub-Clause 67.1. No such decision shall disqualify the Engineer from being called as a witness and giving evidence before the arbitrator/s on any matter whatsoever relevant to the dispute.

Arbitration may be commenced prior to or after completion of the Works, provided that the obligations of the Employer, the Engineer and the Contractor shall not be altered by reason of the arbitration being conducted during the progress of the Works.

67.4 **Failure to Comply with Engineer's Decision**

Where neither the Employer nor the Contractor has given notice of intention to commence arbitration of a dispute within the period stated in Sub-Clause 67.1 and the related decision has become final and binding, either party may, if the other party fails to comply with such decision, and without prejudice to any other rights it may have, refer the failure to arbitration in accordance with Sub-Clause 67.3. The provisions of Sub-Clause 67.1 and 67.2 shall not apply to any such reference.

Notices

68.1 **Notice to Contractor**

All certificates, notices or instructions to be given to the Contractor by the Employer or the Engineer under the terms of the Contract shall be sent by post, cable, telex or facsimile transmission to or left at the Contractor's principal place of business or such other address as the Contractor shall nominate for that purpose.

68.2 **Notice to Employer and Engineer**

Any notice to be given to the Employer or to the Engineer under the terms of the Contract shall be sent by post, cable, telex or facsimile transmission to or left at the respective addresses nominated for that purpose in Part II of these Conditions.

68.3 **Change of Address**

Either party may change a nominated address to another address in the country where the Works are being executed by prior notice to the other party, with a copy to the Engineer, and the Engineer may do so by prior notice to both parties.

Default of Employer

69.1 **Default of Employer**

In the event of the Employer:

(a) failing to pay to the Contractor the amount due under any certificate of the

Engineer within 28 days after the expiry of the time stated in Sub-Clause 60.10 within which payment is to be made, subject to any deduction that the Employer is entitled to make under the Contract,

(b) interfering with or obstructing or refusing any required approval to the issue of any such certificate,

(c) becoming bankrupt or, being a company, going into liquidation, other than for the purpose of a scheme of reconstruction or amalgamation, or

(d) giving notice to the Contractor that for economic reasons it is impossible for him to continue to meet his contractual obligations,

the Contractor shall be entitled to terminate his employment under the Contract by giving notice to the Employer, with a copy to the Engineer. Such termination shall take effect 14 days after the giving of the notice.

69.2 **Removal of Contractor's Equipment**

Upon the expiry of the 14 days' notice referred to in Sub-Clause 69.1, the Contractor shall, notwithstanding the provisions of Sub-Clause 54.1, with all reasonable despatch, remove from the Site all Contractor's Equipment brought by him thereon.

69.3 **Payment on Termination**

In the event of such termination the Employer shall be under the same obligations to the Contractor in regard to payment as if the Contract had been terminated under the provisions of Clause 65, but, in addition to the payments specified in Sub-Clause 65.8, the Employer shall pay to the Contractor the amount of any loss or damage to the Contractor arising out of or in connection with or by consequence of such termination.

69.4 **Contractor's Entitlement to Suspend Work**

Without prejudice to the Contractor's entitlement to interest under Sub-Clause 60.10 and to terminate under Sub-Clause 69.1, the Contractor may, if the Employer fails to pay the Contractor the amount due under any certificate of the Engineer within 28 days after the expiry of the time stated in Sub-Clause 60.10 within which payment is to be made, subject to any deduction that the Employer is entitled to make under the Contract, after giving 28 days' prior notice to the Employer, with a copy to the Engineer, suspend work or reduce the rate of work.

If the Contractor suspends work or reduces the rate of work in accordance with the provisions of this Sub-Clause and thereby suffers delay or incurs costs the Engineer

shall, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and
(b) the amount of such costs, which shall be added to the Contract Price,

and shall notify the Contractor accordingly, with a copy to the Employer.

69.5 **Resumption of Work**

Where the Contractor suspends work or reduces the rate of work, having given notice in accordance with Sub-Clause 69.4, and the Employer subsequently pays the amount due, including interest pursuant to Sub-Clause 60.10, the Contractor's entitlement under Sub-Clause 69.1 shall, if notice of termination has not been given, lapse and the Contractor shall resume normal working as soon as is reasonably possible.

Changes in Cost and Legislation

70.1 **Increase or Decrease of Cost**

There shall be added to or deducted from the Contract Price such sums in respect of rise or fall in the cost of labour and/or materials or any other matters affecting the cost of the execution of the Works as may be determined in accordance with part II of these Conditions.

70.2 **Subsequent Legislation**

If, after the date 28 days prior to the latest date for submission of tenders for the Contract there occur in the country in which the Works are being or are to be executed changes to any National or State Statute, Ordinance, Decree or other Law or any regulation or bye-law of any local or other duly constituted authority, or the introduction of any such State Statute, Ordinance, Decree, Law, regulation or bye-law which causes additional or reduced cost to the Contractor, other than under Sub-Clause 70.1, in the execution of the Contract, such additional or reduced cost shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be added to or deducted from the Contract Price and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

Currency and Rates of Exchange

71.1 **Currency Restrictions**

If, after the date 28 days prior to the latest date for submission of tenders for the Contract, the Government or authorized agency of the Government of the country in which the Works are being or are to be executed imposes currency restrictions and/or transfer of currency restrictions in relation to the currency or currencies in which the Contract Price is to be paid, the Employer shall reimburse any loss or damage to the Contractor arising therefrom, without prejudice to the right of the Contractor to exercise any other rights or remedies to which he is entitled in such event.

72.1 **Rates of Exchange**

Where the Contract provides for payment in whole or in part to be made to the Contractor in foreign currency or currencies, such payment shall not be subject to variations in the rate or rates of exchange between such specified foreign currency or currencies and the currency of the country in which the Works are to be executed.

72.2 **Currency Proportions**

Where the Employer has required the Tender to be expressed in a single currency but with payment to be made in more than one currency and the Contractor has stated the proportions or amounts of other currency or currencies in which he requires payment to be made, the rate or rates of exchange applicable for calculating the payment of such proportions or amounts shall, unless otherwise stated in Part II of these Conditions, be those prevailing, as determined by the Central Bank of the country in which the Works are to be executed, on the date 28 days prior to the latest date for the submission of tenders for the Contract, as has been notified to the Contractor by the Employer prior to the submission of tenders or as provided for in the Tender.

72.3 **Currencies of Payment for Provisional Sums**

Where the Contract provides for payment in more than one currency, the proportions or amounts to be paid in foreign currencies in respect of Provisional Sums shall be determined in accordance with the principles set forth in Sub-Clauses 72.1 and 72.2 as and when these sums are utilised in whole or in part in accordance with the provisions of Clauses 58 and 59.

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PARTICULAR CONDITIONS OF CONTRACT

FEDERATION INTERNATIONAL DES INGENIEURS-CONSEIL

CONDITIONS OF CONTRACT FOR WORKS OF CIVIL ENGINEERING CONSTRUCTION

The Condition of Contract, Part-I: General Conditions shall be those forming Part-I of the "Conditions of Contract for Works of Civil Engineering Construction", fourth edition 1987, reprinted in 1992 with further amendments, prepared by the Federation International Des Ingénieurs-Conseils (FIDIC). These Conditions are subject to the variations and additions set out in Part-II hereof entitled "Particular Conditions of Contract."

PARTICULAR CONDITIONS OF CONTRACT [PART-II]

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PART II - PARTICULAR CONDITIONS OF CONTRACT

1.1 Definitions

(i) The Employer is NED University of Engineering and Technology Karachi.

(ii) The Engineer is M/s. TACE Pvt. Ltd. R-210 Abid Town Karachi

The following paragraph is added:

(a)(vi) "Bidder or Tenderer" means any person or persons, company, corporation, firm or joint venture submitting a Bid or Tender.

(b)(v) The following is added at the end of the paragraph:

The word "Tender" is synonymous with "Bid" and the word "Tender Documents" with "Bidding Documents".

The following paragraph is added:

(b)(ix) "Programme" means the programme to be submitted by the Contractor in accordance with Sub-Clause 14.1 and any approved revisions thereto.

(e)(i) The text is deleted and substituted with the following:

"Contract Price" means the sum stated in the Letter of Acceptance as payable to the Contractor for the execution and completion of the Works subject to such additions thereto or deductions therefrom as may be made and remedying of any defects therein in accordance with the provisions of the Contract.

2.1 Engineer's Duties and Authority

With reference to Sub-Clause 2.1(b), the following provisions shall also apply;

The Engineer shall obtain the specific approval of the Employer before carrying out his duties in accordance with the following Clauses:

(i) Consenting to the sub-letting of any part of the Works under Sub-Clause 4.1 "Subcontracting".

(ii) Certifying additional cost determined under Sub-Clause 12.2 "Not Foreseeable Physical Obstructions or Conditions".

(iii) Any action under Clause 10 "Performance Security" and Clauses 21,23,24 & 25 "Insurance" of sorts.

(iv) Any action under Clause 40 "Suspension".

(v) Any action under Clause 44 "Extension of Time for Completion".

(vi) Any action under Clause 47 "Liquidated Damages for Delay" or Payment of Bonus for Early Completion of Works (PCC Sub-Clause 47.3).

(vii) Issuance of "Taking Over Certificate" under Clause 48.

(viii) Issuing a Variation Order under Clause 51,except:

a) in an emergency* situation, as stated herebelow, or

b) if such variation would increase the Contract Price by less than the amount stated in the Appendix-A to Bid.

(ix) Fixing rates or prices under Clause 52.

(x) Extra payment as a result of Contractor's claims under Clause 53.

(xi) Release of Retention Money to the Contractor under Sub-Clause 60.3 "Payment of Retention Money".

(xii) Issuance of "Final Payment Certificate" under Sub-Clause 60.8.

(xiii) Issuance of "Defect Liability Certificate" under Sub-Clause 62.1.

(xiv) Any change in the ratios of Contract currency proportions and payments thereof under Clause 72 "Currency and Rate of Exchange".

* (If in the opinion of the Engineer an emergency occurs affecting the safety of life or of the Works or of adjoining property, the Engineer may, without relieving the Contractor of any of his duties and responsibilities under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Contractor shall forthwith comply with any such instruction of the Engineer. The Engineer shall determine an addition to the Contract Price, in respect of such instruction, in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer.)

2.2 Engineer's Representative

The following paragraph is added:

The Employer shall ensure that the Engineer's Representative is a professional engineer as defined in the Pakistan Engineering Council Act 1975 (V of 1976)

The following Sub-Clauses 2.7 and 2.8 are added:

2.7 Engineer Not Liable

Approval, reviews and inspection by the Engineer of any part of the Works does not relieve the Contractor from his sole responsibility and liability for the supply of materials, plant and equipment for construction of the Works and their parts in accordance with the Contract and neither the Engineer's authority to act nor any decision made by him in good faith as provided for under the Contract whether to exercise or not to exercise such authority shall give rise to any duty or responsibility of the Engineer to the Contractor, any Subcontractor, any of their representatives or employees or any other person performing any portion of the Works.

2.8 Replacement of the Engineer

"If the Employer intends to replace the Engineer, the Employer shall, not less than 14 days before the intended date of replacement, give notice to the Contractor, of the name, address and relevant experience of the intended replacement Engineer. The Employer shall not replace the Engineer with a person against whom the Contractor raises reasonable objection by notice to the Employer, with supporting particulars."

5.1 Language(s) and Law

(a) The Contract Documents, shall be drawn up in the English language.
(b) The Contract shall be subject to the Laws of Islamic Republic of Pakistan.

5.2 Priority of Contract Documents

The documents listed at (1) to (6) of the Sub-Clause are deleted and substituted with the following:

(1) The Contract Agreement (if completed);
(2) The Letter of Acceptance;
(3) The completed Form of Bid;
(4) Special Stipulations (Appendix-A to Bid);
(5) The Particular Conditions of Contract – Part II;
(6) The General Conditions – Part I;
(7) The priced Bill of Quantities (Appendix-D to Bid);
(8) The completed Appendices to Bid (B, C, E to L);
(9) The Drawings;

(10) The Specifications; and
(11) _____(any other).

In case of discrepancies between drawings, those of larger scale shall govern unless they are superseded by a drawing of later date regardless of scale. All Drawings and Specifications shall be interpreted in conformity with the Contract and these Conditions. Addendum, if any, shall be deemed to have been incorporated at the appropriate places in the documents forming the Contract.

The following Sub-Clauses 6.6 and 6.7 are added:

6.6 Shop Drawings

The Contractor shall submit to the Engineer for review 3 copies of all shop and

erection drawings applicable to this Contract as per provision of relevant Sub-Clause of the Contract.

Review and approval by the Engineer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory and that the Engineer's review or approval shall not relieve the Contractor of any of his responsibilities under the Contract.

6.7 As-Built Drawings

At the completion of the Works under the Contract, the Contractor shall furnish to the Engineer 6 copies and one reproducible of all drawings amended to conform with the Works as built. The price of such Drawings shall be deemed to be included in the Contract Price.

10.1 Performance Security

The text is deleted and substituted with the following:

The Contractor shall provide Performance Security to the Employer in the prescribed form. The said Security shall be furnished or caused to be furnished by the Contractor within 28 days after the receipt of the Letter of Acceptance. The Performance Security shall be of an amount equal to 05% of the Contract Price stated in the Letter of Acceptance. Such Security shall be in the form of bank guarantee from any Scheduled Bank in Pakistan.

The cost of complying with requirements of this Sub-Clause shall be borne by the Contractor.

The following Sub-Clause10.4 is added:

10.4 Performance Security Binding on Variations and Changes

The Performance Security shall be binding irrespective of changes in the quantities or variations in the Works or extensions in Time for Completion of the Works which are granted or agreed upon under the provisions of the Contract.

14.1 Programme to be Submitted

The programme shall be submitted within 42 days from the date of receipt of Letter of Acceptance, which shall be in the form of:

i) a Bar Chart identifying the critical activities.

14.3 Cash Flow Estimate to be Submitted

The detailed Cash Flow Estimate shall be submitted within 21 days from the date of receipt of Letter of Acceptance

The following Sub-Clause 14.5 is added:

14.5 Detailed Programme and Monthly Progress Report

a) For purposes of Sub-Clause 14.1, the Contractor shall submit to the Engineer detailed programme for the following:

(1) Execution of Works;
(2) Labour Employment;
(3) Local Material Procurement;
(4) Material Imports, if any; and
(5) Other details as required by the Engineer.

(b) During the period of the Contract, the Contractor shall submit to the Engineer not later than the 8th day of the following month, 10 copies each of Monthly Progress Reports covering:

(1) A Construction Schedule indicating the monthly progress in percentage;
(2) Description of all work carried out since the last report;
(3) Description of the work planned for the next 56 days sufficiently detailed to enable the Engineer to determine his programme of inspection and testing;
(4) Monthly summary of daily job record;
(5) Photographs to illustrate progress ;and
(6) Information about problems and difficulties encountered, if any, and proposals to overcome the same.

(c) During the period of the Contract, the Contractor shall keep a daily record of the work progress, which shall be made available to the Engineer as and when requested. The daily record shall include particulars of weather conditions, number of men working, deliveries of materials, quantity, location and assignment of Contractor's equipment.

The following Sub-Clauses 15.2 and 15.3 are added:

15.2 Language Ability of Contractor's Representative

The Contractor's authorised representative shall be fluent in the English language. Alternately an interpreter with ability of English language shall be provided by the Contractor on full time basis.

15.3 Contractor's Representative

The Contractor's authorised representative and his other professional engineers working at Site shall register themselves with the Pakistan Engineering Council.

The Contractor's authorised representative at Site shall be authorised to exercise adequate administrative and financial powers on behalf of the Contractor so as to achieve completion of the Works as per the Contract.

The following Sub-Clauses 16.3 and 16.4 are added:

16.3 Language Ability of Superintending Staff of Contractor

A reasonable proportion of the Contractor's superintending staff shall have a working knowledge of the English language. If the Contractor's superintending staff are not fluent in English language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer.

16.4 Employment of Local Personnel

The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labour from sources within Pakistan.

The following Sub-Clauses 19.3 and 19.4 are added:

19.3 Safety Precautions

In order to provide for the safety, health and welfare of' persons, and for prevention of damage of any kind, all operations for the purposes of or in connection with the Contract shall be carried out in compliance with the Safety Requirements of the Government of Pakistan with such modifications thereto as the Engineer may authorise or direct and the Contractor shall take or cause to be taken such further measures and comply with such further requirements as the Engineer may determine to be reasonably necessary for such purpose.

The Contractor shall make, maintain and submit reports to the Engineer concerning safety, health and welfare of persons and damage to property, as the Engineer may from time to time prescribe.

19.4 Lighting Work at Night

In the event of work being carried out at night, the Contractor shall at his own cost, provide and maintain such good and sufficient light as will enable the work to proceed satisfactorily and without danger. The approaches to the Site and the Works where the night-work is being carried out shall be sufficiently lighted. All arrangement adopted for such lighting shall be to the satisfaction of the Engineer's Representative.

20.4 Employer's Risks

The Employer's risks are:

Delete the text and substitute with the following:

(a) insofar as they directly affect the execution of the Works in Pakistan:

(i) war and hostilities (whether war be declared or not), invasion, act of foreign enemies,
(ii) rebellion, revolution, insurrection, or military or usurped power, or civil war,
(iii) ionizing radiations, or contamination by radioactivity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radioactive toxic

explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof,

(iv) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds,

(v) riot, commotion or disorder, unless solely restricted to the employees of the Contractor or of his Subcontractors and arising from the conduct of the Works;

(b) loss or damage due to the use or occupation by the Employer of any Section or part of the Permanent Works, except as may be provided for in the Contract;

(c) loss or damage to the extent that it is due to the design of the Works, other than any part of the design provided by the Contractor or for which the Contractor is responsible; and

(d) any operation of the forces of nature (insofar as it occurs on the Site) which an experienced contractor:

(i) could not have reasonably foreseen, or

(ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures:

(a) prevent loss or damage to physical property from occurring by taking appropriate measures, or

(b) insure against.

21.1 Insurance of Works and Contractor's Equipment

(Employer may vary this Sub-Clause 21.1 (b))

21.4 Exclusions

The text is deleted and substituted with the following:

There shall be no obligation for the insurances in Sub-Clause 21.1 to include loss or damage caused by the risks listed under Sub-Clause 20.4 paras (a) (i) to (iv).

The following Sub-Clause 25.5 is added:

25.5 Insurance Company

The Contractor shall be obliged to place all insurances relating to the Contract (including, but not limited to, the insurances referred to in Clauses 21, 23 and 24) with either National Insurance Company of Pakistan or any other insurance company operating in Pakistan and acceptable to the Employer.

Costs of such insurances shall be borne by the Contractor.

The following Sub-Clause 31.3 is added:

31.3 Co-operation with other Contractors

During the execution of the Works, the Contractor shall co-operate fully with other contractors working for the Employer at and in the vicinity of the Site and also shall provide adequate precautionary facilities not to make himself a nuisance to local residents and other contractors.

The following Sub-Clauses 34.2 to 34.12 are added:

34.2 Rates of Wages and Conditions of Labour

The Contractor shall pay rates of' wages and observe conditions of labour not less favourable than those established for the trade or industry where the work is carried out. In the absence of any rates of wages or conditions of labour so established, the Contractor shall pay rates of wages and observe conditions of labour which are not less favourable than the general level of wages and conditions observed by other employers whose general circumstances in the trade or in industry in which the Contractor is engaged are similar.

34.3 Employment of Persons in the Service of Others

The Contractor shall not recruit his staff and labour from amongst the persons in the services of the Employer or the Engineer; except with the prior written consent of the Employer or the Engineer, as the case may be.

34.4 Housing for Labour

Save insofar as the Contract otherwise provides, the Contractor shall provide and maintain such housing accommodation and amenities as he may consider necessary for all his supervisory staff and labour, employed for the purposes of or in connection with the Contract including all fencing, electricity supply, sanitation, cookhouses, fire prevention, water supply and other requirements in connection with such housing accommodation or amenities. On completion of the Contract, these facilities shall be handed over to the Employer or if the Employer so desires, the temporary camps or housing provided by the Contractor shall be removed and the Site reinstated to its original condition, all to the approval of the Engineer.

34.5 Health and Safety

Due precautions shall be taken by the Contractor, and at his own cost, to ensure the safety of his staff and labour at all times throughout the period of the Contract. The Contractor shall further ensure that suitable arrangements are made for the prevention of epidemics and for all necessary welfare and hygiene requirements.

34.6 Epidemics

In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government, or the local medical or sanitary authorities, for purpose of dealing with and overcoming the same.

34.7 Supply of Water

The Contractor shall, so far as is reasonably practicable, having regard to local conditions**,** provide on the Site, to the satisfaction of the Engineer or his representative, adequate supply of drinking and other water for the use of his staff and labour.

34.8 Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Statutes, Ordinances and Government Regulations or Orders for the time being in force, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his Subcontractors, agents, staff or labour.

34.9 Arms and Ammunition

The Contractor shall not give, or otherwise dispose of to any person or persons, any arms or ammunition of any kind or permit or suffer the same as aforesaid.

34.10 Festivals and Religious Customs

The Contractor shall in all dealings with his staff and labour have due regard to all recognised festivals, days of rest and religious and other customs.

34.11 Disorderly Conduct

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst staff and labour and for the preservation of peace and protection of persons and property in the neighbourhood of the Works against the same.

34.12 Compliance by Subcontractors

The Contractor shall be responsible for compliance by his Subcontractors of the provisions of this Clause.

The following Sub-Clauses 35.2 and 35.3 are added:

35.2 Records of Safety and Health

The Contractor shall maintain such records and make such reports concerning safety, health and welfare of persons and damage to property as the Engineer may from time to time prescribe.

35.3 Reporting of Accidents

The Contractor shall report to the Engineer details of any accident as soon as possible

after its occurrence. In the case of any fatality or serious accident, the Contractor shall, in addition, notify the Engineer immediately by the quickest available means.

The following Sub-Clause 36.6 is added:

36.6 Use of Pakistani Materials and Services

The Contractor shall , so far as may be consistent with the Contract, make the maximum use of materials, supplies, plant and equipment indigenous to or produced or fabricated in Pakistan and services, available in Pakistan provided such materials, supplies, plant, equipment and services shall be of required standard.

41.1 Commencement of Works

The text is deleted and substituted with the following:

The Contractor shall commence the Works on Site within the period named in Appendix-A to Bid from the date of receipt by him from the Engineer of a written Notice to Commence. Thereafter, the Contractor shall proceed with the Works with due expedition and without delay.

The following Sub-Clause 47.3 is added:

48.2 Taking Over of Sections or Parts

For the purposes of para (a) of this Sub-Clause, separate Times for Completion shall be provided in the Appendix-A to Bid “Special Stipulations”.

51.2 Instructions for Variations

At the end of the first sentence, after the word “Engineer", the words “in writing” are added.

52.1 Valuation of Variations

In the tenth line, after the words “Engineer shall” the following is added:
within a period not exceeding one-eighth of the completion time subject to a minimum of 56 days from the date of disagreement whichever is later.

53.4 Failure to Comply

This Sub-Clause is deleted in its entirety.

54.3 Customs Clearance

(Employer may vary this Sub-Clause)

54.5 Conditions of Hire of Contractor’s Equipment
The following paragraph is added:

The Contractor shall, upon request by the Engineer at any time in relation to any item of hired Contractor's Equipment, forthwith notify the Engineer in writing the name and address of the Owner of the equipment and shall certify that the agreement for the hire thereof contains a provision in accordance with the requirements set forth above.

The following Sub-Clauses 59.4 & 59.5 are added:

59.4 Payments to Nominated Subcontractors

The Contractor shall pay to the nominated Subcontractor the amounts which the Engineer certifies to be due in accordance with the subcontract. These amounts plus other charges shall be included in the Contract Price in accordance with Clause 58 [Provisional Sums], except as stated in Sub-Clause 59.5 [Certification of Payments].

59.5 Certification of Payments & Nominated Subcontractors

Before issuing a Payment Certificate which includes an amount payable to a nominated Subcontractor, the Engineer may request the Contractor to supply reasonable evidence that the nominated Subcontractor has received all amounts due in accordance with previous Payment Certificates, less applicable deductions for retention or otherwise. Unless the Contractor:

a) submits reasonable evidence to the Engineer, or
b) i) satisfies the Engineer in writing that the Contractor is reasonably entitled to withhold or refuse to pay these amounts, and
   ii) submits to the Engineer reasonable evidence that the nominated Subcontractor has been notified of the Contractor's entitlement,

then the Employer may (at his sole discretion) pay direct to the nominated Subcontractor, part or all of such amounts previously certified (less applicable deductions) as are due to the nominated Subcontractor and for which the Contractor has failed to submit the evidence described in sub-paragraphs (a) or (b) above. The Contractor shall then repay, to the Employer, the amount which the nominated Subcontractor was directly paid by the Employer.

60.1 Monthly Statements

In the first line after the word "shall", the following is added:

"on the basis of the joint measurement of work done under Clause 56.1,"

In Para (c) the words "the Appendix to Tender" are deleted and substituted with the words " Sub-Cause 60.11 (a)(6) hereof".

(in case Clause 60.11 is applicable)

60.2 Monthly Payments

In the first line, "28" is substituted by "14".

60.10 Time for Payment

The text is deleted and substituted with the following:

The amount due to the Contractor under any Interim Payment Certificate issued by the Engineer pursuant to this Clause, or to any other terms of the Contract, shall , subject to Clause 47, be paid by the Employer to the Contractor within 30 days after such Interim Payment Certificate has been jointly verified by Employer and Contractor, or, in the case of the Final Certificate referred to in Sub Clause 60.8, within 60 days after such Final Payment Certificate has been jointly verified by Employer and Contractor; Provided that the Interim Payment shall be caused in 42 days and Final Payment in 60 days in case of foreign funded project. In the event of the failure of the Employer to make payment within the times stated, the Employer shall pay to the Contractor compensation at the 28 days rate of KIBOR+2% per annum for local currency and LIBOR+1% for foreign currency, upon all sums unpaid from the date by which the same should have been paid. The provisions of this Sub-Clause are without prejudice to the Contractor's entitlement under Clause 69.

The following Sub-Clause 60.11is added:

60.11 Secured Advance on Materials

a) The Contractor shall be entitled to receive from the Employer Secured Advance against an indemnity bond acceptable to the Employer 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:

(1) The materials are in accordance with the Specifications for the Permanent Works;

(2) Such materials have been delivered to the Site and are properly stored and protected against loss or damage or deterioration to the satisfaction of the Engineer but at the risk and cost of the Contractor;

(3) 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;

(4) 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 therefor;

(5) Ownership of such materials shall be deemed to vest in the Employer and these materials shall not be removed from the Site or otherwise disposed of without written permission of the Employer; and

(6) 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 other materials.

(b) The recovery of Secured Advance paid to the Contractor under the above provisions shall be effected from the monthly payments on actual consumption basis.

60.12 Financial Assistance to Contractor

Financial assistance shall be made available to the Contractor by the Employer by adopting any one of the following three Alternatives**:**

Mobilization Advance

"Mobilization Advance", After signing the Contract commencement of work and in exchange for the Performance Bond and a separate guarantee for the amount of the Mobilization advance the Contractor shall receive from the engineer and advance payment Certificate for an amount equal to ten (10) percent of the Contract Value less any sum for the contingencies if included in the Contract Value.

The guarantee for the full amount of the Mobilization advance shall be from scheduled bank of Pakistan and in the form appended herewith together with any modifications, additions or deletions that the Employer may consider necessary. The conditions of the guarantee shall bind the Guarantor to pay the Employer in full or part of the Advance Payment which remains not repaid by the Contractor to the Employer and which the Contractor has failed to repay in accordance with this clause.

The Advance payment made by the Employer shall be recovered from the Contractor at the rate of not less than 10% of each payment invoice of the contractor.

This guarantee shall be valid for the period to be mentioned in the Guarantee or until full recovery of the advance Payment whichever is the later.

If, however, the Advance Payment is recovered in full prior to the end of the said period, the Contractor make application to the Employer for the release of the guarantee which will not be unreasonable with-held.

63.1 Default of Contractor

The following para is added at the end of the Sub-Clause:

Provided further that in addition to the action taken by the Employer against the Contractor under this Clause, the Employer may also refer the case of default of the Contractor to Pakistan Engineering Council for punitive action under the Construction and Operation of Engineering Works Bye-Laws 1987, as amended from time to time.

65.2 Special Risks

The text is deleted and substituted with the following:

The Special Risks are the risks defined under Sub-Clause 20.4 sub paragraphs (a) (i) to (a) (v).

67. 3 Arbitration

In the sixth to eight lines, the words "shall be finally settled .....appointed under such Rules" are deleted and substituted with the following:

shall be finally settled under the provisions of the Arbitration Act, 1940 as amended or any statutory modification or re-enactment thereof for the time being in force.

The following paragraph is added:

The place of arbitration shall be Karachi, Pakistan.

68.1 Notice to Contractor

The following paragraph is added:

For the purposes of this Sub-Clause, the Contractor shall, immediately after receipt of Letter of Acceptance, intimate in writing to the Employer and the Engineer by registered post, the address of his principal place of business or any change in such address during the period of the Contract.

68.2 Notice to Employer and Engineer

For the purposes of this Sub-Clause, the respective address are:

a) The Employer :

Projector Coordinator / Engineer - Construction Of Academic Block At NED University Of Engineering And Technology

b) The Engineer:

M/s. TACE Pvt. Ltd. R-210 Abid Town Gulshan-e-Iqbal Karachi

Tel: 021-34964622

70.1 Increase or decrease of cost

Delete the entire text of this Sub-Clause and substitute as follows:

The amounts payable to the Contractor, pursuant to Sub-Clause 60.1, shall be adjusted in respect of the rise or fall in the cost of labor, materials, and other inputs to the Works, by applying to such amount the formula prescribed in this Sub-Clause.

(a) Other Changes in Cost

To the extent that full compensation for any rise or fall in costs to the Contractor is not covered by the provisions of this or other Clauses in the Contract, the unit rates and prices included in the Contract shall be deemed to include amounts to cover the contingency of such other rise or fall of costs.

(b) Adjustment Formula

The adjustment to the monthly statements in respect of changes in cost shall be determined from the following formula:-

$$\text{Where} = A + b\frac{Ln}{Lo} + c\frac{Mn}{Mo} + d\frac{Em}{Eo} + \text{------}$$

Pn is a price adjustment factor to be applied to the amount for the payment of the work carried out in the subject month, determined in accordance with Paragraph 60.1 (a), and with Paragraphs 60.1 (b) and (e), where any variations and daywork are not otherwise subject to adjustment;

A is a constant, specified in Appendix-C to Bid, representing the nonadjustable portion in contractual payments;

b, c, d etc. are weightages or coefficients representing the estimated proportion of each cost element (labour, cement and reinforcing steel etc.) in the Works or Sections thereof, net of Provisional Sums and Prime Cost; the sum of A, b, c, d, etc. shall be one;

Ln, Mn, En, etc. are the current cost indices or reference prices of the cost elements for month “n”, determined pursuant to Sub-Clause 70.1(d), applicable to each cost element; and

Lo, Mo, Eo, etc. are the base cost indices or reference prices corresponding to the above cost elements at the date specified in Sub-Clause 70.1(d).

(c) Sources of Indices and Weightages

The sources of indices shall be those listed in Appendix-C to Bid, as approved by the Engineer. As the proposed basis for price adjustment, the Contractor shall have submitted with his bid the tabulation of Weightages and Source of Indices if different than those given in Appendix-C to Bid, which shall be subject to approval by the Engineer.

(d) Base, Current, and Provisional Indices

The base cost indices or prices shall be those prevailing on the day 28 days prior to the latest date for submission of bids. Current indices or prices shall be those prevailing on the day 28 days prior to the last day of the period to which a particular monthly statement is related. If at any time the current indices are not available, Provisional indices as determined by the Engineer will be used, subject to subsequent correction of the amounts paid to the Contractor when the current indices become available.

(e) Adjustment after Completion

If the Contractor fails to complete the Works within the Time for Completion prescribed under Clause 43, adjustment of prices thereafter until the date of completion of the Works shall be made using either the indices or prices relating to the prescribed time for completion, or the current indices or prices, whichever is more favorable to the Employer, provided that if an extension of time is granted pursuant to Clause 44, the above provision shall apply only to adjustments made after the expiry of such extension of time.

(f) Weightages

The weightages for each of the factors of cost given in Appendix-C to Bid shall be adjusted if, in the opinion of the Engineer, they have been rendered unreasonable, unbalanced, or inapplicable as a result of varied or additional work executed or instructed under Clause 51. Such adjustment(s) shall have to be agreed in the variation order.

The following Sub-Clauses 73.1, 73.2, 74.1, 75.1, 76.1, 77.1and 78.1 are added:

73.1 Payment of Income Tax

The Contractor, Subcontractors and their employees shall be responsible for payment of all their income tax, super tax and other taxes on income arising out of the Contract

and the rates and prices stated in the Contract shall be deemed to cover all such taxes.

73.2 Customs Duty & Taxes

The cost in BoQ items should include all taxes and duties imposed by Federal/Provincial/ Government time to time

74.1 Integrity Pact

If the Contractor or any of his Subcontractors, agents or servants is found to have violated or involved in violation of the Integrity Pact signed by the Contractor as Appendix-L to his Bid, then the Employer shall be entitled to:

(a) recover from the Contractor an amount equivalent to ten times the sum of any commission, gratification, bribe, finder's fee or kickback given by the Contractor or any of his Subcontractors, agents or servants;

(b) terminate the Contract; and

(c) recover from the Contractor any loss or damage to the Employer as a result of such termination or of any other corrupt business practices of the Contractor or any of his Subcontractors, agents or servants.

The termination under Sub-Para (b) of this Sub-Clause shall proceed in the manner prescribed under Sub-Clauses 63.1 to 63.4 and the payment under Sub-Clause 63.3 shall be made after having deducted the amounts due to the Employer under Sub-Para (a) and (c) of this Sub-Clause.

75.1 Termination of Contract for Employer's Convenience

The Employer shall be entitled to terminate the Contract at any time for the Employer's convenience after giving 56 days prior notice to the Contractor, with a copy to the Engineer. In the event of such termination, the Contractor :

(a) shall proceed as provided in Sub-Clause 65.7 hereof; and

(b) shall be paid by the Employer as provided in Sub-Clause 65.8 hereof.

76.1 Liability of Contractor

The Contractor or his Subcontractors or assigns shall follow strictly, all relevant labour laws including the Workmen's Compensation Act and the Employer shall be fully indemnified for all claims, damages etc. arising out of any dispute between the Contractor, his Subcontractors or assigns and the labour employed by them.

77.1 Joint and Several Liability

If the Contractor is a joint venture of two or more persons, all such persons shall be jointly and severally bound to the Employer for the fulfilment of the terms of the Contract and shall designate one of such persons to act as leader with authority to bind the joint venture. The composition or the constitution of the joint venture shall not be altered without the prior consent of the Employer.

78.1 Details to be Confidential

The Contractor shall treat the details of the Contract as private and confidential, save in so far as may be necessary for the purposes thereof, and shall not publish or disclose the same or any particulars thereof in any trade or technical paper or elsewhere without the prior consent in writing of the Employer or the Engineer. If any dispute arises as to the necessity of any publication or disclosure for the purpose of the Contract, the same shall be referred to the decision of the Engineer whose award shall be final.

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SPECIAL PROVISIONS

SPECIAL PROVISIONS

1. General

These special provisions shall be used as supplementary and in conjuction with other contract documents and shall be deemed to be incorporated and become part of the contract documents.

All works shall be carried out in accordance with the following specifications, supplemented by detailed specifications contained in the following sections. Any inconsistencies or ambiguities shall be brought to the notice of the Engineer for his clarification/decision. Decision and direction of the Engineer, in all such cases shall be final and binding.

The Contractor shall make himself thoroughly familiar with the site conditions, foresee any and all problems likely to the encountered during execution of the works, and shall be able and ready to solve them effectively. Proposals for solutions to the problems shall be submitted to the Consultant for approval before proceeding with the work.

The Tender Drawings, Design Criteria and Specifications are to be read in conjunction and shall be mutually explanatory. In case of any conflict the order of preference shall be as under duly followed by the Special and General Conditions of Contract in Volume I of Tender & Contract documents.

I) Specifications
ii) Tender Drawings iii)
Bill of Quantities

2. Scope of Work

The scope of work comprises **Construction of Academic Block at NED University of Engineering and Technology** works as per drawings and specification as defined hereunder and as specified in subsequent sections of tender documents. The Contractor shall perform all relevant engineering, procurement, installation, construction and execution, coordination with other services, testing and commissioning including all documentation, drawings, calculations and supply of manuals as required to complete the work. The Contractor shall also be responsible to supply and install all other items not specifically mentioned in these documents but which are necessary for proper completion of the works included in the scope of this Contract.

3. Applicable Codes and Standards

In the absence of other Standards being required by the Contract Documents, all work and materials shall meet the requirement of the Uniform Building Code of the United States, and/or applicable American Society for Testing Materials (ASTM) American Association of State Highway and Transportation Officials (AASHTO) Specifications and the latest American Concrete Institute Manual of Concrete Practice and American. Institute of Steel Construction (AISC) Manual relevant to the Works except in cases where the Pakistan Building Code requires s higher standard. In such cases the Pakistani Code shall govern, where the abbreviations listed below are used, it refers to the latest code, standards, or publications of the following

organizations:

AASHTO American Association of State Highway and Transportation Officials.

ACI American Concrete Institute

AISC American Institute of Steel Construction ANSI

American National Standards Institute ASA

American Standard Association

ASCE American Society of Civil Engineers

ASTM American Society for Testing and Material

AWS American Welding Society

BSI British Standards Institute

ICAO International Civil Aviation Organization

BSICP British Standard Institute Code of

PCA Practice Portland Cement Association

PSI Pakistan Standard Institute

UBC Uniform Building Code

Should the Contractor, at any time and for any specific reasons, wish to deviate from the above standards or desires to use materials or equipment other than those provided for by the above standards, then he shall state the exact nature of the change giving the reasons for making the change and shall submit complete specifications of the materials and descriptions of the equipment for the Engineer's approval, whose decisions shall be conclusive and binding upon the Contractor.

4. Codes, Standards, Certificates

The Contractor shall supply and have at his site office:

Copies of all latest editions of codes and standards referred to in these specifications by number, or equivalent codes and standards approved by the Engineer.

Catalogues and published, recommendations from manufacturers supplying products and materials for the project.

The Contractor shall provide manufacturers or supplier’s certificates to the Engineer for all products and materials which must meet the requirements of a specific code or standard as stated in these Specifications.

5. Units of Measurements

The British System of Units (FPS) shall be used throughout this Project.

6. Manufacturer's Recommendations

Installation of manufactured items shall be in accordance with procedures

recommended by the manufacturer or as approved by the Engineer.

7. Existing Condition at Site

Drawings and information pertaining to existing project conditions are furnished for reference. Neither the Employer nor the Engineer warrants the adequacy or correctness of these.

8. Protection and Precautions

The Contractor and his sub-contractors shall afford all necessary protection to existing structures and will be required to make good at his own expense any damage done to such structures through his own or his representatives or subcontractors' fault and negligence.

The Contractor and his sub-contractors shall afford all necessary protection to existing roads in the area. He will clear and make good at his own expense any damage to or debris on these roads through his own fault and negligence. He must at all time ensure the free and normal flow of traffic and shall not cause obstruction to the traffic system. The Contractor and his sub-contractors shall provide and maintain necessary protection and precautionary measures such as warning signs, warning lamps and barricades etc. to prevent accidents.

The Contractor shall promptly correct all such damage to original condition at no additional expense to the Employer.

The Contractor shall cooperate with trades performing work under other Contracts as necessary for completion.

9. Setting Out of Work

Establish all boundaries, markers, leveling stakes and benchmarks on the site to adequately set out all work. Verify all data and their relationship to establish and Engineer’s survey control points and public benchmarks and report discrepancies to the Engineer.

Permanently mark the necessary controls for distance and elevation sufficient to serve throughout the Contract and protect these control points adequately against damage and displacement.

Project setting out is for the use of all trades; each trade is responsible for the layout of its own work.

10. Sequence of Construction

The Contractor shall submit his proposal for approval of the Engineer the sequence of Construction, prior to starting the works. the works shall be executed as per approved sequence of construction.

11. Lines and Levels

Survey control points will be established by’ the Engineer. The Contractor shall be responsible for verifying these and shall be responsible for all requirements necessary for the execution of any work to the locations, lines, and levels specified or shown on the drawings, subject to such modifications

as the Engineer may require as work progresses.

12. Partial Possession

Whenever, as determined by the Employer any portion of work performed by the Contractor is in a condition suitable for use, the Employer may take possession of or use such portion.Such use by the Employer shall in no instance be construed as constituting final acceptance, and shall neither relieve the Contractor of any of his responsibilities under the Contract, nor acts a waiver by the Employer of any of the conditions thereof, provided that the Contractor shall not be liable for the cost of repairs, re-work, or renewals which may be required due to ordinary wear and tear resulting from such use. However, if such use increases the cost or delays to the completion of remaining portions of work, the Contractor will be entitled to an equitable adjustment.

If, as a result of the Contractor's failure to comply with the provision of the Contract, such use proves to be unsatisfactory, the Consultant will have the right to continue such use until such portion of the work can, without injury to the Consultant, be taken out of service for correction of defects, errors, omissions, or replacement of unsatisfactory materials or equipment, as necessary for such work to comply with the Contract; provided that the period of such operation or pending completion of appropriate remedial action shall not exceed twelve months unless otherwise mutually agreed upon in writing between the parties.

13. Existing Services

The Contractor shall search for, find locate and protect any visible/un visible wiring, cable, duct, pipe work, etc., within or immediately adjoining the site area.

The Contractor shall take full responsibly for safety of existing service lines, utilities and utility structures uncovered or encountered during excavation, dismantling and construction operations.

The Contractor shall take full responsibility for damaging any such service lines, utility/utility structure and any cost and/or expense that arises or issues from any such damage shall be borne directly by himself. Should any damage to any such service occur the Contractor shall forthwith take remedial action, initiate safety precautions, install temporary services and carryout repair all at his own cost and expense and inform the Engineer and notify all relevant authorities.

Existing utilities which are to remain in service or after the works are to be determined by the Contractor. If any existing service lines, utilities and utility structures which are to remain in service are uncovered or encountered during these operations, they shall be safeguarded, protected from damage, and supported.

14. Plant and Equipment

The Contractor shall submit a detailed list of plant and equipment, which he shall undertake to bring to the site to carry out the work. The list shall satisfy

the Engineer as to type, size and quantity. The list shall include for each piece of equipment the type, manufacturer, model, identification number and year of manufacture. The Contractor shall provide on the site of the work at his cost all of the equipment listed and all subsequent equipment required for approval of the detailed program me of work and such equipment which may be directed by the Engineer. The Contractor shall supply all plant and equipment necessary for the construction of each phase of the work and it must be on site, inspected and approved by the Engineer.

15. Construction Area and Access

The Contractor shall confine his operations to the areas that are actually required for the Works and shall fence the area accordingly Arrangements for access roads, storage areas and routes for haulage of materials are to be made by the Contractor at his own cost, subject to the approval of the Engineer.

16. Storage & Handling Facilities

The Employer will provide the Contractor possible space within or nearby the area of site of works for the storage of plant, equipment and materials and for Contractor's temporary office, during the currency of the Contract. In case the adjacent area as required by the Contractor is not available within the Project boundary for storage of plant, equipment and machines then the Contractor shall arrange at his own expense possible space for storage of plant, equipment and machines at his own cost and expense. On no account shall such temporary installations conflict/ interfere with any of the permanent installations, services and any operational function of Employer. The handling and storage of all plants, equipment and materials at site shall be the sole responsibility of the Contractor and at no risk and cost to the Employer.

The Contractor shall protect all material against corrosion, mechanical damage or deterioration during storage and erection on site. The protection methods shall be to the approval of the Engineer.

17. Test Laboratory and Testing

17.1 Testing, except as otherwise specified herein, shall be performed by an approved testing agency as proposed by the Contractor and at no extra cost to the Employer. The Engineer may require all testing to be carried out under his supervision only.

17.2 If suitable and adequate material testing laboratory is not available in the vicinity, then the Contractor shall provide and maintain a materials testing laboratory in the vicinity of the Contractor’s Camp and the laboratory shall have sufficient working area and shall be equipped with all necessary facilities including a suitable store room.

17.3 The Contractor shall supply and maintain to the satisfaction of the Engineer or his representative complete testing equipment, apparatus. tools, gauges, instruments, etc. in sufficient number and adequate for all tests to be carried out as specified in these specifications. Valid calibration certificates of gauges instruments requirement shall be

provided by the Contractor.

17.4 The Contractor, after the approval by the Engineer for the source of cement and steel "shall make available at the site sufficient stock of the materials in advance in order to allow sample testing for quality control prior to use.

17.5 The quality contract testing shall be performed" by the Contractor's competent personnel in accordance with a site testing and quality control program me to be established by the Contractor and approved by the Engineer or his Representative. The Contractor shall keep a complete record of all quality tests performed on site and submit the same to the Engineer. All quality control and related tests shall be carried out in accordance with applicable standards and codes.

18. Construction & Checking at Site

The Contractor shall submit to the Engineer in due time for approval and discussion, his proposals and plans as to the method and procedure to be adopted for the temporary and permanent works involved.

The submitting to these suggestions and arrangements, and the approval thereof by the Engineer shall not relieve the Contractor of his responsibilities and duties under the Contract.

The carrying out of all work included In the Contract is to be supervised by a sufficient number of qualified representatives of the Contractor and full facilities and assistance are to be afforded by the Contractor for the Engineer or his Representative to check & examine the execution of the work.

The Engineer reserves the right to inspect all parts of the works but may at his discretion waive inspection on certain items. This shall in no way absolve the Contractor from his responsibilities. This particularly applies to the checking of materials, the accurate setting out of foundations, and to the leveling, setting and aligning of the various parts, and to the proper fitting and adjustment of manufactured and finished materials and fixtures in position.

If the Engineer or his Representative find that the work progress is slow in such a way that the works or parts thereof will not be completed in the time specified, then he shall order the Contractor to work overtime or in shifts and the Contractor shall comply. These arrangements will be free of all financial encumbrances and at no additional costs to the Employer.

In the event of night work, the Contractor shall provide sufficient and adequate lighting to the satisfaction of the Engineer or his Representative and shall supply the necessary manpower for satisfactory continuation of the work after normal hours.

19. Bar Bending Schedule

Bar bending (reinforcement bars) schedule of all drawings shall be prepared by the Contractor and submitted to Consultants' Head Office for approval. The approved bar bending scheduled shall be followed for cutting of steel and preparation of bills.

20. Drawings

20.1 Tender Drawings: The drawings listed in the General Conditions of contract, Volume I and provided in Volume III are referred to as Tender Drawings and these show the scope of work to be performed by the Contractor. Tender Drawings shall not be used as a basis for fabrication or construction but may be used as a basis for placing preliminary order for materials, subject to corrections based on the future issue of Drawings as provided under sub-clause 19.2 Drawings Issued for Construction. Tender Drawings are subject to be modified and supplemented by additional detail by the Engineer.

20.2 Drawings Issued for Construction: After Award of Contract, Tender Drawings shall be replaced by Drawings Issued for Construction including supplementary Specifications as may be necessary. Such drawings and specifications shall be construed to be included in the expression Custody of Drawings under Sub-Clause 6.1 of General Conditions of Contract Part I. Drawings Issued for Construction may include some of the Tender Drawings with or without modification and additional drawings as required to express design intent in greater detail. Such drawings may also be modified from time to time. Drawings Issued for Construction will be the drawings from which shop, fabrication, erection installation, concrete placing, formwork, or other construction detail drawings shall be prepared by the Contractor. The work shall be executed in conformity with Drawings Issued for Construction. The Contractor shall prepare a schedule of Drawings Issued for Construction of various parts of the Works based on Construction programme approved by the Engineer for issuance to the Contractor from time to time.

20.3 Study of Drawings: The Contractor shall study all Drawings Issued for Construction carefully as soon as practicable after receipt thereof, and any errors discovered shall promptly be brought to the knowledge of the Engineer for his instructions.

20.4 Copies of Drawing: Drawings will be issued to the Contractor free of charge as follows:

Drawings Issued for Construction - Two copies as specified in sub-clause 6.1 Custody of Drawings, of General Conditions of Contract - Part I Volume I.

20.5 Drawings to be furnished by the Contractor:

Shop Drawings

All shop drawings required for the work including all kinds of fabrication, field erection, installation, placement and layout drawings shall be furnished by the Contractor for approval of the Engineer. If additional detail drawings are necessary to complete any part of the work, such including reinforcing steel, drawings shall be prepared by the Contractor and submitted to the Engineer. for approval. All drawings shall be complete and shall be submitted in due time and in logical order to facilitate proper coordination.

a. Lift and placement Drawings.

At least thirty calendars. days prior to starting construction of any concrete lift or other placement, the Contractor shall submit lift or other placement drawings to the Engineer for approval. Lift or other placement drawings shall be submitted for each lift or other placement of concrete to be placed. These drawings shall be to such scale as to clearly show all recesses, openings, and embedded parts, including embedded structural steel, mechanical and electrical items, reinforcement placement in each lift in sufficient detail for proper execution of the work.

b. Construction Plant Layout Drawings.

Three prints of drawings, showing the layout of construction plant and equipment the Contractor proposes to use on the work, shall be submitted by the Contractor for review to the Engineer. The drawings shall show the locations of the principal components of the construction plant, offices, storage areas and yards which the Contractor proposes to construct or use at the site of the work and elsewhere. The drawings shall also show the unloading facilities for materials and equipment at the work site.

c. Submissions and Approvals:

Except as otherwise specified, three copies of each drawing for approval or review shall be furnished to the Consultant. Within thirty calendar days after receipt the Consultant will send one copy to the Contractor marked Approved, Approved/Except as Noted, or Returned for Correction. The notations Approved and Approved/Except as Noted will authorize the Contractor to proceed with the fabrication of the materials and equipment covered by such drawings subject to the corrections, if any, indicated thereon. Drawings returned for correction will be resubmitted for approval in the same manner as for new drawings. Every revision made during the life of the Contract shall be shown by number, date and subject in a revision block.

Upon receipt of prints which have been Approved or Approved Except as Noted, the Contractor shall furnish three prints plus one reproducible of each drawing to the Engineer. If revisions are made after a drawing has been approved, the Contractor shall furnish 3 additional prints and one reproducible subsequent to each approved revision.

d. Shop drawings to be prepared by a Sub-contractor shall be submitted in the same manner as (a) & (b) above but they will be submitted through the Contractor.

e. All of the applicable requirements of this Clause with reference to drawings to be prepared by the Contractor, including Subcontractors, shall apply equally to catalogue cuts, illustrations, printed specifications, or other data submitted for approval.

f. Any work done on Contractor's drawings shall be at the Contractor's risk. The Engineer will have the right to request any additional details and to require the Contractor to make any changes in the drawings which are necessary to conform to the provisions and intent of design and specifications without additional cost to the Employer. The approval of the drawings by the Consultant shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory. Approval by the· Engineer of the Contractor's drawings shall not be held to relieve the Contractor of his obligation to meet all the requirements of the Specifications or of his responsibility for the correctness of the Contractor's drawings or of his responsibility for correct fit of assembled parts in final position or of his· responsibility for the adequacy of method of construction.

21. As-Built Drawings

The Contractor shall, at all times, keep on the site one copy of all drawings and approved samples together with copies of all building, mechanical, electrical and public safety codes and relevant standards applicable to the works. All such material shall be made available to the Engineer.

In addition, the Contractor shall, at all times, keep on site a separate set of prints on which shall be noted neatly, accurately and promptly as the work progresses all significant changes between the work shown on the drawings and that which is actually constructed. The sub-Contractors shall each keep on site, at all times, a separate set of prints of the drawings showing their parts of the work on which shall be noted, neatly accurately and promptly as work progresses the exact physical location and configuration of the works as actually installed, including any revisions or deviation from the Contract Documents.

At the completion of the works, the Contractor shall at his expense, supply to the Engineer six copies and one reproducible copy of all drawings along with CD containing all as built drawings amended to comply with the work "As Built". The Contractor shall provide in the same format as the original drawings, any additional drawing required to record the work.

22. Restoration and Cleaning

The Contractor shall do regular cleaning and clean away all rubbish and excess materials that may accumulate from time to time on completion and before handing over. Upon completion of the works he shall obliterate all signs of temporary construction facilities such as work areas, structures, foundations of temporary structures, stock piles of excess or waste materials, or any other vestiges of construction, unless otherwise directed by the Consultant/Engineer Incharge. The works and site shall be left in a clean and satisfactory state for immediate use and occupation. Care shall be taken not to use any cleaning materials which may cause damage to the surface to be cleaned.

23. Protection of the Works

The Contractor shall whenever necessary cover up and protect the works from Weather damage by his own or other workmen performing subsequent operation. He shall provide all necessary dust sheets, barriers and guard rails and clear away the same at completion.

The Contractor shall take all proper steps for protection at all places on or about the works which may be dangerous to his workmen or any other person or to traffic. The Contractor shall provide and maintain warning signs, warning lamps and barricades as necessary.

24. Product Data

Manufacture's standard schematic drawings shall be modified or deleted to indicate only information which is applicable to the project. Such standard information shall be supplemented to provide all additional applicable information.

Manufacturer's catalogue sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive literature shall be clearly marked to identify pertinent materials products or models. Dimensions and required clearances shall be indicated. Shop performance characteristics and capacities shall be noted.

25. Samples

25.1 The Contractor shall furnish for approval of the Engineer with reasonable Promptness all samples as directed by the Consultant or specifically called for in these Specifications. The Consultant shall check and approve such samples with reasonable promptness for compliance with the requirements of Contract Documents. All work shall be in accordance with approved samples.

25.2 Duplicate final approved samples, in addition to any required for the Contractor's use, shall be furnished to the Consultant, one for office use and the other for the Site.

25.3 Samples shall be furnished so as not to delay fabrication, allowing the Consultant/Engineer Incharge reasonable time for consideration of the sample' submitted.

25.4 Each sample shall be properly labeled with the name and quality of the material, manufacturers name, name of the project, the contractor's name and the date of submission, and the Specifications Article number to which the sample refers.

25.5 The manufacturer's installation directions shall be provided with each sample. The Contractor shall pay all transportation costs and deliver samples to the Engineer's office & Consultants' Head office, Site or testing laboratory as directed by the Engineer. Samples will not be returned unless return is requested at the time of submission; all packing and transportation costs for the return of samples shall be paid by the Contractor.

25.6 Samples shall be of adequate size and number to permit proper evaluation of the material by the Consultant/Engineer Incharge.

Where variations in colour, texture, dimensions or other characteristics are to be expected, the Contractor shall submit samples showing the maximum range of variation. Materials exceeding the range of variation of the approved samples shall not be used on the Work.

25.7 If both Shop Drawings and samples are required for the same item, the Consultant/Engineer Incharge may require both to be submitted before approving either,25.7 No acceptance or approval of any Shop Drawings or sample, or any indication or directions by the Engineer on any Shop Drawings shall constitute an authorization for any increase in the Contract Sum.

In the event that the site cannot be connected to a local electricity network or where the available power is insufficient the Contractor has to make his own provision and maintain such installation.

A temporary lighting system shall be furnished, installed and maintained by the Contractor as required to satisfy the minimum requirements for safety and security. The temporary lighting system shall afford adequate general illumination to all building areas. Adequate outdoor lighting shall be provided to illuminate staging trenches and the like to the satisfaction of the Engineer Incharge and general illumination throughout adequate for watchmen and emergency personnel. .

Temporary equipment and wiring for power and lighting shall be in· accordance with the applicable provisions of governing codes. Temporary wiring shall be maintained in a safe manner and utilized so as not to constitute a hazard to persons or property.

When the permanent electrical power and lighting systems are in an operating condition, they may be used for temporary power and lighting for construction purposes provided that the Contractor obtains the written approval of the Client and assumes full responsibility for the entire power and lighting system and pays all charges/costs for operation and maintenance of the system mutually agreed between the Employer and the Contractor.

Approval, license etc. if required under local laws will be obtained by the Contractor on his own responsibility and cost.At completion of construction work, or at such time as the Contractor makes use of permanent electrical equipment and devices, temporary electricity services shall be removed by the Contractor as his own expense.

25.6.1 Waste Disposal

The Contractor shall make such temporary provisions as may be required in order to dispose of any chemicals, fuels, grease, bituminous materials, waste and soil waste and the like without causing pollution to either the site or the environment. Disposal of any materials, wastes, effluents, garbage, oil, grease, chemicals and the like shall be in areas specified by the concern d local authority proposed by the Contractor and subject to the

approval of the Engineer. If any waste material is dumped in unauthorized areas the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed area. If necessary, contaminated ground shall be excavated, disposed off as directed by the Engineer In charge and replaced with suitable fill material compacted and finished with topsoil all at the expense of the Contractor.

25.6.2 Fire Protection

The Contractor shall provide and maintain adequate fire protection in the form of barrels of water with buckets, fire bucket tanks, fire extinguishers, or other effective means ready for instant use, distributed around the project and in and about temporary inflammable structures during construction of the works.

Gasoline and other flammable liquids shall be stored in and dispensed from safety containers approved by the Engineer In charge and storage shall not be within building.

Torch-cutting and welding operations performed by the Contractor shall have the approval of the Engineer In charge before such work is started and a chemical extinguisher is to be available at the location where such work is in progress.

The Contractor shall follow the instructions and specifications of the relevant department and or other local authority.

25.6.3 Telephone

The Contractor shall immediately after receiving the Letter of Acceptance take the necessary steps to obtain mobile and land line telephone at site. He shall be responsible for all installation and connection charges and periodic mobile and landline telephone accounts. The telephone shall be made available to the Engineer for the due performance of his duties at all times and free 0', charge during construction and defects liability period.

Deleted

26. Construction Schedule

A Construction schedule shall be maintained in accordance with the provisions of the General Conditions of Contract.

The schedule shall be accompanied with sufficient data and information including all necessary particulars of constructional plant, equipment machinery, temporary Works, arrival of plant, equipment at site and their installation, method of operation, work forces employed, etc, for an activity of the Works.

Should the Consultant / Engineer consider any alteration or addition in the programme and time schedule, the Contractor shall conform thereto without any cost to the Employer.

Whenever necessary and wherever the progress of the actual work shows departure, the programme and time schedule shall be undated and submitted

to the Consultant/Engineer In charge for his approval.

27. Notification to the Engineer

The Engineer's Representative shall be notified daily in writing of the nature and location of the Works the Contractor intends to perform the next day so as to enable necessary inspection and measurement to be carried out. The Engineer may, if necessary, direct that longer notice be given of certain operations.

28. Night Work

When work is done at night the Contractor shall maintain from sunset to sunrise such lights on or about his work and plant as the Engineer may deem necessary for the proper observations of the work and the efficient prosecution hereof.

29. Weather

No work is to be undertaken when, in the opinion of the Engineer, the weather is so unsuitable that proper protection of the work cannot be ensured.

30. Co-Ordination With Other Contractors

The Contractor shall make all necessary coordination with other Contractor and shall make sure that all embedding components such as pipes, steel bases etc. (as required for completion of electrical works) are properly, accurately and timely installed. The Contractor shall inform the other contractor· the schedule of any construction activity well in advance giving him sufficient time to finish his part of job, before any compaction/concreting etc. The Contractor shall get the signature of the authorized representation of the other contractor before carrying out any construction activity.

If any part of electrical work is damaged or has to be dismantled or redone due to negligence omissions / incorrect position of the embedding etc. on part of the Contractor, all such losses/expensed shall be borne by the Contractor.

All expenses incurred for the above works including coordination are deemed to be covered in his tendered cost and no separate/extra payment shall be paid against such item.

31. Submission Requirements

31.1 Schedule submission at least sixty days before the dates when reviewed submittals will be needed.

31.2 Submit Shop Drawings as per provision given in Sub-Clause 20.5 (a) and number of copies of Product Data which the Contractor requires for distribution plus four copies which will be retained by the Engineer.

31.3 Submit three samples unless otherwise specified.

31.4 Accompany submittals with transmittal letter, in duplicate, containing: Date Project title and number Contractor's name and address The number of each Shop Drawing, Product Data and the Sample submitted. Notification of deviations from Contract Documents. Other pertinent data.

32. Resubmission Requirements Shop Drawings:

Revise initial drawings as required and resubmit as specified for initial submittal. Indicate on drawings any changes which have been made by the Engineer. Product Data and Samples: Submit new data and samples as required for initial submittal.

33. Survey Instruments

All the instruments, equipment, stakes and other material necessary to perform all work shall be provided by the Contractor. The survey work shall be carried out by competent staff consistent with the current practices. The Contractor shall maintain on site surveying instruments in perfect working conditions to enable the Engineer to check lines and level at all times.

Survey instruments and equipment shall include but not limit to the following: Electronic Total Station

Laser Meter

Precision Level invert Staff

Automatic Levels

Power level

Compass, steel tape, ranging poles

34. Weekly Progress Report and Photographs

34.1 During the continuance of the Contract, the Contractor shall submit weekly progress reports on forms as approved by the Consultant. Such weekly reports shall show the actual progress completed as of date of the report plotted against the schedule as given by the Contractor at the start of work and shall be broken down so as to indicate status of all activities associated - with mobilization design, material procurement, manufacture, surveys work, tests with regard to the agreed contract programme.

34.2 The Employer and the Engineer reserve the right to coordinate the schedules of this Contractor and other Contractors working at the Site, and to adjust and/or change any and all such schedules as required during the course of construction in order to achieve a coordinated project in harmony with the Employer's completion date.

34.3 Commencing after the first week of construction, and continuing every week until completion, the Contractor shall take and submit photographs to the Engineer's Representative, to show progress of his work and completion of each structure or major feature.

35. Contractor to Notify Delays Etc.

Any delay which will affect the completion of Works shall be detailed by the Contractor who shall state the action he is taking for effective completion of the Contract programme. The Contractor shall submit a report in respect of the various sections of the Works, the equipment in use or held in readiness, 'a return of labour and supervisory staff, and details of any matters arising which may generally affect the progress of the work.

The Contractor shall give a summary of the detailed progress report giving the position with regard to the agreed Contract programme.

The progress reports shall be set out in a format to the approval of the Consultant, and forwarded promptly so that on receipt the information contained therein is not more than 21 days out of date.

If during execution of the Contract, the Employer considers the progress position of any section of the work to be unsatisfactory, or for any other reason relating to the Contract, he will be at liberty to convene a meeting and the Contractor's Representatives are to attend such meeting.

The Contractor's Site Office shall prepare and submit 6 copies of a weekly progress report to the Employer and Engineer's Site Office. This report shall summarize site activities and record and details where difficulties in maintaining the agreed programme are being experienced or are likely to cause subsequent delay.

The Contractor's Site Office shall also prepare and submit to the Engineer's Site Office 2 copies of Daily Activity Report summarizing the main activities to be undertaken each day, noting special activities such a tests, alignment checks, etc. The Contractor shall be responsible for expediting the delivery of all material and equipment to be provided by him and his subcontractors.

36. Photographs

As soon as work commences on Site, the Contractor shall provide photographs (at least 10 to 12) of the works from positions to be selected by the Engineer. Each photographic print shall not be less than 297 mm x 210 mm and shall bear a printed description, a serial number and the date when taken.

The negatives of all photographs shall be held at the Contractor's Site Office, numbered and handed over to the Employer at the completion of the Contract.

37. Facilities for the Engineer

37.1 Site Office

The Contractor shall construct, provide and maintain Consultant's Site Office of about 150-200 square ft covered area alongwith necessary furniture and fixtures No payment shall be made for the works involved within the scope of this section of specification.The cost thereof shall be deemed to have been included in the quoted unit

rate of other items of the Bills of Quantities.

37.3 Contractor's Representatives

The contractor shall appoint experienced Project Manager and Site Engineer (Professional Engineers) registered with PEC and duly licneced who will be posted at the site of work for the execution of the work properly. Contractor will also appoint supervisor and surveyor at site

The contractor shall also have a responsible person permanently on the site during normal working hours who is capable of receiving, and acting upon, instructions received from the engineer and employers representatives

The contractor shall provide such assistance and supply such labours, materials and equipment as may be required by the Engineers representative and his staff to enable them to carry out their duties under the contract.

38 Security Passes

The contractor shall arrange security passes and identification cards for all his employees and those of his sub contractor from the University Security Department of the University

39. Visitors

The contractor shall not allow any visitor on site

SPECIAL CONDITIONS OF CONTRACT

1. Mobilization Advance

The Contractor will be entitled to Mobilization Advance as per the discretion of the Employer after the signing of Contract against as irrevocable bank guarantee of any schedule bank, valid and in full force from the date of issue of the bank guarantee up to the time of deduction of advance, have equaled the amount of guarantee. The advance will given at the rate of ten percent (10%) of the Contract value in two stages 5% at each stage.

The advance will be recovered from the interim payment (Running Bill) of the Contractor at the rate of ten percent (10%) till the amount paid to the Contractor is fully adjusted. The mobilization period shall be two weeks from the date of receipt of letter of award to the Contractor by the Employer.

2. Shop Drawings

Where nature of work of Contract makes it necessary and where specifically required by these specifications and in particulars for doors, windows, ceilings, joinery, all finishes, plumbing, electrical, mechanical, roof drainage, gas, compressed air, A/C pipes and fittings and their installation etc. Contractor shall cause his materials vendors, fabricators or sub-contractors to submit scales and full size shop drawings of his work for approval of Consultant.

Shop Drawings must be complete in every detail including provisions required of various trades, connections with other work, all cutting, fitting and drilling required and any / all other necessary information in accordance with usual and customary trade practice as particularly required to be submitted to Consultants for approval.

It is to be understood that prior to manufacture, fabrication or installation of work under contract is carried forward, shop drawings shall be prepared and three copies of each drawing shall be submitted to the Consultants who will within two to three weeks after receipt thereof send one copy to the Contractor marked (I) “Approved”, (II) “Approved Except as Noted” or (III) Returned for Correction”. The notations approved and Approved Except as Noted shall authorized the Contractor to proceed with the fabrication of materials and equipment covered by such drawings subject to the correction, if any indicated thereon. When prints of drawings have been returned for correction the Contractor shall make the necessary revision on the drawings and shall re-submit prints for approval in the same manner as per new drawings. Every revision made during the life of the contract shall be shown by number, date and subject in a revision block.

So far as practicable, each drawing shall bear a cross reference note referring to sheet number or numbers of Consultants' drawings showing same work in order to facilitate checking of shop drawings in Consultants' Office and their prompt return to Contractor.

It is Contractor's obligation and responsibility to check and verify all dimensions and be fully responsible for them and for their coordination in connection with work. Contractor is responsible for submission of vendor's and / or fabricators shop drawings in proper rotation that is where the shop drawings of trade are dependent upon shop drawing of another trade, proper shop drawing shall be submitted first. No extension of time in respect to final completion date of work will be granted to Contractor because of failure to have any shop drawings in ample time to allow for checking and approval.

All shop drawings submitted by Contractor shall bear stamp of approval of Contractor as evidence that drawings have been checked by Contractor. Any drawings submitted without this stamp of approval will be considered as not having been submitted.

Each consignment of shop drawings submitted for approval must be accompanied by a letter of transmittal itemizing applicable work and number of the drawings. Each drawing must be marked with name of building and each series numbered consecutively for ready reference.

Contractor shall obtain all points from suppliers / manufacturers and others as necessary for construction purposes and the coordination of other trades and distribute them to all parties concerned.

No work being executed in any instance prior to approval by Consultants of any of respective shop drawings.

Consultants' approval, however, shall not relieve Contractor of responsibility for errors, as Consultants' approval of shop drawings is only general and is not intended to serve as a check and does not relieve Contractor from furnishing the materials and performing the work as required by drawings and specification.

3. As-Built Drawings

The Contractor shall at all times keep on the site one copy of all drawings and approved samples together with copies of all public safety codes and relevant standards applicable to the works. All such material shall be made available to the Engineer.

In addition, the Contractor shall, at all times, keep on site a separate set of prints on which shall be noted neatly, accurately and promptly site work progresses all insignificant changes between the work shown on the drawings and that which is actually constructed.

At the completion of works, the Contractor shall at his expense, supply to the Engineer six copies and two CD'S of all drawings amended to comply with work "As Built". The Contractor shall provide in the same format as the original drawings and additional drawing required to record the work.

4. Defective Work Noticed After Payment to the Contractor

If it shall appear to the Consultants that any work has been executed with unsound, imperfect or unskilled workmanship or with materials of any inferior description, or that any materials or articles, provided by the Contractor for the execution of the work are unsound or of a quality inferior to that contract or otherwise not in accordance with the Contract, the Contractor shall on demand in writing from the Consultants specifying the work, materials or articles completed of notwithstanding that the same may have been passed, certified and paid for, forthwith rectify or remove and reconstruct the work so specified in whole or in part, according to the requirement at his own charge and cost. No additional and extra payment will be made for this. In the event of his failing to do so, no payments shall be made for the same till the defect is rectified as per instruction of the Consultants and in cases where rectification or removal of defects or material is not possible and work can be accepted otherwise the rates for such items will be reduced, in such cases the decision of the Consultants will be final and binding on the Contractor.

5. Re-Measurement of Work

After checking of the bill by the Consultant, if at any stage it is observed that the measurements were wrong or doubtful then the same will be re-measured and the measurement corrected. The Contractor will be informed the date and time for joint measurement. If the Contractor or his representative does not attend, then the measurement taken by the Consultant will be taken as correct and final.

6. Contractors Representative / Agent

A competent agent registered with PEC as professional Engineer and duly authorized through a power Attorney whose qualifications and appointment shall be approved in writing by the Consultants [which approval may at any time can be withdrawn] is to be constantly on the works and shall give his whole time to the Superintendence of the same. If such approval shall be withdrawn by the Engineer the Contractor shall as soon as is practicable remove the Agent from

the site and shall not thereafter employ him again on the site in any capacity and shall promptly replace him by another agent approved by the Consultant. The agent shall receive on behalf of the Contractor directions and instructions from the Consultants or the representative of the Consultants. The approval by the Consultant of the qualifications and appointment of the Contractors' representative for Superintendence of the work shall not relieve the of the qualifications and appointment of the Contractors' representative for Superintendence of the work shall not relieve the Contractor of any of his duties or responsibilities under the contract.

7. Contractors Representative

The Engineer shall be at liberty to object to and require the Contractor to remove forthwith from the works any person provided by the Contractor who in the opinion of the Engineer, misconduct himself or is incompetent or negligent in the proper performance of his duties or whose presence on site is otherwise considered by the Engineer to be undesirable and such person shall not be again allowed upon the work. Any person so removed from the work shall be replaced as soon as possible.

8. Approved Manufacturers List

A list of approved manufacturers is attached. The list is for guidance only. Other alternative manufacturers can also be considered provided they meet the criteria and specifications of the required product. However preference will be given to products obtained from the approved manufacturers.

9. Samples

Where required in specifications as otherwise required by the Consultant samples of items of fittings, hardware, electrical and mechanical materials etc; to be applied in the work, shall be submitted by Contractor for approval to the Consultant before the Contractor takes the work in hand.

Samples of all materials submitted for approval to the Consultant shall be supplied in triplicate, each sample bearing a neatly typed label bearing the Contractor's name, name of sub-contractor or producer of materials, kind, quality and finish or formula where applicable [as in the case of liquids or paints] intended to be used, in the project with date of submission. Written approval shall be obtained prior to processing or fabrication of any materials for which samples are submitted and all finished work shall conform to the characteristics of approved samples. In no instance shall approval of a sample relieve the Contractor of the responsibility for full compliance with any specification requirement.

The fact that materials have been accepted at shop or wherever the work is in preparation or progress shall not prevent its rejection under provisions hereof at the work sites either before or after installation. All samples shall be supplied by the Contractor at his own cost, for approval as directed. Prior to the start of the application of any paint and or / finish treatment otherwise, the Contractor shall apply samples of the required finish treatment to specific representative walls and ceiling surface or other areas or surfaces where indicated by the Engineer representative. The size to be determined by the Engineer's representative / Client.

10. Insurance

The Contractor shall be responsible for obtaining a Contractors all risks policy from an insurance company acceptable to the Employer against risks to the works and shall make good at his own cost, all losses or damages whether to works themselves or to the lives, persons, whether under the Workmen's Compensation Act of Third Party Risk or property of others from whatsoever cause arising out of or in connection with the works either during the progress of the works or during the period of maintenance provided by this Contract.

The Contractor shall whenever required, produce to the Employer / Consultant the policy or policies of insurance and the receipt for the payment of the current premiums. All works together with material and plant for incorporation therein for which Contractor will be responsible under the terms of Contract. The insurance shall cover the period from the date of commencement until the date the final taking over certificate is signed, and shall also cover during the period of maintenance, loss or damage arising from a cause for which the Contractor is held responsible, whether the cause is detected prior to commencement of the period of maintenance.

Accident or Injury to Workmen

The Employer / Consultant shall not be liable for or in respect of any damages or compensation payable according to the provision of the Workmen's Compensation Act 1923 and any other laws in force in respect or in consequence of any accident, injury or death arising in connection with this contract to any workman or other person in the employment of the Contractor or any sub-contractor and the Contractor shall indemnify the Employer against all such damages, compensation, claims, demands, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

LIST OF APPROVED MANUFACTURERS / SUPPLIERS

All equipment and material provided under this contract shall be procured from the following manufacturers / suppliers only.

CIVIL WORK

S. NO	NAME OF MATERIAL	NAME OF MANUFACTURER / SUPPLIER
C-01	Cement	Lucky, Pakland and Thatta
C-02	White Cement	Anwarzeb or approved equivalent
C-03	Reinforcement	Amreli Steel, Razzaque & Mughal
C-04	Testing Laboratories	NED, PCSIR, Karachi Shipyard Engineering, Soil Mat
C-05	Ceramic Tiles	Master, STILE, EMCO, PORTA, National Tiles
C-06	Marble Tiles	Boticina, Fancy, Tavera, Chippi or approved equivalent
C-07	Terrazo Tiles	Noor, Al-Muhammad Tiles & Concrete Technologies
C-08	Paint	ICI, Berger, Dulux, Jotun, Nelson, Kansai
C-09	Aluminum	Alcop, Pakistan Cables & A.C.P or approved equivalent
C-10	Door Shutter	Interwood & Sterling or approved equivalent
C-11	Glass	Imported make i.e. Jeddah, Dubai, Prince Glass & Ghani Glass
C-12	Tinted Glass	Imported make i.e. USA and Belgium or approved equivalent
C-13	Lock	Imported make i.e. Japan, Germany, UK, Italian and Mandali
C-14	Expansion Joint Chemical	Zahabya's & Sikka or approved equivalent
C-15	Composite Doors	AVT & Homezone or approved equivalent
C-16	Porcelain Tiles	Master, Shabir
C-17	Granite	Salim Industries, Imported or as approved
C-18	Facing Block	Envicrete or Equivalent, Stone Tiles, Glazed Tiles
C-19	Paver / Kerb Block	Envicrete, Hubcrete & Megnacrete, City Crete

PLUMBING WORK

S. NO	NAME OF MATERIAL	NAME OF MANUFACTURER / SUPPLIER
P-01	Ceramic Fixture	ICL, PORTA, Finecera, Marachi
P-02	G.I. Pipes	IIL, Steellex, Jamal Pipes, Bashir Pipe
P-03	G.I. Pipe Fittings	HE China and TG China
P-04	Cast Iron Pipes	CME, TIPPU & Singer or approved equivalent
P-05	RCC Pipes	Razia & Dawood or approved equivalent
P-06	PVC Pipes	AGM, DADEX, BEETA and Jeddah Pipes
P-07	uPVC Pipes	Dadex, AGM, LANSO, Jeddah and Pak Arab
P-08	PPRC Pipes	AGM, DADEX, MASTER. Pak Asia or approved equivalent
P-09	C.I. Pipes & Fittings	Al-Pine Steel (Pvt.) Ltd. Sandal Engineering, Teepu Supreme
P-10	Bathroom Fittings	Master, SONEX, K.S and Asif
P-11	Water Cooler	MECO and Sunny or approved equivalent
P-12	Geyser	Singer, Skyline, Skyflame or approved equivalent
P-13	Fiber Glass	Master, TINO, Popular or approved equivalent
P-14	Kitchen Sinks	Super Asia & Atlas or approved equivalent
P-15	Sanitary Fittings	Master, Faisal & Perfect Industries. or approved equivalent
P-16	Valves	KITZ-JAPAN or approved equivalent
P-17	Gas Water Heaters	Singer, Corona, Adnurak or approved equivalent
P-18	C.I. Covers with Frame Floor Drains & Floor Cleanouts	Al-Pine Steel (Pvt.) Ltd & Sandal Engineering

ELECTRICAL WORK

S. NO	NAME OF MATERIAL	NAME OF MANUFACTURER / SUPPLIER
E-01	PVC Pipes & Accessories	Jeddah, Galco & Pak Arab & DADEX
E-02	Wires & Cables	Pakistan Cables, Fast, Newage and AGE
E-03	Switches & Sockets	Clipsal, Orange
E-04	Light Fixtures	Philips, Osaka and approved equivalent
E-05	Distribution Boards, Main & Sub	Zelon, Unique, Babar Bros, PEL & Tarasaki, Scheneider, ABB, Nadeem & Co., Hussain
E-06	Main Panel	Siemens, Elmatech, Electromech, Alstom & Babar Bros, Schnieder, ABB, Nadeem & Co., Hussain
E-07	Back Boxes, Pull Boxes, Floor Boxes	Busch, Milano, Legrand, ABB, Laeeq Sons, Pesco & Zeltec
E-08	Emergency Lights	OSAKA / Philips
E-09	Circuit Breakers	Terasaki, Schneider, ABB Germany, LS Korea
E-10	Fans	Pak Fan, GFC, ROYAL
E-11	Control Fuse	Tarasaki, Schnieder,
E-12	MCCBS & MCBS ELCBS	Marlin Gerlin (MG) (France), Siemens (Germany) ABB & (Italy), Terasaki, Schnieder
E-13	PVC Conduit & Accessories	Galco, PAK ARAB, Jaddah
E-14	Steel Conduit & Accessories	IIL, Jamal.
LOW VOLTAGE SYSTEM		
E-15	Data / Voice Cables CAT-6	Clipsal (Australia), 3M, Schnieder
E-16	Face Plate with CAT-6 I/O	Clipsal (Australia), 3M, Schnieder
E-17	Telephone Cables	Pakistan Cables, Siemens (Germany), Pioneer Cables & 3M
E-18	Telephone Junction Box	S.A. Electric, N.R. Industries, Misto Industries
E-19	Fire Alarm System	ZITON (UK), ZETA (UK) & GENT (UK)
E-20	CC TV Cables	Saxton (USA) or approved equivalent
E-21	CC TV Camera	Samsung / Proline (Korea / UK) or approved equivalent
E-22	Speakers	TOA (Japan), Pioneer (Japan) or approved equivalent
SPLIT TYPE AIR-CONDITIONERS & ACCESSORIES		
E-23	uPVC Pipes / Accessories	AGM, Jeddah, Pak Arab
E-24	Face Plate with CAT-6 I/O	Clipsal (Australia), Schneider
E-25	Split Type Air-Conditioner	Gree, Haier

VOLUME - II

SPECIFICATIONS

CONSTRUCTION OF ACADEMIC BLOCK AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY



PROJECT OF:

TACE PVT. LTD

www.tace.com.pk

CONSULTANT:

NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY

WWW.TACE.COM.PK

SPECIFICATIONS

VOLUME -II

TECHNICAL SPECIFICATIONS

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SECTION - 1 GENERAL REQUIREMENTS

1. General

The General Conditions of Contract & Special Conditions of Contract shall form an integral part of these General Requirements.

The Contractor shall notify all sub-contractors of the provisions of the Conditions of Contract and the General Requirement of this Specification.

The arrangement and divisions of these Specifications is not to be construed as establishing the limits of responsibility of sub-trades.

The Contractor is responsible for delineating the scope of Sub-Contracts and for coordinating all the Works.

All works shall be carried out in accordance with the following specifications, supplemented by detailed specifications contained in the following sections. Any inconsistencies or ambiguities shall be brought to the notice of the Engineer for his clarification/decision. Decision and direction of the Engineer, in all such cases shall be final and binding.

The Contractor shall make himself thoroughly familiar with the site conditions, foresee any and all problems likely to the encountered during execution of the works, and shall be able and ready to solve them effectively. Proposals for solutions to the problems shall be submitted to the Consultant for approval before proceeding with the work.

The Tender Drawings, Design Criteria and Specifications are to be read in conjunction and shall be mutually explanatory. In case of any conflict the order of preference shall be as under duly followed by the Special and General Conditions of Contract in Volume I of Tender & Contract documents.

i) Specifications
ii) Tender Drawings
iii) Bill of Quantities

2. Scope of Work

The scope of work comprises **Construction of Academic Block at NED University of Engineering and Technology.** works as per drawings and specification as defined hereunder and as specified in subsequent sections of tender documents. The Contractor shall perform all relevant engineering, procurement, installation, construction and execution, coordination with other services, testing and commissioning including all documentation, drawings, calculations and supply of manuals as required to complete the work. The Contractor shall also be responsible to supply and install all other items not specifically mentioned in these documents but which are necessary for proper completion of the works included in the scope of this Contract.

3. Applicable Codes and Standards

In the absence of other Standards being required by the Contract Documents, all work and materials shall meet the requirement of the Uniform Building Code of the United States, and/or applicable American Society for Testing Materials (ASTM) American Association of State Highway and Transportation Officials (AASHTO) Specifications and the latest American Concrete Institute Manual of Concrete Practice and American.

Institute of Steel Construction (AISC) Manual relevant to the Works except in cases where the Pakistan Building Code requires s higher standard. In such

cases the Pakistani Code shall govern, where the abbreviations listed below are used, it refers to the latest code, standards, or publications of the following organizations:

AASHTO	American Association of State Highway and Transportation Officials.
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
ASA	American Standard Association
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Material
AWS	American Welding Society
BSI	British Standards Institute
ICAO	International Civil Aviation Organization
BSICP	British Standard Institute Code of
PCA	Practice Portland Cement Association
PSI	Pakistan Standard Institute
UBC	Uniform Building Code

Should the Contractor, at any time and for any specific reasons, wish to deviate from the above standards or desires to use materials or equipment other than those provided for by the above standards, then he shall state the exact nature of the change giving the reasons for making the change and shall submit complete specifications of the materials and descriptions of the equipment for the Engineer's approval, whose decisions shall be conclusive and binding upon the Contractor.

4. Codes, Standards, Certificates

The Contractor shall supply and have at his site office:

Copies of all latest editions of codes and standards referred to in these specifications by number, or equivalent codes and standards approved by the Engineer.

Catalogues and published, recommendations from manufacturers supplying products and materials for the project.

The Contractor shall provide manufacturer's or supplier's certificates to the Engineer for all products and materials which must meet the requirements of a specific code or standard as stated in these Specifications.

5. Units of Measurements

The British System of Units (FPS) shall be used throughout this Project.

6. Manufacturer's Recommendations

Installation of manufactured items shall be in accordance with procedures recommended by the manufacturer or as approved by the Engineer.

7. Existing Condition at Site

Drawings and information pertaining to existing project conditions are furnished for reference. Neither the Employer nor the Engineer warrants the adequacy or correctness of these.

8. Protection and Precautions

The Contractor and his sub-contractors shall afford all necessary protection to existing structures and will be required to make good at his own expense any damage done to such structures through his own or his representatives or subcontractors' fault and negligence.

The Contractor and his sub-contractors shall afford all necessary protection to existing roads in the area. He will clear and make good at his own expense any damage to or debris on these roads through his own fault and negligence. He must at all time ensure the free and normal flow of traffic and shall not cause obstruction to the traffic system. The Contractor and his sub-contractors shall provide and maintain necessary protection and precautionary measures such as warning signs, warning lamps and barricades etc. to prevent accidents.

The Contractor shall promptly correct all such damage to original condition at no additional expense to the Employer.

The Contractor shall cooperate with trades performing work under other Contracts as necessary for completion.

9. Setting Out of Work

Establish all boundaries, markers, leveling stakes and benchmarks on the site to adequately set out all work. Verify all data and their relationship to establish and Engineer's survey control points and public benchmarks and report discrepancies to the Engineer.

Permanently mark the necessary controls for distance and elevation sufficient to serve throughout the Contract and protect these control points adequately against damage and displacement.

Project setting out is for the use of all trades; each trade is responsible for the layout of its own work.

10. Sequence of Construction

The Contractor shall submit his proposal for approval of the Engineer the sequence of Construction, prior to starting the works. the works shall be executed as per approved sequence of construction.

11. Lines and Levels

Survey control points will be established by' the Engineer. The Contractor shall be responsible for verifying these and shall be responsible for all requirements necessary for the execution of any work to the locations, lines, and levels specified or shown on the drawings, subject to such modifications as the Engineer may require as work progresses.

12. Partial Possession

Whenever, as determined by the Employer any portion of work performed by the Contractor is in a condition suitable for use, the Employer may take possession of or use such portion.

Such use by the Employer shall in no instance be construed as constituting final acceptance, and shall neither relieve the Contractor of any of his

responsibilities under the Contract, nor acts a waiver by the Employer of any of the conditions thereof, provided that the Contractor shall not be liable for the cost of repairs, re-work, or renewals which may be required due to ordinary wear and tear resulting from such use. However, if such use increases the cost or delays to the completion of remaining portions of work, the Contractor will be entitled to an equitable adjustment.

If, as a result of the Contractor's failure to comply with the provision of the Contract, such use proves to be unsatisfactory, the Consultant will have the right to continue such use until such portion of the work can, without injury to the Consultant, be taken out of service for correction of defects, errors, omissions, or replacement of unsatisfactory materials or equipment, as necessary for such work to comply with the Contract; provided that the period of such operation or pending completion of appropriate remedial action shall not exceed twelve months unless otherwise mutually agreed upon in writing between the parties.

13. Existing Services

The Contractor shall search for, find locate and protect any visible/un visible wiring, cable, duct, pipe work, etc., within or immediately adjoining the site area.

The Contractor shall take full responsibly for safety of existing service lines, utilities and utility structures uncovered or encountered during excavation, dismantling and construction operations.

The Contractor shall take full responsibility for damaging any such service lines, utility/utility structure and any cost and/or expense that arises or issues from any such damage shall be borne directly by himself. Should any damage to any such service occur the Contractor shall forthwith take remedial action, initiate safety precautions, install temporary services and carryout repair all at his own cost and expense and inform the Engineer and notify all relevant authorities.

Existing utilities which are to remain in service or after the works are to be determined by the Contractor. If any existing service lines, utilities and utility structures which are to remain in service are uncovered or encountered during these operations, they shall be safeguarded, protected from damage, and supported.

14. Plant and Equipment

The Contractor shall submit a detailed list of plant and equipment, which he shall undertake to bring to the site to carry out the work. The list shall satisfy the Engineer as to type, size and quantity. The list shall include for each piece of equipment the type, manufacturer, model, identification number and year of manufacture. The Contractor shall provide on the site of the work at his cost all of the equipment listed and all subsequent equipment required for approval of the detailed programme of work and such equipment which may be directed by the Engineer. The Contractor shall supply all plant and equipment necessary for the construction of each phase of the work and it must be on site, inspected and approved by the Engineer.

15. Construction Area and Access

The Contractor shall confine his operations to the areas that are actually required for the Works and shall fence the area accordingly Arrangements for access roads, storage areas and routes for haulage of materials are to be

made by the Contractor at his own cost, subject to the approval of the Engineer.

16. Storage & Handling Facilities

The Employer will provide the Contractor possible space within or nearby the area of site of works for the storage of plant, equipment and materials and for Contractor's temporary office, during the currency of the Contract. In case the adjacent area as required by the Contractor is not available within the Project boundary for storage of plant, equipment and machines then the Contractor shall arrange at his own expense possible space for storage of plant, equipment and machines at his own cost and expense. On no account shall such temporary installations conflict/ interfere with any of the permanent installations, services and any operational function of Employer. The handling and storage of all plants, equipment and materials at site shall be the sole responsibility of the Contractor and at no risk and cost to the Employer.

The Contractor shall protect all material against corrosion, mechanical damage or deterioration during storage and erection on site. The protection methods shall be to the approval of the Engineer.

17. Test Laboratory and Testing

17.1 Testing, except as otherwise specified herein, shall be performed by an approved testing agency as proposed by the Contractor and at no extra cost to the Employer. The Engineer may require all testing to be carried out under his supervision only.

17.2 If suitable and adequate material testing laboratory is not available in the vicinity, then the Contractor shall provide and maintain a material testing laboratory in the vicinity of the Contractor's Camp and the laboratory shall have sufficient working area and shall be equipped with all necessary facilities including a suitable store room.

17.3 The Contractor shall supply and maintain to the satisfaction of the Engineer or his representative complete testing equipment, apparatus. tools, gauges, instruments, etc. in sufficient number and adequate for all tests to be carried out as specified in these specifications. Valid calibration certificates of gauges instruments requirement shall be provided by the Contractor.

17.4 The Contractor, after the approval by the Engineer for the source of cement and steel "shall make available at the site sufficient stock of the materials in advance in order to allow sample testing for quality control prior to use.

17.5 The quality contract testing shall be performed" by the Contractor's competent personnel in accordance with a site testing and quality control programme to be established by the Contractor and approved by the Engineer or his Representative. The Contractor shall keep a complete record of all quality tests performed on site and submit the same to the Engineer. All quality control and related tests shall be carried out in accordance with applicable standards and codes.

18. Construction & Checking At Site

The Contractor shall submit to the Engineer in due time for approval and discussion, his proposals and plans as to the method and procedure to be adopted for the temporary and permanent works involved.

The submitting to these suggestions and arrangements, and the approval thereof by the Engineer shall not relieve the Contractor of his responsibilities and duties under the Contract.

The carrying out of all work included In the Contract is to be supervised by a sufficient number of qualified representatives of the Contractor and full facilities and assistance are to be afforded by the Contractor for the Engineer or his Representative to check & examine the execution of the work.

The Engineer reserves the right to inspect all parts of the works but may at his discretion waive inspection on certain items. This shall in no way absolve the Contractor from his responsibilities. This particularly applies to the checking of materials, the accurate setting out of foundations, and to the leveling, setting and aligning of the various parts, and to the proper fitting and adjustment of manufactured and finished materials and fixtures in position.

If the Engineer or his Representative find that the work progress is slow in such a way that the works or parts thereof will not be completed in the time specified, then he shall order the Contractor to work overtime or in shifts and the Contractor shall comply. These arrangements will be free of all financial encumbrances and at no additional costs to the Employer.

In the event of night work, the Contractor shall provide sufficient and adequate lighting to the satisfaction of the Engineer or his Representative and shall supply the necessary manpower for satisfactory continuation of the work after normal hours.

19. Bar Bending Schedule

Bar bending (reinforcement bars) schedule of all drawings shall be prepared by the Contractor and submitted to Consultants' Head Office for approval. The approved bar bending scheduled shall be followed for cutting of steel and preparation of bills.

20. Drawings

20.1 Tender Drawings: The drawings listed in the General Conditions of contract, Volume I and provided in Volume III are referred to as Tender Drawings and these show the scope of work to be performed by the Contractor. Tender Drawings shall not be used as a basis for fabrication or construction but may be used as a basis for placing preliminary order for materials, subject to corrections based on the future issue of Drawings as provided under sub-clause 19.2 Drawings Issued for Construction. Tender Drawings are subject to be modified and supplemented by additional detail by the Engineer.

20.2 Drawings Issued for Construction: After Award of Contract, Tender Drawings shall be replaced by Drawings Issued for Construction including supplementary Specifications as may be necessary. Such drawings and specifications shall be construed to be included in the expression Custody of Drawings under Sub-Clause 6.1 of General Conditions of Contract Part I. Drawings Issued for Construction may include some of the Tender Drawings with or without modification and additional drawings as required to express design intent in greater

detail. Such drawings may also be modified from time to time. Drawings Issued for Construction will be the drawings from which shop, fabrication, erection installation, concrete placing, formwork, or other construction detail drawings shall be prepared by the Contractor. The work shall be executed in conformity with Drawings Issued for Construction. The Contractor shall prepare a schedule of Drawings Issued for Construction of various parts of the Works based on Construction programme approved by the Engineer for issuance to the Contractor from time to time.

20.3 Study of Drawings: The Contractor shall study all Drawings Issued for Construction carefully as soon as practicable after receipt thereof, and any errors discovered shall promptly be brought to the knowledge of the Engineer for his instructions.

20.4 Copies of Drawing: Drawings will be issued to the Contractor free of charge as follows:

Drawings Issued for Construction - Two copies as specified in sub-clause 6.1 Custody of Drawings, of General Conditions of Contract - Part I Volume I.

20.5 Drawings to be furnished by the Contractor:

Shop Drawings

All shop drawings required for the work including all kinds of fabrication, field erection, installation, placement and layout drawings shall be furnished by the Contractor for approval of the Engineer. If additional detail drawings are necessary to complete any part of the work, such including reinforcing steel, drawings shall be prepared by the Contractor and submitted to the Engineer. for approval. All drawings shall be complete and shall be submitted in due time and in logical order to facilitate proper coordination.

a. Lift and placement Drawings.

At least thirty calendar. days prior to starting construction of any concrete lift or other placement, the Contractor shall submit lift or other placement drawings to the Engineer for approval. Lift or other placement drawings shall be submitted for each lift or other placement of concrete to be placed. These drawings shall be to such scale as to clearly show all recesses, openings, and embedded parts, including embedded structural steel, mechanical and electrical items, reinforcement placement in each lift in sufficient detail for proper execution of the work.

b. Construction Plant Layout Drawings.

Three prints of drawings, showing the layout of construction plant and equipment, the Contractor proposes to use on the work, shall be submitted by the Contractor for review to the Engineer. The drawings shall show the locations of the principal components of the construction plant, offices, storage areas and yards which the Contractor proposes to construct or use at the site of the work and elsewhere. The drawings shall also show the unloading facilities for materials and equipment at the work site.

c. Submissions and Approvals:

Except as otherwise specified, three copies of each drawing for approval or review shall be furnished to the Consultant. Within thirty

calendar days after receipt the Consultant will send one copy to the Contractor marked Approved, Approved/Except as Noted, or Returned for Correction. The notations Approved and Approved/Except as Noted will authorize the Contractor to proceed with the fabrication of the materials and equipment covered by such drawings subject to the corrections, if any, indicated thereon. Drawings returned for correction will be resubmitted for approval in the same manner as for new drawings. Every revision made during the life of the Contract shall be shown by number, date and subject in a revision block.

Upon receipt of prints which have been Approved or Approved Except as Noted, the Contractor shall furnish three prints plus one reproducible of each drawing to the Engineer. If revisions are made after a drawing has been approved, the Contractor shall furnish 3 additional prints and one reproducible subsequent to each approved revision.

d. Shop drawings to be prepared by a Sub-contractor shall be submitted in the same manner as (a) & (b) above but they will be submitted through the Contractor.

e. All of the applicable requirements of this Clause with reference to drawings to be prepared by the Contractor, including Subcontractors, shall apply equally to catalogue cuts, illustrations, printed specifications, or other data submitted for approval.

f. Any work done on Contractor's drawings shall be at the Contractor's risk. The Engineer will have the right to request any additional details and to require the Contractor to make any changes in the drawings which are necessary to conform to the provisions and intent of design and specifications without additional cost to the Employer. The approval of the drawings by the Consultant shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory. Approval by the· Engineer of the Contractor's drawings shall not be held to relieve the Contractor of his obligation to meet all the requirements of the Specifications or of his responsibility for the correctness of the Contractor's drawings or of his responsibility for correct fit of assembled parts in final position or of his· responsibility for the adequacy of method of construction.

21. As-Built Drawings

The Contractor shall, at all times, keep on the site one copy of all drawings and approved samples together with copies of all building, mechanical, electrical and public safety codes and relevant standards applicable to the works. All such material shall be made available to the Engineer.

In addition, the Contractor shall, at all times, keep on site a separate set of prints on which shall be noted neatly, accurately and promptly as the work progresses all significant changes between the work shown on the drawings and that which is actually constructed. The sub-Contractors shall each keep on site, at all times, a separate set of prints of the drawings showing their parts of the work on which shall be noted, neatly accurately and promptly as work progresses the exact physical location and configuration of the works

as actually installed, including any revisions or deviation from the Contract Documents.

At the completion of the works, the Contractor shall at his expense, supply to the Engineer six copies and one reproducible copy of all drawings along with CD containing all as built drawings amended to comply with the work "As Built". The Contractor shall provide in the same format as the original drawings, any additional drawing required to record the work.

22. Restoration and Cleaning

The Contractor shall do regular cleaning and clean away all rubbish and excess materials that may accumulate from time to time on completion and before handing over. Upon completion of the works he shall obliterate all signs of temporary construction facilities such as work areas, structures, foundations of temporary structures, stock piles of excess or waste materials, or any other vestiges of construction, unless otherwise directed by the Consultant/Engineer Incharge. The works and site shall be left in a clean and satisfactory state for immediate use and occupation. Care shall be taken not to use any cleaning materials which may cause damage to the surface to be cleaned.

23. Protection of the Works

The Contractor shall whenever necessary cover up and protect the works from Weather damage by his own or other workmen performing subsequent operation. He shall provide all necessary dust sheets, barriers and guard rails and clear away the same at completion.

The Contractor shall take all proper steps for protection at all places on or about the works which may be dangerous to his workmen or any other person or to traffic. The Contractor shall provide and maintain warning signs, warning lamps and barricades as necessary.

24. Product Data

Manufacture's standard schematic drawings shall be modified or deleted to indicate only information which is applicable to the project. Such standard information shall be supplemented to provide all additional applicable information.

Manufacturer's catalogue sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive literature shall be clearly marked to identify pertinent materials products or models. Dimensions and required clearances shall be indicated. Shop performance characteristics and capacities shall be noted.

25. Samples

25.1 The Contractor shall furnish for approval of the Engineer with reasonable Promptness all samples as directed by the Consultant or specifically called for in these Specifications. The Consultant shall check and approve such samples with reasonable promptness for compliance with the requirements of Contract Documents. All work shall be in accordance with approved samples.

25.2 Duplicate final approved samples, in addition to any required for the Contractor's use, shall be furnished to the Consultant, one for office use and the other for the Site.

25.3 Samples shall be furnished so as not to delay fabrication, allowing the Consultant/Engineer Incharge reasonable time for consideration of the sample' submitted.

25.4 Each sample shall be properly labeled with the name and quality of the material, manufacturers name, name of the project, the contractor's name and the date of submission, and the Specifications Article number to which the sample refers.

25.5 The manufacturer's installation directions shall be provided with each sample. The Contractor shall pay all transportation costs and deliver samples to the Engineer's office & Consultants' Head office, Site or testing laboratory as directed by the Engineer. Samples will not be returned unless return is requested at the time of submission; all packing and transportation costs for the return of samples shall be paid by the Contractor.

25.6 Samples shall be of adequate size and number to permit proper evaluation of the material by the Consultant/Engineer Incharge. Where variations in colour, texture, dimensions or other characteristics are to be expected, the Contractor shall submit samples showing the maximum range of variation. Materials exceeding the range of variation of the approved samples shall not be used on the Work.

25.7 If both Shop Drawings and samples are required for the same item, the Consultant/Engineer Incharge may require both to be submitted before approving either,25.7 No acceptance or approval of any Shop Drawings or sample, or any indication or directions by the Engineer on any Shop Drawings shall constitute an authorization for any increase in the Contract Sum.

In the event that the site cannot be connected to a local electricity network or where the available power is insufficient the Contractor has to make his own provision and maintain such installation.

A temporary lighting system shall be furnished, installed and maintained by the Contractor as required to satisfy the minimum requirements for safety and security. The temporary lighting system shall afford adequate general illumination to all building areas. Adequate outdoor lighting shall be provided to illuminate staging trenches and the like to the satisfaction of the Engineer Incharge and general illumination throughout adequate for watchmen and emergency personnel. .

Temporary equipment and wiring for power and lighting shall be in· accordance with the applicable provisions of governing codes. Temporary wiring shall be maintained in a safe manner and utilized so as not to constitute a hazard to persons or property.

When the permanent electrical power and lighting systems are in an operating condition, they may be used for temporary power and lighting for construction purposes provided that the Contractor obtains the written approval of the Client and assumes full responsibility for the entire power and lighting system and pays all charges/costs for operation and maintenance of the system mutually agreed between the Employer and the Contractor.

Approval, license etc. if required under local laws will be obtained by the Contractor on his own responsibility and cost.

At completion of construction work, or at such time as the Contractor makes use of permanent electrical equipment and devices, temporary electricity services shall be removed by the Contractor as his own expense.

25.6.1 Waste Disposal

The Contractor shall make such temporary provisions as may be required in order to dispose of any chemicals, fuels, grease, bituminous materials, waste and soil waste and the like without causing pollution to either the site or the environment. Disposal of any materials, wastes, effluents, garbage, oil, grease, chemicals and the like shall be in areas specified by the concern d local authority proposed by the Contractor and subject to the approval of the Engineer. If any waste material is dumped in unauthorized areas the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed area. If necessary, contaminated ground shall be excavated, disposed off as directed by the Engineer In charge and replaced with suitable fill material compacted and finished with topsoil all at the expense of the Contractor.

25.6.2 Fire Protection

The Contractor shall provide and maintain adequate fire protection in the form of barrels of water with buckets, fire bucket tanks, fire extinguishers, or other effective means ready for instant use, distributed around the project and in and about temporary inflammable structures during construction of the works.

Gasoline and other flammable liquids shall be stored in and dispensed from safety containers approved by the Engineer In charge and storage shall not be within building.

Torch-cutting and welding operations performed by the Contractor shall have the approval of the Engineer In charge before such work is started and a chemical extinguisher is to be available at the location where such work is in progress.

The Contractor shall follow the instructions and specifications of the relevant department and or other local authority.

25.6.3 Telephone

The Contractor shall immediately after receiving the Letter of Acceptance take the necessary steps to obtain mobile and land line telephone on site. He shall be responsible for all installation and connection charges and periodic mobile and landline telephone accounts. The telephone shall be made available to the Engineer for the due performance of his duties at all times and free 0', charge during construction and defects liability period.

26. Construction Schedule

A Construction schedule shall be maintained in accordance with the provisions of the General Conditions of Contract.

The schedule shall be accompanied with sufficient data and information including all necessary particulars of constructional plant, equipment machinery, temporary Works, arrival of plant, equipment at site and their

installation, method of operation, work forces employed, etc, for an activities of the Works.

Should the Consultant / Engineer consider any alteration or addition in the programme and time schedule, the Contractor shall conform thereto without any cost to the Employer.

Whenever necessary and wherever the progress of the actual work shows departure, the programme and time schedule shall be undated and submitted to the Consultant/Engineer In charge for his approval.

27. Notification to the Engineer

The Engineer's Representative shall be notified daily in writing of the nature and location of the Works the Contractor intends to perform the next day so as to enable necessary inspection and measurement to be carried out. The Engineer may, if necessary, direct that longer notice be given of certain operations.

28. Night Work

When work is done at night the Contractor shall maintain from sunset to sunrise such lights on or about his work and plant as the Engineer may deem necessary for the proper observations of the work and the efficient prosecution hereof.

29. Weather

No work is to be undertaken when, in the opinion of the Engineer, the weather is so unsuitable that proper protection of the work cannot be ensured.

30. Co-Ordination With Other Contractors

The Contractor shall make all necessary coordination with other Contractor and shall make sure that all embedding components such as pipes, steel bases etc. (as required for completion of electrical works) are properly, accurately and timely installed. The Contractor shall inform the other contractor· the schedule of any construction activity well in advance giving him sufficient time to finish his part of job, before any compaction/concreting etc. The Contractor shall get the signature of the authorized representation of the other contractor before carrying out any construction activity.

If any part of electrical work is damaged or has to be dismantled or redone due to negligence omissions / incorrect position of the embedding etc. on part of the Contractor, all such losses/expensed shall be borne by the Contractor.

All expenses incurred for the above works including coordination are deemed to be covered in his tendered cost and no separate/extra payment shall be paid against such item.

31. Submission Requirements

31.1 Schedule submission at least sixty days before the dates when reviewed submittals will be needed.

31.2 Submit Shop Drawings as per provision given in Sub-Clause 20.5 (a) and number of copies of Product Data which the Contractor requires for distribution plus four copies which will be retained by the Engineer.

31.3 Submit three samples unless otherwise specified.

31.4 Accompany submittals with transmittal letter, in duplicate, containing: Date Project title and number Contractor's name and address The number of each Shop Drawing, Product Data and the Sample submitted. Notification of deviations from Contract Documents. Other pertinent data.

32. Resubmission Requirements Shop Drawings:

Revise initial drawings as required and resubmit as specified for initial submittal. Indicate on drawings any changes which have been made by the Engineer. Product Data and Samples: Submit new data and samples as required for initial submittal.

33. Survey Instruments

All the instruments, equipment, stakes and other material necessary to perform all work shall be provided by the Contractor. The survey work shall be carried out by competent staff consistent with the current practices. The Contractor shall maintain on site surveying instruments in perfect working conditions to enable the Engineer to check lines and level at all times.

Survey instruments and equipment shall include but not limit to the following:

Electronic Total Station

Laser Meter

Precision Level invert Staff

Automatic Levels

Power level

Compass, steel tape, ranging poles

34. Weekly Progress Report and Photographs

34.1 During the continuance of the Contract, the Contractor shall submit weekly progress reports on forms as approved by the Consultant. Such weekly reports shall show the actual progress completed as of date of the report plotted against the schedule as given by the Contractor at the start of work and shall be broken down so as to indicate status of all activities associated - with mobilization design, material procurement, manufacture, surveys works, tests with regard to the agreed contract programme.

34.2 The Employer and the Engineer reserve the right to coordinate the schedules of this Contractor and other Contractors working at the Site, and to adjust and/or change any and all such schedules as required during the course of construction in order to achieve a coordinated project in harmony with the Employer's completion date.

34.3 Commencing after the first week of construction, and continuing every week until completion, the Contractor shall take and submit photographs to the Engineer's Representative, to show progress of his work and completion of each structure or major feature.

35. Contractor to Notify Delays Etc.

Any delay which will affect the completion of Works shall be detailed by the Contractor who shall state the action he is taking for effective completion of the Contract programme.

The Contractor shall submit a report in respect of the various sections of the Works, the equipment in use or held in readiness, 'a return of labour and supervisory staff, and details of any matters arising which may generally affect the progress of the work.

The Contractor shall give a summary of the detailed progress report giving the position with regard to the agreed Contract programme.

The progress reports shall be set out in a format to the approval of the Consultant, and forwarded promptly so that on receipt the information contained therein is not more than 21 days out of date.

If during execution of the Contract, the Employer considers the progress position of any section of the work to be unsatisfactory, or for any other reason relating to the Contract, he will be at liberty to convene a meeting and the Contractor's Representatives are to attend such meeting.

The Contractor's Site Office shall prepare and submit 6 copies of a weekly progress report to the Employer and Engineer's Site Office. This report shall summarize site activities and record and details where difficulties in maintaining the agreed programme are being experienced or are likely to cause subsequent delay.

The Contractor's Site Office shall also prepare and submit to the Engineer's Site Office 2 copies of Daily Activity Report summarizing the main activities to be undertaken each day, noting special activities such a tests, alignment checks, etc. The Contractor shall be responsible for expediting the delivery of all material and equipment to be provided by him and his subcontractors.

36. Photographs

As soon as work commences on Site, the Contractor shall provide photographs (at least 10 to 12) of the works from positions to be selected by the Engineer. Each photographic print shall not be less than 297 mm x 210 mm and shall bear a printed description, a serial number and the date when taken.

The negatives of all photographs shall be held at the Contractor's Site Office, numbered and handed over to the Employer at the completion of the Contract.

37. Facilities for the Engineer

37.1 Site Office

The Contractor shall construct, provide and maintain Consultant's Site Office of about 150-200 square meter covered area as per the specifications at each location. A preliminary layout of the site office shall be provided by the Consultant. After receiving letter of award the Contractor will submit to the Engineer detailed shop drawings for review and approval. Specifications for construction of site office shall be the same as provided in Volume-II of the tender documents.

The Consultant's site office shall be furnished and equipped with new and unused furniture, equipment, air-conditioners, electrical fittings etc., as per the list given below:

1	Wooden office table with drawers and side racks	2 (Two) No.
2	Office Chairs	2 (Two) No.
3	Wooden sitting visitors chairs with arms (standard size)	4 (Four) No.
4	Steel filing cabinet (standard size)	1 (One) No.
5	Split type (1-1/2 ton)	1 (One) No.
6	Electric Kettle	1 (One) No.
7	Computer Dual Core, Original Intel processor 2GB DDR2 Ram, 160 GB hard disk, 17" LCD Monitor along with Laser Printer (A-3 Size), Scanner, DVD Writer, Speakers, Licensed software for microsoft, MS office and autocad.	1 (One) No.
8	56 k Speed Modem Card etc.	1 (One) No.
9	Computer Table & chair	1 (One) No..
10	Conference Table (1.5 meter x 1.0 meter) & chairs	1 (One) set.

Mobile & Landline Telephone with connections 1 (One) No. Each Engineer

If any equipment, furniture and installations become unserviceable for any reason whatsoever the Contractor shall promptly replace the same as and when directed by the Consultant. The Consultant's Site office with fittings, fixtures and all other equipment/accessories shall be maintained and operated for the entire duration of construction period as well as for the duration of subsequent defects liability period.

The Site Office including fittings, fixtures, furniture, furnishing and all other equipment/accessories shall be the property of the Employer on completion of the Contract.

37.3 Contractor's Employees

The Contractor shall provide and employ on the Site for the purpose of or in connection with the Contract:

S. No	Staff to be Employed with Qualification	No.	Experience
1	Project Manager - B.E. in Civil	1	Minimum 15 years experience
2	Senior Site Engineer - B.E./B.Tech in Civil	2	Minimum 8 years experience
3	Site Inspector - D.A.E. (3 years)in Civil	2	Minimum 5 years experience.
4	Surveyor - D.A.E. (3 years) in Civil	1	Minimum 5 years experience.
5	Quantity Surveyor - D.A.E. (3 years) in Civil	1	Minimum 10 years experience.

S. No.	Staff to be Employed with Qualification	No.	Experience
1	Work Superintendents	3	Metric / non-metric with 10 to 15 years experience in the construction of RCC work and can understand drawings well
2	Remaining staff be employed by the Contractor as required at site as per schedule of Work		

38. Payment of Work

No payment shall be made for the works involved within the scope of this section of specification.

The cost thereof shall be deemed to have been included in the quoted unit rate of other items of the Bills of Quantities.

SECTION – 2 CONTRACTOR'S CAMP

1. Scope

The work to be done under this item consists of construction, erection, installation and maintenance of the Contractor's Project Site Offices or main camp and the Contractor's sub-camps or temporary camps, if any, and shall include all offices, shops, warehouses, and other operational buildings; all' housing and related facilities including accommodations for the Contractor's personnel.

The location of the Contractor's camps, including all buildings, utilities and facilities there for, and of the camps or establishments of all persons/parties in the vicinity operating or associated with the Contractor shall be subject to approval of the Engineer.

The work to be done under this item will terminate upon the actual Completion Date. However, if directed by the Consultant or the Employer, the Contractor shall continue such work to the extent required by the Contractor's personnel during the period of maintenance. No compensation shall be paid for the continued operation and maintenance of the Contractor's Camps during the period of maintenance.

Upon completion of the Works, or at such time within the period of maintenance as directed by the Consultant, the Contractor shall remove all buildings utilities and other facilities from the Site and restore all camp areas to a neat and clean condition.

The construction, operation and maintenance of all camps of the Contractor shall comply with all applicable provisions of current Pakistan Labour Camp Rules.

Adequately equipped and properly staffed portable first aid stations or dispensaries shall be provided by the Contractor at camps and other strategic locations to administer first aid treatment at any time required and free of charge to all persons on the Site, including employees of the Consultant and the Employer.

2. Payment of Work

No payment shall be made for the works involved within the scope of this section of Specifications unless otherwise specifically stated in the Bills of Quantities or herein.

The cost thereof shall be deemed to have been included in the quoted unit rate of other items of the Bills of Quantities.

SECTION – 3 STAKE-OUT SURVEY

1. Scope

Under this item the Contractor shall make the stakeout survey for construction purposes with competently qualified men, consistent with the current practices. The work shall proceed immediately upon the award of the contract and shall be expeditiously progressed to completion in a manner and at a rate satisfactory to the Engineer. The Contractor shall keep the Engineer fully informed as to the progress of the stakeout survey. The scope of this section of specifications is covered by detailed specifications as laid down herein.

2. Material and Equipment

All instruments, equipment, stakes and other material necessary to perform all work shall be provided by the Contractor. These instruments and equipment shall be available to Engineer at all times for the purpose of checking the work of the Contract.

All stakes used shall be of a type approved by the Engineer, clearly and permanently marked so as to be legible at all times. It shall be the Contractor's responsibility to maintain these stakes in their proper position and location at all times. Any existing stakes or markers defining property lines and survey monuments which may be disturbed during construction shall be properly tied into fixed reference point before being disturbed and accurately reset in their proper position upon completion of the work.

3. Construction

The Contractor shall trim trees, bushes and other interfering objects, not consistent with the plan, from survey lines in advance of all survey work to permit accurate and unimpeded work by his stake-out survey crews and the Engineer's survey crews. The exact position of all work shall be established from control points, which are shown on the plans or modified by the Engineer. Any error, apparent discrepancy in or absence of data shown or required for accurately accomplishing' the stakeout survey shall be referred to the Engineer for interpretation or furnishing when such is observed or required.

The Contractor shall be responsible for the accuracy of his work and shall maintain all reference points, stakes, etc. throughout the life of the contract. Damaged, destroyed or inaccessible reference points, bench marks or stakes shall be replaced by the Contractor. Existing or new control points that will be or are destroyed during construction shall be re-established and all reference ties recorded thereon shall be furnished to the Engineer. All stakeout survey work shall be referenced to the centerlines shown on the Plans. All computations necessary to establish the exact position of the work from control points shall be made and preserved by the Contractor. All computations, survey notes and other records necessary to accomplish the work shall be kept neatly and made available to the Engineer upon request and furnished to the Employer upon Contract completion.

The Engineer may check all or any portion of the stakeout survey work or notes made by the Contractor and any necessary correction to the work shall be immediately made. Such checking by the Engineer shall not relieve the

Contractor of any of his responsibilities for the accuracy or completeness of his work.

Reference points, base lines, stakes and benchmarks for borrow pits shall be established by the Contractor.

All required right-of-way and easement limits shall be established, staked and referenced by the Contractor concurrent with the construction stakeout survey.

The Contractor shall place at least two offset stakes or references at each centre lines station and at such intermediate stations as the Engineer may direct. From computations and measurements made by the Contractor, these stakes shall be clearly marked with the correct centre line, station number, offset and cut or fill so as to permit the establishment of the true centre line location during construction. He shall locate and place all cut, fill, slope, line grade or other stakes and points as the Engineer may direct to be necessary for the proper progress of the work.

4. Payment of Work

No payment shall be made for the Works involved within the scope of this section of Specifications unless otherwise specifically stated in the Bills of Quantities or herein.

The cost thereof shall be deemed to have been included in the quoted unit rate of other items of the Bills of Quantities.

SECTION – 4 CLEARING AND GRUBBING

1. Scope

The clearing and grubbing shall consist of clearing the designated area of all trees, down timber, snags, bush, other vegetation, rubbish and all other objectionable material, and shall include grubbing stumps, roots, and matted roots, and disposal of all spoil material resulting from the clearing and grubbing. It shall also include the removal and disposal of structures that protrude, encroach upon, or otherwise obstruct the work, except when other vise provided for on the plans or directed by the Engineer to be saved. The scope of this section of specifications is covered with detailed specifications laid down herein.

2. Limit of Area

2.1 Location of Works

The Engineer will define the limit of areas where clearing and grubbing is to be done. Normally it will include all land within the right of way and all other construction area including ditches, detours, minor road crossings and other areas shown on the plans or as specified or as directed by the Engineer. The Engineer will designate the fences, structures and debris and trees and bushes to be cleared where grubbing is not required. It shall not include clearing and grubbing of borrow or other pit areas from which material is secured. It shall include the leveling or removal of all bunds or mounds within the right of way unless otherwise directed by the Engineer.

2.2 Grubbing and Cutting

All roots and stumps within the limits of the site shall be grubbed and excavated unless otherwise specified or approved by the Engineer.

2.3 Disposal

All wood and bush shall be burned or otherwise disposed off within fifteen (15) days after cutting or felling unless otherwise approved. No tree trunks, stumps or other debris shall be left within Site unless approved in writing by the Engineer. The location of disposal areas shall be within or outside the limits of the project or as approved in writing by the Engineer and shall be acquired by the Contractor at his own expense. Any useable material shall remain the property of the Employer.

2.4 Protection and Restoration

The Contractor shall prevent all damage to pipes, conduits, wires, cables or structures above or below ground. No land monuments, property markers, or official datum points shall be damaged or removed until the Engineer has witnessed or otherwise referred their location and approved their removal. The Contractor shall so control his operations as to prevent damage to trees and shrubs, which are to be preserved. Protection may include fences and boards lashed to trees tv prevent damage from machine operations. The existing covered or open benchmarks should be relocated as directed by the Engineer. In the event that anything specified herein to be saved and protected is damaged.

SECTION – 5 DISMANTLING WORKS

1. Scope

The work covered by this Section of the Specifications consists of furnishing all plant, labour, equipment, appliances and performing all operations in connection with demolition! dismantling and removal of existing building components, walls, floors, skirting, plaster and removing of doors, windows and ventilators, removal / re-routing of utility services of the building with accessories, removal of existing roof finishes and disposal/stacking of material to designated places. Whole work shall be done in accordance with these and other relevant specifications and as directed by the Engineer.

2. Procedures

2.1 The Engineer will define the limits where demolition/ dismantling and removal activity is to be done and shall approve the procedures/methods to be adopted by the Contractor.

2.2 Whole work shall be performed in an orderly manner and the Contractor shall take all necessary precautions and expedients to prevent damages to the adjacent structures, installed equipment/machinery, pipes, conduits etc. Any damage caused to the structures and installations due to negligence of the Contractor during demolition dismantled and removal operations shall be repaired / replaced by the Contractor at his cost and to the satisfaction of the Engineer.

3. Demolition of Building Components

3.1 The Contractor shall demolish walls, floors skirting, cutting of plaster, removing of doors, windows, ventilators, concrete/ masonry works and other associated parts to the line and depth as shown on the Drawings or as directed by the Engineer. Explosives shall not be used to remove the plain and reinforced cement concrete or any other material whatsoever. Manually or where required mechanically operated breakers, concrete saws, chipping hammers or other approved methods shall be employed for cutting. Care shall be taken that existing services and structures are not damaged. It shall be the responsibility of the Contractor to replace at his cost any services, Structures damaged by the Contractor due to his negligence during cutting operations or thereafter until the whole of cut parts areas are restored to original condition to the satisfaction of the Engineer.

4. Removal of Existing Services/ Utilities/Finishes

4.1 The Contractor shall mark all the services/ utilities falling within the Contract area. After getting approval from the Engineer, the contractor shall remove all such Services/utilities/finishes as per the requirement specifications of the relative department whose utilities/services finishes are being removed/ shifted.

5. Disposal

5.1 All debris materials resulting from demolition / dismantling works shall be disposed off to places designated by the Engineer in the manner of disposition required and directed by the Engineer.

5.2 All useable materials resulting from demolition and removal shall remain the property of the Employer and shall be stacked at

designated places.

6. Measurement and Payment

6.1 General

Except otherwise specified herein or elsewhere in the Bill of Quantities/Contract Documents no measurement and payment will be made for the under mentioned items related to this section. The cost thereof shall be deemed to have been included in the quoted unit rate of the other items of the Bill of Quantities under this section.

6.1.1 Temporary diversion and safety measures.

6.1.2 Loading, unloading, transportation and disposal of demolished dismantled/removed/useable material to the place designated by the Engineer.

6.1.3 Permissions/approvals, if required, from the relative department.

6.1.4 Stacking of all useable material to the place designated by the Engineer.

6.1.5 Earth work

6.2 Dismantling of Tile Floors/Dado/Skirting / Wall fly proof jail

6.2.1 Measurement

Measurement for acceptably completed works of dismantling and removal of existing tile floors/dada/skirting/wall/fly proof jali and staking of useable material at designated places will be made on the basis of actual area in square foot of dismantled floor/dado/skirting/wall/fly proof jali as directed by the Engineer.

6.2.2 Payment

Payment will be made for acceptably measured quantity of dismantled tile floor/dado/skirting/wall/fly proof jali on the basis of unit rate per square foot quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the item. If this item is not covered in the BOQ the cost thereof shall be deemed to have been included in the quoted unit rate of other items of bill of quantities.

6.3 Removal of Doors and Windows with Chowkhats

6.3.1 Measurement

Measurement for acceptably completed works of removal of existing doors/windows with chowkhats and staking of useable material at designated places will be made on the basis of actual number of removed doors/windows with chowkhats as directed by the Engineer.

6.3.2 Payment

Payment will be made for acceptably measured quantity of removal of existing doors/windows with chowkhats on the basis of unit rate per number quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the item. If this item is not covered in the BOQ the cost

thereof shall be deemed to have been included in the quoted unit rate of other items of bill of quantities.

6.4 RCC Slab

6.4.1 Measurement

Measurement for acceptably completed works of removal of existing RCC slab will be made on the basis of actual volume in cubic feet of dismantled concrete as directed by the Engineer.

6.4.2 Payment

Payment will be made for acceptably measured quantity of dismantling of existing RCC slab on the basis of unit rate per cubic feet quoted in the Bill of Quantities full compensation for all the works related to the item.

SECTION – 6 EARTH WORK

1. Scope of Work

The work under this section of the specification consist of furnishing all plant, labour equipment, appliances and materials and in performing all operations in connection with earthworks of all underground services and structural units, stock piling of suitable excavated material, disposal of unsuitable and surplus excavated material in accordance with this section of specifications, the applicable drawings and subject to terms and conditions of the Contract.

2. General

2.1 The Contractor shall be deemed to have made. local and independent inquires as to, and shall take the whole risk of, the nature of the ground subsoil or material to be excavated or penetrated and the Contractor shall not be entitled to receive an extra or additional payment nor to be relieved from any of his obligations by reasons of the nature of such ground subsoil or material.

2.2 All excavations, cut and fills shall be constructed to the lines, levels and gradients specified with any necessary allowance for consolidation, settlement and drainage so that at the end of the Period of Maintenance· the ground shall be at the required lines, levels and gradients. During the course of the Contract and during the Period of Maintenance any damage or defects in cuts and fills, in structures and other works, caused by slips, falls of wash-ins or any other ground movement due to the Contractor's negligence shall be made good by the contractor at his own cost.

3. Site Preparation

3.1 The Contractor shall set out the works and shall be responsible for true and perfect Setting out of the same and for correctness of the positions levels, dimensions and alignments of all parts thereof. If at any time any error in this respect shall appear during the progress of the works, the Contractor shall at his own expense rectify such error, to the satisfaction of the Engineer.

3.2 The Contractor shall construct and maintain accurate bench marks so that the Lines and Levels can be easily checked by the Engineer.

3.3 The Contractor shall perform a joint surely with the Engineer's Representative, of the area where earth work is required, plot the ground levels on the drawings and obtain approval from the Engineer before starting the earth work and shall supply a copy to the Employer duly checked, signed and authenticated by the Engineer before start of work.

4. Excavations

4.1 Excavation shall include the removal of all material of every name and nature. It is expected that rock and other hard material will be encountered during excavation, The rate of excavation shall include the removal of all sub-surface material of every name and nature and no classification of sub-surface material shall be made nor any additional payment shall be made.

4.2 The major portion of excavations shall be carried out by mechanical

excavators and excavated materials disposed off to stock on spoil as directed by the Engineer. The excavation may be done by normal means, unless otherwise specified by the Engineer, leveling, trimming and finishing to the required levels and dimensions shall be done manually. The material suitable for fill and backfill if approved by the Engineer shall be stockpiled within the limits of whole of the Site as directed by the Engineer. Excavated material unsuitable for use as fill and backfill shall be disposed off by the Contractor at locations approved by the Engineer within specified free haulage limit.

4.3 The Contractor shall give reasonable notice that he intends to commence any excavation and he shall submit to the Engineer full details of his proposals. The Engineer's approval shall not relieve the Contractor of his responsibility with respect to such work.

4.4 The Contractor shall preserve the completed excavation from damage due to slips' and earth movements, ingress of water from any source whatsoever and deterioration by exposure to the sun and the effects of the weather.

All excavations shall be kept free of water and shall be maintained dry to the satisfaction of the Engineer. Prevent surface water and sub-surface water and sub surface ground water from flowing into the excavation and flooding the project site and surroundings.

Do not allow water to accumulate in excavations, remove water from excavations to present softening of foundation bottoms, under cutting footings and soil changes determined to the stability of sub-grades and foundations. Provide and discharge lives necessary to convey the water away from the excavations convey water removed from excavation and rain water to outside the limits in manner that no damages is caused to the surrounding services properties.

4.5 Excavation for pits, cable trenches, equipment-foundations and other structures shall be taken out to the levels and dimensions shown on Drawings or such other levels and dimensions as the Engineer may direct.

4.6 Excavation shall extend to adequate distance from walls and footings to allow for placing and removal of forms, installations of services and for inspection, except where the concrete for walls and footings is authorized to be deposited directly against excavated surfaces. Undercutting will not be permitted. The additional excavation for placing and removal of forms, installation of services, for inspection and generally for working area on slopes for stability shall not be measured for payment and shall be deemed to be included in the rates for excavation as measured net.

4.7 All' excavations in foundations shall be taken to 6 inch above the final excavation elevations shown on the drawings and the 6-inch shall be trimmed carefully to a smooth and level surface. Immediately after trimming to the final elevation, a layer of blinding concrete shall be placed to the thickness shown on the drawings. All excavations for foundations which have been trimmed and disturbed shall be compacted and covered by lean concrete by the end of the day.

4.8 No excavation shall be refilled nor any permanent work commenced until the foundation has been inspected by the Engineer and his

permission to proceed is given.

4.9 If excavation for sub-structures are carried below the required level, as shown on the Drawings or as directed by the Engineer, the surplus depth shall be filled in with concrete of same grade as of blinding concrete at the sole cost of the Contractor.

4.10 All excavation shall be performed in the dry. The placing of blinding concrete, placing of reinforcement and casting of the permanent works in the excavation shall be carried out in the dry.

4.11 Shoring, where required during excavation, shall be installed to protect workmen and the bank, adjacent paving, structures and utilities. The term shoring shall also be deemed to cover whatever methods the Contractor elects to adopt, with prior approval of the Engineer, for upholding the sides of excavation and also for planking and strutting to excavation against the side of roadways and adjoining properties in existing hardcore of any other material. The Contractor will be held responsible for upholding the sides of all excavations and no claim for additional excavation, concrete or other material will be considered in this respect.

4.12 Existing utility lines that are shown on the drawings or the locations of which are made known to the Contractor prior to excavation and that are to be retained, as well as utility lines constructed during excavation and backfilling, and if damaged, shall be repaired by the Contractor at his own expense. Any existing utility lines which are not known to the Contractor in sufficient time to avoid damage, if inadvertently damaged during excavation, shall be repaired by the Contractor and adjustment in payment will be made as approved by the Engineer. When utility lines which are to be removed, ace encountered within the area of operations the Contractor shall notify the Engineer in. ample time for the necessary measures to be taken to prevent interruption of the service.

4.13 Where applicable the excavation work shall include the excavation in above water table and excavation below water table. The Contractor shall provide all plant, equipment, pumps, sheeting, well points as required to keep the water table 3.0 feet below the deepest foundation as shown on the drawings till the completion of foundation works.

4.14 4.14 Before starting the excavation for pipelines, the Contractor shall ensure the correct alignment of the pipeline on the ground the depth and width of excavation of the trench, all in accordance with the Drawings and instructions of the Engineer. The Contractor shall make profile with cement concrete pillars.

4.15 Excavation shall be carried out true to lines, levels, grades and widths as shown on the drawings or as directed by the Engineer ensuring proper laying of the pipe line, the bedding fill, construction of chambers for appurtenances and any other structures. The trench bottom shall be graded to provide even and substantial bearing over the specified bedding and of the structure.

Without the written permission of the Engineer, not more than 600 feet of the trench shall be opened in advance of the completed pipeline.

4.16 The Engineer may require the Contractor to excavate below the

.elevations shown on the drawings or he may order him to stop above the elevations shown depending upon the suitable foundation material encountered,.

4.17 If for any reason, the levels, grades or profiles of the excavations are changed adversely by the Contractor, the Contractor shall at his own cost, be liable to bring the excavations to the required levels and profiles as shown on the drawings or as directed by the Engineer.

5. Excavation Tolerances

Excavation shall be performed within the tolerances for excavation limits indicated on the drawings, where no tolerance limits are indicated excavation shall be performed to tolerances established by the Engineer as acceptable for the design and type of work involved.

6. Fill and Backfill

6.1 The backfilling shall include filling under the floors, around the foundation trenches, pipes, conduits, ducts and channels.

The backfilling shall include loading, unloading, transporting, placing, stacking, spreading of earth, watering, rolling, ramming and compacting, etc., complete as specified herein.

6.2 The excavated material if found suitable shall be stockpiled within the free haulage limit of the Project Boundary. This material shall be used for filling/back-filling if approved by the Engineer and shall be transported by the Contractor anywhere required for the purpose of filling/back-filling work in this Contract.

The Contractor shall provide the approved quality of backfill and fill material required to complete the fill and back- filling work from the places /borrow areas as designated by the Engineer. All necessary permissions from any authority for excavation within Borrow areas/ designated places shall be of contractor’s responsibility. Deep filling shall be predominantly granular material and free from slurry mud, organic or other unsuitable matter and capable of compaction by ordinary means.

6.3 Material for backfilling shall be as approved by the Engineer and shall be placed in layers not exceeding 6 inches measured as compacted material with sufficient water and compacted to produce in-situ density not less than 95% of the maximum dry density at optimum moisture content.

6.4 Depending on the depth of fill the Engineer may instruct increased thickness of successive layers to be placed. The filling shall be compacted by mechanical means as approved by the Engineer.

6.5 Filling around pipes and cables shall be carefully placed with fine material to cover the pipe or cable completely before the normal fill is placed.

6.6 Backfilling of trenches/foundations shall be carried out only after the pipe line/structural works within the excavations have been inspected, tested and approved by the Engineer.

Fill shall not be placed against foundation walls prior to approval by the Engineer. Fill shall be brought up evenly on each side of the walls as far as practicable. Heavy equipment for spreading and compacting

the fill shall not be operated closer to the wall than a distance equal to the height of the fill above the wall.

7. Tolerances

The stabilization of compacted backfill / fill surface shall be smooth and even and shall not vary more than 3/8 inch in 10 feet from true profile and shall not be more than 1/2 inch from true elevation.

8. Disposal of Surplus Excavated Material

8.1 The rejected unsuitable material and surplus excavated material shall be disposed off at designated place or as directed by the Engineer. No compensation of any lead/lift is . admissible and rates quoted shall be deemed to include the same.

8.2 The disposal of surplus/unsuitable excavated material shall include loading, unloading, transporting, stacking, spreading and leveling as directed by the Engineer.

9. Measurement and Payment

9.1 General

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned works related to the relevant BOQ items. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

9.1.1 Timber shoring, planking, strutting and providing slope for upholding the sides of excavations.

9.1.2 Any fill with approved material necessitated by over excavation due to fault or convenience of the Contractor except under structural members.

9.1.3 Stockpiling the excavated material at approved location within free haulage limit of the Project Boundary and transporting back suitable material to places requiring fill or backfill.

9.1.4 Specified foundation bed preparation.

9.1.5 Excavation involved in providing adequate working space around sides of foundation and service line trenches.

9.1.6 Providing approved quality fill/backfill material obtained from excavated material as designated by the Engineer.

9.1.7 Rolling, leveling, watering & compacting the fill and backfill to required density.

9.1.8 All laboratory and field tests stipulated in these specifications.

9.1.9 Disposal of rejected surplus and unsuitable excavated material at designated place or as directed by the Engineer. No compensation of any lead/lift is admissible and rates quoted shall be deemed to include the same.

9.1.10 De-watering to keep the foundations dry during construction.

9.1.11 All cost inclusive of borrow area's royalty charges

9.1.12 Testing of Sub-grade material equal to or greater than CBR

value 10%

9.1.13 Providing and testing of sweet earth.

9.2 Excavation

9.2.1 Measurement

Quantities of excavation shall be, circulated / measured from the pre-work levels of leveled and graded ground taken jointly by the Contractor and the Engineer before commencement of the work.

The quantities set out for excavation and its subsequent disposal shall be deemed to be the bulk quantity before excavating and no allowance shall be made for any subsequent variations in bulk or for any extra excavation.

Unless otherwise shown on the Drawings quantities of excavation shall be measured of acceptably completed works on the basis of vertical excavations required in accordance with lines of concrete.

Quantities of excavation for laying service line trenches shall be measured for payment on the basis of vertical excavation faces for the specified width for the trench as shown on the drawings.

Measurement for acceptably completed excavation works shall be made on the basis of number of cubic feet of material excavated for foundation and service trenches as shown on the Drawings or as directed by the Engineer.

9.2.2 Payment

Payment will be made for acceptably measured quantity of excavation on the basis of unit rate per cubic feet quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item, including but not limiting to back filling.

9.3 Backfill/Fills

9.3.1 Measurement

Measurement for acceptably completed backfill/fill works will be made on the basis of number of cubic feet of compacted back fill / fill in position in accordance with the lines, levels and grade as shown on Drawings or as directed by the Engineer.

9.3.2 Payment

Payment will be made for acceptably measured quantity of backfill/fill on the basis of unit rate per cubic feet quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item.

SECTION – 7 FORM WORK

1. Scope

The work under this section of the Specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in any floor and roof and floor and at any height in connection with the supply and installation of formwork for the purpose of shuttering in concreting work, complete in strict accordance with this section of the' specifications and the applicable drawings and subject to the terms and conditions of the Contract. The works include all formwork required at any floor and at any height required for the completion of the work as per drawings/specifications.

2. General

It shall be the responsibility of the Contractor to perform the work by engaging well-trained & experienced staff or by the sub-contractor who shall have enough number of well-trained and experienced staff to coordinate his activities with the other operations. However the Contractor shall be responsible for the quality of work performed by the sub-contractor -as per the requirements of these specifications.

3. Materials

The Contractor shall use the following formwork materials for different purposes as stated below:

3.1 Timber

Form framing, sheathing and shoring.

3.2 Plywood

Form sheathing and panels.

3.3 Steel

Heavy forms and false Work Column and joint forms Permanent forms Welding of permanent forms

3.4 Form Ties Anchors and Hangers

For securing formwork against. placing loads and pressures.

3.5 Coatings

To facilitate form removal.

3.6 Steel Joists

For formwork support.

3.7 Steel frame shoring

For formwork support.

4. Delivery And Storage

4.1 Delivery

The delivery of formwork materials shall be done in such a manner that damage can be prevented.

4.2 Storage

Formwork should be stored, after cleaning and preparing for re-use if used before, in. such a manner that access to all different materials is available.

Material which can be affected by weathering :)hall be stored in appropriate building or under covers and shade.

5. Workmanship

5.1 Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete and shall have sufficient rigidity to maintain specified tolerances.

Where required details and locations of special forms to be used are set out on the drawings. The Engineer shall refuse any formwork in any part of the building, which has been constructed with a non-approved formwork. The Engineer shall refuse any concreting which will not be perfect or may not conform to the approved model.

5.2 Earth cuts shall not be used as forms for vertical surfaces of reinforced concrete work unless required as such or permitted by the Engineer.

5.3 Mud centering shall not be permitted without the prior approval of the Engineer.

5.4 Formwork shall be of wrought timber steel, plywood, proprietary building boards and such special materials, as may be shown on the drawings or approved by the Engineer, which give the required finish to the surface of concrete. Wooden formwork shall be free from loose knots and shall be well seasoned.

The responsibility of the safe design of the formwork shall be entirely that of the Contractor.

a) No wooden props, bamboo, ballies etc., shall be used as supports to beams or roofs and floors. Only steel pipe scaffoldings (tubular) to be used for all works.

b) No wooden formwork shall be allowed to be used in columns, roofs and floors and beams etc. All the form work shall be of steel as approved.

c) Only wooden planks of approved quality and thickness of 2 inches minimum on the sides of beams shall be allowed.

d) All the erected formwork shall be inspected and approved in all respects by the Engineer or his representative prior to concreting.

e) Where concrete will be exposed to view, special care shall be taken in the selection of the form material and the construction of the forms, to the end that the concrete will be smooth, uniform in texture, true in line and face and free from honey-combing and other projections. All sides and joints on the forms shall be flush (without lipping) and inconspicuous, wood used for such work shall be thoroughly cleaned before each reuse and shall be free from cracks, splinters, nails, or other defects effecting the appearance of the concrete.

5.5 The formwork shall conform to the shape, lines and dimensions as shown on the plans and be so constructed as to remain sufficiently rigid during the placing and compacting of the concrete, and shall be sufficiently tight to prevent loss of liquid from the concrete. The design and Engineering of the formwork, as well as its construction, shall be the responsibility of the Contractor. Where necessary, to maintain the specified tolerances, the formwork shall be cambered to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete and due to construction loads. The Contractor shall establish and maintain in an undisturbed conditioned until final completion and acceptance of the project, sufficient control points and benchmarks to be used as references for checking upon tolerances.

5.6 Forms for architectural concrete shall be designed to produce the required finish or finishes. Deflection of facing materials between studs as well as deflection of studs and wailers shall be limited to 0.0025 times the span or as otherwise specified. Forms shall be designed to permit easy removal. Prying against the face of the concrete shall not be allowed. Only wooden wedges shall be used.

5.7 Where natural plywood-form-finish, grout-cleaned-finish, smooth-rubbed- finish, scrubbed-finish or sand-floated-finish is required, forms shall be smooth (faced with plywood, liner sheets, or pre-fabricated panels) and true to line, in order that the surfaces produced will require little dressing to arrive at true surfaces. -Where any as-cast finish is required, no dressing shall be permitted in the finishing operation.

5.8 Where as-cast surfaces, including natural plywood-form-finish are specified, the panels of material against which concrete is cast shall be orderly in arrangement, with joints between panels planned in approved relation to openings, building corners, and other architectural features.

5.9 Where panels for as-cast surfaces are separated by recessed or otherwise emphasized joints, the structural design of the forms shall provide for locating form ties, where possible, within the joints so that patches of tie holes will not fall within the panel areas.

5.10 Forms shall not be re-used if there is any evidence of surface wear and tear or defect, which would impair the quality of the surface finish. Forms shall be thoroughly cleaned and properly coated with form oil before re-use.

5.11 The formwork shall be designed so that the soffits of slabs and sides of beams, columns and walls may be removed first, leaving the forms to the soffits of beams and their supports in position.

5.12 Forms shall be sufficiently tight to prevent loss of mortar from the concrete. Unless otherwise specified in the Contract Documents chamfer strips shall be placed in the corners of forms to produce beveled edges on permanently exposed surfaces. Interior corners on such surfaces and the edges of formed joints will not require beveling unless required by the Contract Documents.

5.13 Positive means such as wedges or jacks for accurate adjustment and for proper removal of shores and struts shall be provided and all

settlement shall be monitored during concrete placing operation. Forms shall be securely braced against lateral deflections.

5.14 Where concreting of thin members is required to be carried out within formwork of considerable depth, temporary openings in the sides of the formwork shall be provided where necessary to facilitate the placing and consolidation of concrete. Small temporary openings shall also be provided at the bottom of the formwork for columns, walls and deep beams to permit the cleaning out of debris and observation immediately before concrete is deposited.

5.15 Form ties shall be constructed so that the ends or end fasteners can be removed without causing appreciable spelling at the faces of the concrete. After the ends or end fasteners of form ties have been removed, the embedded portion of the ties shall terminate not less than 2 diameter or twice the minimum dimension of the tie from the formed faces of concrete to be permanently exposed to view except that in no case shall this distance be less than 3/4 inch. When the formed face of the concrete is not to be permanently exposed to view, form ties may be cut of flush with the formed surfaces. Precaution shall be taken not to rotate form ties. Through bolts may be permitted provided that they are greased to allow for easy withdrawal and the holes subsequently made good. Through bolts are not to be used on water-retaining structures and basement walls.

5.16 At construction joints contact surface of the form sheathing for flush surfaces exposed to view shall overlap the hardened concrete in the previous placement by no less than 1. Inch. The forms shall be held against the hardened concrete to prevent offsets or loss of mortar at the construction joint so as to maintain a true surface.

5.17 Wood forms for wall opening shall be constructed to facilitate loosening, if necessary to counteract swelling of the forms.

5.18 Wedges used for final adjustment of the forms prior to concrete placement shall be fastened in position after the final check.

5.19 Formwork shall be so anchored to shores or to other supporting surfaces or members that upward or lateral movement of any part of the formwork system during concrete placement will not occur.

5.20 Runways or planks for moving labour and equipment shall be provided with struts or legs and shall be supported directly on the formwork or upon the structural member without resting on the reinforcing steel.

5.21 All surfaces of forms and embedded materials shall be cleaned of any accumulated mortar or grout from previous concreting and of all other foreign material before placing fresh concrete.

Forms shall be sufficiently tight to prevent leakage of grout or cement paste. Board forms having joints opened by shrinkage of the wood shall be removed and replaced. Plywood and other wood surfaces not subject to shrinkage shall be sealed against absorption of moisture from the concrete by either:

1. A field applied, approved form oil or sealer, or
2. A factory applied non-absorptive liner .

When forms are coated to prevent bond will concrete, it shall be done

prior to placing of the reinforcing steel. Excess coating material shall not be allowed to stand in puddles in the forms nor allowed to come in contact with the concrete against which fresh concrete will be placed. Care shall be taken that such approved composition is kept out of contact with the reinforcement. Whereas-cast finishes are required, materials, which will impart a stain to the concrete shall not be applied to the form surfaces. Where the finished surface is required to be painted, the material applied to form surfaces shall be compatible with the type of paint to be used.

5.22 For reinforced concrete, in no circumstances shall forms be struck until the concrete attains 75% of ultimate strength.

The strength referred to shall be that of concrete using the same cement and aggregates, with the same proportions, and cured under conditions of temperature and moisture similar to those obtaining in the work. Where possible, the formwork should be left for longer time as it would assist the curing.

In normal circumstances (generally where temperatures are above 20° C and where ordinary cement is used, forms may be struck after expiry of the following periods. Walls, columns and vertical sides of beams.48 hours or as may be decided by the Engineer.

Side of slab (shores of props left under)	6 days.
Beams soffits (shores or props left under)	12 days.

Removal of shores or props to slabs.

Spanning up to 12 feet.	10 days.
Spanning over 12 feet.	16 days.

Removal of shores or props to beams.

Spanning up to 18 feet.	18 days
Spanning over 18 feet.	25 days

For rapid hardening cement 3/7 of the above period will be sufficient in all cases except vertical sides of slabs, beams and columns which should be retained for a minimum of 24 hours.

The number of shores or props, their sizes and disposition shall be such as to be able to safely carry the full dead load of the slab and beams, as the case may be.

Proper allowance shall be made for the decrease in rate of hardening of concrete in cold weather and the above minimum duration must be increased when the mean daily temperature is below 20° C.

5.23 When repair of surface defects or finishing is required at an early age, forms shall be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations.

5.24 Top forms on sloping surfaces of concrete shall be removed as soon as the concrete has attained sufficient stiffness to prevent sagging. Any needed repairs or treatment required on such sloping .surfaces shall be performed at once and be followed by the specified curing.

5.25 Wood forms for wall openings shall be removed as soon as this can be acomplished without damage to the concrete.

5.26 All formwork shall be removed without such shock or vibration as would damage the reinforced concrete. Before the top plank and struts are removed, the concrete surface shall be exposed where necessary in order to ascertain that the concrete has sufficiently hardened. Proper precautions shall be taken to allow for the decrease in the rate of hardening that occurs with all cement in the cold weather.

5.27 When reshoring or repropping is permitted or required, the operations shall be planned in advance and shall be subject to approval. While reshoring is underway no live load shall be permitted on the new construction. In no case during reshoring shall concrete in beam, slab, columns or any other structural member be subjected to combined dead and construction loads in excess of the load permitted by the Engineer for the developed concrete strength at the time of reshoring.

Reshores shall be placed as soon as practicable after stripping operations are complete but in no case later than the end of working day on which stripping occurs.

Reshores shall be tightened to carry their required loads without overstressing the construction. Reshores shall remain in place at least until tests representative of the concrete being supported have reached the strength specified in sub-clause 5.23 hereof.

5.28 Floors supporting props or shores under newly placed concrete shall have their original supporting props or shores left in place or shall be reshored. The reshoring system shall have a capacity sufficient to resist the anticipated loads and in all cases shall have a capacity equal to at least one half the capacity of the shoring system above. The reshores shall be located directly under a shore position above unless other locations are permitted.

The reshoring or re-propping shall extend over a sufficient number of storey's to distribute the weight of newly placed concrete, forms, and construction live loads in such. a manner that the design superimposed loads of the floors supporting shores or props are not exceeded.

5.29 It is generally desirable to give forms for reinforced concrete an upward camber to ensure that the beams or slabs (specially cantilever slabs) do not have a sag when they have taken up their deflection, but this should not be done unless permitted by the Engineer.

5.30 No loads, other than man and light plant required in connection with the actual work in hand, shall be allowed on suspended floors until 28 days after concreting where ordinary Portland Cement is used and 14 days when rapid hardening Portland Cement is used.

5.31 Prior to placing concrete, all forms shall be inspected and all debris and extraneous matter removed. The form oil or release agent shall not react with concrete to afect the strength nor shall it give any colour.

6. Measurement and Payment

No payment will be made for the works involved within the scope of this section of the specifications unless otherwise specifically stated in the Bills of Quantities or herein.

The cost thereof shall be deemed to have been included in the quoted unit rate of relevant items of the Bills of Quantities.

SECTION – 8 REINFORCEMENT

1. Scope

The work under this section of specifications consists of furnishing, cutting, fabricating, bending and placing steel reinforcement in concrete structures or elsewhere as shown on the drawings or as directed by the Engineer. The scope of this section of specification is covered with detailed specifications as laid down herein.

2. Applicable Standards

Latest editions of the following Pakistan, British and ASTM Standards are relevant to these specifications wherever applicable.

British Standard

B.S 4449 Carbon steel bars for the reinforcement of concrete.

B.S 4466 Specifications for bending dimensions and scheduling of bars for the reinforcement of concrete.

ACI Standard

ACI315 Details and detailing of concrete reinforcement.

ACI318 Building Code Requirements for Reinforced Concrete and commentary.

ASTM Standard

A 82 Cold - Drawn steel wire for concrete reinforcement.

A 305 Minimum requirement for the deformations of deformed steel bars for concrete reinforcement.

A 615 Deformed Billet Steel Bars concrete Reinforcement.

In addition to the above, the latest editions of other Pakistan Standards, British standards, American Concrete Institute Standards, American Society for Testing and Materials Standards and other standard as may be specified by the Engineer for Special Material and construction are also relevant.

3. Material

3.1 Unless otherwise specified, all steel bars for reinforcement of concrete shall be conforming to ASTM A615, Grade 60 deformed hot rolled billet steel bars with minimum yield strength of 60,000 Psi (414Mpa).

3.2 Reinforcement shall be free from all loose or flaky rust and mill scale, or coating, Including ice, and any other substance that would reduce or destroy the bond.

4. Compliance With Specifications

The Contractor shall submit certificates of compliance from the manufacturer stating that the supplied reinforcement conforms to the specifications. In addition, wherever and as directed by the Engineer, conformance of the supplied reinforcing bars with the specifications shall be demonstrated by the Contractor through laboratory tests, in accordance with the relevant standards.

5. Delivery & Storage

5.1 Delivery

Steel reinforcement bars shall be kept in bundles firmly secured and tagged. Each bar or bundle of bars shall be identified by marks as per relevant BS standards.

5.2 Storage

The method of storage shall be approved by the Engineer. Reinforcing bars shall, be stored in racks or platforms above the surface of ground and shall be protected against scaling, rusting, oiling, coatings, damage, contamination and structural defects prior to placement in works. Bars of different diameters and grades shall be so labeled and kept separately.

6. Bar Bending Schedules

The Contractor shall prepare bar bending schedules of all the reinforcing steel bars and these bar bending schedules shall be submitted to the Engineer for his approval. The Contractor shall obtain approval of the bar bending schedules before starting actual bar bending works.

The Engineer's approval, however, will not relieve the Contractor of his responsibility in this regard.

7. Fabricating, Bending & Placing

7.1 Reinforcement is to be accurately placed as shown in the drawings, and secured against displacement by using 16 guage G.I wire ties or suitable slips at intersections and supported from the formwork by using concrete, metal or plastic chairs and spacers or hangers of an approved pattern.

Where concrete blocks are used for ensuring the cover, they shall be made of mortar not leaner ·than 1 part of cement to 2 parts of sand.

Where the concrete surface will be exposed to the weather in the finished structure, the portions of all accessories in contact with the form work shall be galvanized or shall be made of plastic.

7.2 Bars used for concrete reinforcement shall be fabricated in accordance with the dimensions shown in the bar bending schedule approved by the Engineer.

7.3 The cutting tolerance for all bars shall be + 25 mm

7.4 Fabrication tolerances shall be as per ACI-315

7.5 Placing tolerances shall be as per ACI-318 & 317.

7.6 Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter or enough to exceed the above tolerances, the resulting arrangement of bars shall be subject to approval of Engineer.

7.7 Vertical bars in columns shall be offset at least one bar diameter at lapped splices. To ensure proper placement, templates shall be furnished for all columns dowels.

7.8 Reinforcement shall not be bent or straightened in a manner that will

injure the material. No bars shall be bent twice in the same place, nor shall they be straightened after bending. Unless permitted by Engineer, reinforcement shall not be bent after being partially embedded in hardened concrete.

7.9 No splice of reinforcement shall be made, except as shown on the working drawings.

7.10 Welding of reinforcement shall not be done unless permitted and approved by the Engineer.

7.11 Exposed reinforcement intended for bonding with future extensions is to be effectively protected from corrosion. Protection is also to be provided to reinforcement partly built into concrete where the exposed part is to be built into later concrete.

7.12 No concreting is to be carried out until the reinforcement has been checked and approved by the Engineer.

7.13 All detailing shall be done as per ACI-315, ACI-318 and ACI-350R, as and where required.

7.14 Standard or actual weight whichever is lesser shall be used for calculation of weight.

8. Measurement & Payment

8.1 General

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the· quo+9d unit rate of the respective items of the Bill of Quantities.

8.1.1 Providing and installing chairs, supports, hooks, hangars, spacers, binding wires, corrosion protection and laps not shown on Drawings including wastage and rolling margin.

8.1.2 Testing of mild and deformed steel bars.

8.2 Reinforcing Bars

8.2.1 Measurement

Measurement for acceptably completed works of reinforcement bars shall be made by weight according to bar bending schedules approved by the Engineer.

8.2.2 Payment

Payment will be made for access table measured quantity of reinforcement on the basis of unit rate per metric ton quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the item.

SECTION – 9 PLAIN AND REINFORCED CONCRETE

1. Scope

The work under this section of the specification consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in connection with the supply. and installation of plain and reinforced concrete work complete in any floor and at any height as per drawings except where specifically stated in the relevant item of Bill of Quantities, in strict accordance with this section of the specifications and the applicable drawings, and subject to the terms and conditions of the Contract. The scope of this section of specification is covered with detailed specifications as laid down herein.

2. General

2.1 Full co-operation shall be given to trades like electrical, mechanical and other services.

2.2 Suitable templates or instructions or both shall be provided for setting out items not placed in the forms. Embedded items and other materials for mechanical and electrical operations shall have been completed, inspected, tested and approved before concrete is placed.

2.3 For special concrete finish and for special methods of construction (e.g. slip forms), formwork shop drawings shall be designed and prepared by the Contractor, at his own cost. Approval of shop drawings as well as that of actual samples of concrete finish shall be obtained before work is commenced.

3. Applicable Standards

Latest editions of the following Pakistan, British and ASTM Standards are relevant to these specifications wherever applicable.

3.1 Pakistan Standards

PS 177 PS 232 PS 243	Compaction proctor test.
PS 279	Portland Cement (ordinary & rapid hardening). Natural aggregates for concrete.
PS 280	Abrasion of coarse aggregates by the use of Los Angeles machine
PS 281	Determination of aggregate/crushing value.
PS 282	Organic impurities in sand for concrete aggregates.
PS 283	Material finer than No. 200 B.S. test sieve in aggregates, method of test for. Soundness test for aggregates by the use of sodium sulphate or magnesium sulphate. Sampling aggregates for concrete.

PS 284	Sampling aggregates for concrete.
PS 285	Sieve or screen analysis of fine and coarse aggregates. Description and classification of mineral aggregates. Sampling fresh concrete.
PS 286	Sampling fresh concrete.
PS 421	Slump test for concrete.
PS 422 PS 560	Making and curing concrete compression test specimen in the field. Sulphate-resistant Portland cement type "A' and sampling fresh concrete in the laboratory.
PS 612	Mixing and sampling fresh concrete in the laboratory.
PS 716	Compacting factor test for concrete.
PS 717	Definitions and terminology of cements.
PS 746 PS 849	Making and curing concrete compression test cubes.

3.2 ASTM (American Society for Testing and Materials)

B 370 C 33 Copper sheet and strip for building construction. Concrete Aggregates.

C40	Organic impurities in sand for concrete.
C87	Effect of organic impurities in fine aggregates on of mortar. Soundness of aggregates. Ready mixed Concrete.
C88	Compressive strength of hydraulic cement mortars.
C94	Material finer than NO.200 (0.075mm) sieve. Light-weight pieces in aggregates.
C109	Concrete and concrete aggregates.
C117	Specific gravity and absorption of coarse aggregate.
C123	Specific gravity and absorption of fine aggregate.
C125	Resistance to abrasion of small size coarse aggregates.
C127	Sieve or screen analysis of fine and coarse aggregate. Clay lumps and friable particles in aggregates.
C131	Slump of Portland Cement Concrete.
C136	Aggregate for masonry mortar.
C142	Portland Cement.
C143	Water retention by concrete cunning material
C144	Sheet material for curing concrete.
C150	Air content or hydraulic cement mortar.
C156	Density of hydraulic cement.
C171	Time of setting of hydraulic cement by vicat needle.
C185	Air entraining admixtures for concrete.
C188	Potential reactivity of aggregate.
C191	Liquid membrane-forming compounds for curing concrete.
C260	Lightweight aggregates for structural concrete.
C289	Lightweight aggregates for concrete masonry.
C309	Lightweight aggregates for insulating concrete.
C330	Chemical admixtures for concrete.
C331	Resistance to abrasion of large size coarse aggregates.
C494	Unit weight of structural lightweight concrete.
C535	Aggregate sampling.
C567	Preformed expansion joint filler for concrete.

D75	Concrete joint sealer (hot poured elastic type).
D994	Preformed expansion joint filler for concrete paving and structural construction.
D1190	
D1751	Preformed sponge rubber and cork expansion joint fillers for concrete paving and structural construction.
D1752	
D1850	Concrete joint sealer (cold application type).
E11	Wire cloth sleeves for testing purposes.
E96	Water vapor transmission of materials in sheet form.
E154	Materials for use as vapor barrier under concrete slabs.
E337	Relative humidity by wet and dry bulk psychomotor.

3.3 ACI (American Concrete Institute)

3.3.1 Recommended practice for selecting proportions for normal and heavy weight concrete.

214 Recommended practice for evaluation of strength test result of concrete

301 Specifications for structural concrete for buildings.

304 Recommended practice for measuring, mixing, transporting and placing concrete.

305 Hot weather concreting.

308 Recommended practice for curing concrete.

309 Recommended practice for consolidation of concrete.

318 Building code requirements for reinforced concrete.

347 Recommended practice for concrete for work.

512 Precast structural concrete in building.

517 Low pressure steam curing.

533 Fabrication, handling and erection of Precast concrete wall panels.

3.4 British Standards

BS 12 BS Portland cement, ordinary and rapid hardening.

410 Test Sieves.

BS 812 BS 882	Methods for the sampling and ~~sting of mineral aggregates, sands and fillers.
BS 1305	Coarse and fine aggregates from natural sources.
BS 1881	Batch Mixer.
BS 3148	Methods of testing and sampling concrete.
BS 3837	Tests for water for making concrete.
BS 5328	Expanded polystyrene boards.
BS 3869	Structural Concrete.
BS 3927	Rigid expanded polyvinyl chloride for thermal insulation.
BS 4027	Phenolic foam materials for thermal insulation and building applications. Sulphate-resisting Portland cement.
BS 8110	Structural use of concrete.
CP 114	Structural use of reinforced concrete in buildings.

CP 116	Structural use of Precast concrete.
CP 5337	The structural use of concrete for retaining aqueous liquids

In addition, the latest editions of other Pakistan and British Standards, American Concrete Institute Standards, American Society for Testing and Materials Standards and other Standards as may be specified by the Engineer for special Materials and Construction are also relevant.

4. Materials

4.1 Aggregates

4.1.1 The sources of supply of all fine and coarse aggregates shall be subject to the approval of the Engineer.

4.1.2 All fine and coarse aggregates shall be clean and free from clay, loam, silt and other deleterious matter. If required, the Engineer reserves the right to have them washed by the Contractor at no additional expense. Coarse and fine aggregates shall be delivered and stored separately at site. Aggregates shall not be stored on muddy ground or where they are likely to become dirty or contaminated.

4.1.3 Fine aggregate shall be hard coarse sand, crushed stone or gravel screenings shall conform to requirements of PS 243 and/or BS 882 and/or ASTM C 33. Only fine aggregate of grading zones 1 to 3 (BS 882) shall be used.

4.1.4 Coarse aggregate shall be gravel or crush stone of hard, durable material free laminated structure and conforming PS 243 and/or BS 882 and/or ASTM C 33 graded as follows for use in mass concrete as in foundations:

Total Pressure B.S.Sieve	**Percent by weight**
3 inc. (76.2mm)	100
1.5 inc. (38.10mm)	95-100
0.75 inc. (19.05mm)	30-70
0.38 inc. (9.52mm)	10-35
0.19 inc. (4.76mm)	0-5

Coarse aggregate for all cast-in-place concrete other than mass concrete as for foundations shall be graded with the following limits:

Total Passing B.S. Sieve	**Percent by weight**
1.5 in. (38.10 mm)	100
0.75 in. (19.05 mm)	95-100

4.1.5 Wherever feasible, the nominal maximum size of aggregate for cast- in- place reinforced concrete slabs and other members shall be 3/4 inch. If there are difficulties in placing such a concrete the maximum size may be restricted to 1/2 inch provided the requirements for strength are satisfied. The grading requirements of 1/2 inch or 3/8 inch down aggregate shall be agreed to with the Engineer as per relevant ASTM/BS standards.

4.1.6 The nominal maximum size of the aggregate for Precast concrete shall not be larger than one fifth of the narrowest dimension between sides of forms, or one-third of the depth of slabs or three-fourths of the minimum clear distance between. reinforcing bars or between bars and forms, whichever is least. In Precast columns the nominal maximum size of the aggregate shall be limited as above but shall not be larger than two-thirds of the minimum clear distance between bars.

4.1.7 Coarse aggregates in Precast concrete of normal weight may be of one maximum size for all concrete placed in 1 day when quantities to be placed are too small to permit economical use of more than one mix design.

When a single mix design is so used. the maximum nominal size shall be as required for the most" critical condition of concreting, in accordance with the requirements of clause (4.1.6) above.

4.1.8 Except where it can be shown to the satisfaction of the Engineer that a supply of properly graded aggregate of uniform quality can be maintained over the period of the work, the grading of the aggregates shall be controlled by obtaining the 3/4" maximum nominal size, the different sizes being stocked in separate stock piles and recombined in the correct proportion for each batch at the batching plant. The materials shall be stock-piled for a period before use so as to drain nearly to constant moisture content (as long as site and other conditions permit, preferably for at least a day). The grading of the coarse and fine aggregates shall be tested at least once for every 100 tons supplied, to ensure that the grading is uniform and same as that of the samples used iri the preliminary tests.

4.1.9 For use in fire proof concrete, the aggregates shall be fire clay and semi-acidic fine ground. The use of broken fire clay bricks as coarse aggregate and waste of semi-acidic refractory particles as fine aggregate can be allowed.

4.2 Cement

4.2.1 The cement shall be fresh and of approved origin and manufacture. It shall be one of the following as may be specified by the Engineer.

Ordinary or Rapid Hardening Portland cement complying with the requirements of PS 232 or BS 12 or ASTM C 150.

Sulphate Resisting Portland/Cement complying with the requirements of PS 612 or BS 4027 or ASTM C 150.

4.2.2 Unless otherwise specified, ordinary Portland Cement complying with the requirements of BS 12 shall be used.

4.2.3 For all fair faced concrete it will be necessary to use approved cement with a view to obtain light shade concrete as approved by the Engineer.

4.2.4 The Contractor shall supply to the Engineer at fortnightly intervals, test certificates with the appropriate standard in respect of the samples of cement from the work-site. These

tests shall be carried out in a laboratory approved by the Engineer.

4.2.5 Only one brand of each type of cement shall be used for concrete in any individual member of the structure. Cement shall be used in the sequence of receipt of shipment, unless otherwise directed.

4.2.6 There shall be sufficient cement at site to ensure that each section of work is completed without interruption.

4.2.7 Cement reclaimed from cleaning of bags or from leaky containers shall not be used.

4.2.8 The Contractor shall provide and erect (at his cost) a suitable plain, dry, well ventilated, weatherproof and water proof shed of sufficient capacity to store the cement.

4.2.9 Cement shall be used as soon as possible after delivery and cement which the

4.2.10 Engineer considers has become stale or unsuitable through absorption of moisture' from the atmosphere or otherwise shall be rejected and removed immediately from the site at the Contractor's expense. Any cement in containers damaged so as to allow the contents to spill or permitting access of the atmosphere prior to opening of the container at the time of concrete mixing shall be rejected and removed immediately from the site at the Contractor's expense.

4.2.11 The mixing together of different types of cement will not be permitted.

4.3 Water

Only clean water from the city supply, tube well installed at the site or from other sources approved by the Engineer shall be used. The Contractor shall supply sufficient water for all purposes, including mixing the concrete, curing, "d cleaning plant and tools. Where doubt exists as to the suitability of the water, it shall be tested in accordance with BS 3148. Where water can be shown to contain any sugar or an excess of acid, alkali or salt, the Engineer may refuse to permit its use.

In case of doubt, the Engineer may require that concrete mixed with water proposed to be used should not have a compressive strength lower than 90 percent of the strength of concrete mixed with distilled water.

4.4 Additive

All additives such as foaming and water proofing agents shall be from a manufacturer approved by the Engineer.

Air Entraining Admixtures shall conform to APM C 260. Other Admixtures shall conform to ASTM C494.

5. Nominal Concrete Mixes

5.1 Proportions of Mix

5.1.1 Cement and aggregates:

Cement, fine aggregate and the coarse aggregate shall be weighed separately. The proportions of cement to fine aggregate and coarse aggregate shall be adjusted so as to provide the concrete of the required crushing strength when tested as set out in Table 1.

5.1.2 The Contractor shall regulate and arrange mixing of the ingredients for the designed mix of the concrete by weight batching. The cost of designing the mix shall be borne by the Contractor.

5.1.3 Water / Cement ratio:

The quantity of water used shall be just sufficient to produce dense concrete of adequate strength and workability for its purpose. For all external work and foundations the water/cement ratio should not exceed 0.55 for concrete Class A, B and C.

5.1.4 Workability:

The workability shall be controlled by direct measurement of the water content, allowance being made for any water in the fine and coarse aggregates. The concrete shall be just sufficiently workable to be placed and compacted, without difficulty, by the available means.

'Workability' shall be determined by either the slump or compaction factor tests as directed by the Engineer and these shall be performed in accordance with the methods given in PS 422 to PS 177 or ASTM C 143.

The slump or compaction factor for each class of concrete shall be determined during the preliminary Test mixes and the value obtained shall not be modified without the written consent of the Engineer. Unless otherwise permitted or specified, the concrete shall be proportioned and produced to have a slump of 3 inch or less for consolidation by vibration. A tolerance of up to 1 inch above- the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, which ever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

5.2 Strength requirements for concrete :-

5.2.1 Portland cement concrete when aggregates comply with BS 882.

5.2.2 Concrete made with Portland cement shall comply with the strength Table 1 columns 4&6 (Works Test).

Table 1: Strength requirements for Portland concrete with aggregates complying with BS. 882.

Class Min Cement per of concrete	Min Cube Crushing of Strength at 28 days (psi) (lb)	Min. water per 110 lb. bag of (gallon)	Class Min Cement per of concrete
1	2	3	4
A	30.00	4350	4.40
B	22.00	3750	5.06
C	18.00	3000	5.28
D	13.00	1550	7.05
E	9.50	1000	7.27

Note: Conversion Factors. 1 psi = 006897 MPa 1 gal = 4.54 liter

1 lb. = 0.4537 Kg. 1cu.ft. = 0.028 cum.

5.2.3 The strengths given in Table 1 are based on the assumption that average temperature is 20 degree C. Where accurate records of temperature are kept, allowance may be made for change of temperature or the cubes may be tested at the equivalent maturity.

5.2.4 Unless otherwise stated, the types of concrete shall be classified on the basis of compressive strength requirements. The Contractor shall provide Mix design by weight for each class of concrete.

Manufacture 12 test cubes for each 3 mix design batches (6 x 6 x 6) inches in accordance with the Mix design batching by weight and test 3 cubes each at 3,7,14 & 28 days intervals in the presence of Engineer's Representative and submit all relevant data and results of tests for approval of the Engineer. The Contractor shall obtain approval from the Engineer in writing for each Mix design before producing the actual concrete for the Works.

No payments for producing the Mix design, manufacture of test cubes and testing shall be paid. The Contractor shall include this cost in the relevant item of concrete.

5.3 Batching

5.3.1 All cement, including cement supplied in bulk, shall be batched by weight. A bag of cement may be taken as weighing 110 lb. with the prior approval of the Engineer.

5.3.2 Aggregates shall be batched by weight, due allowance being made for water content. Aggregates may be batched by volume through conversion of weigh batching, only with the prior permission of the Engineer. The apparatus for weight batching may be an integral part of the mixer or a separate unit of a type approved by the Engineer. It shall be accurate within 2% and shall be checked for accuracy at least once a

week.

5.3.3 The quantity of additives i.e. foaming and water proofing agents etc. shall be as prescribed by the manufacturer or as directed by the Engineer.

5.3.4 Where the batching plant is of the type in which cement and aggregates are weighed in the same compartment. the cement shall be introduced into the compartment between two sizes of aggregates.

5.3.5 Each batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates. Water shall continue to flow for a period, which may extend to the end of the first 25 percent of the specified mixing time. Controls shall . be provided to prevent batched ingredients from entering the mixer before the previous batch has ·been completely discharged.

5.4 Mixing

The concrete shall be mixed in an approved batch mixer conforming to the requirements of BS 1305. It shall be fitted with the manufacturer's plate stating the rates, capacity and the recommended number of revolutions per minute and shall be operated in accordance therewith. It shall be equipped with a suitable charging mechanism and an accurate water-measuring device. The mixer shall be capable of thoroughly combining the aggregates, cement and water into a uniform mass within the specified mixing time and of discharging the concrete without harmful segregation.

5.4.1 Mixing shall continue for the period recommended by the mixer manufacturer or until there is apparently a uniform distribution of the materials and the mass is uniform in colour, whichever period is longer. If it is desired to use a mixing period of less than 1-1/2 minutes, the Engineer's approval shall be obtained in writing.

5.4.2 Controls shall be provided to ensure that the batch cannot be discharged until the required mixing time has elapsed. At least three quarters of the required mixing time shall take place after the last of the mixing water has been added.

5.4.3 The interior of the mixer shall be free of accumulations that will interfere with mixing action. Mixing blades shall be replaced when they have lost 10 percent of their original height.

5.4.4 Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall not be re tempered, but shall be discarded.

5.5 Transporting:

5.5.1 The concrete shall be transported from the place of mixing to the place of final deposit as rapidly as practicable by means, which will prevent segregation or loss of ingredients. All skip vehicles, or containers used for transporting the concrete shall be thoroughly cleaned.

5.5.2 During hot or cold weather, concrete shall be transported in

deep containers, on account of their lower ratios of surface area to mass, which reduces the rate of loss' of water, by evaporation during hot weather and loss of heat during cold weather.

5.6 Placing

5.6.1 Before placing of concrete, formwork shall have been completed; water shall have been removed; reinforcement shall have been secured in place; expansion joint material, anchors and other embedded items shall have been kept in position; and the entire preparation shall have been approved by the Engineer.

No concrete is to be placed into the foundation trenches until the ground to receive the same has been examined and approved by the Engineer for this purpose.

5.6.2 Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete, which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be located as shown in the Contract Documents or as approved by the Engineer. Placing shall be carried out at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened shall not be deposited. Temporary spreaders in forms shall be removed when the concrete placing has reached an elevation rendering their services unnecessary. They may remain embedded in the concrete only if made of metal or concrete and if prior approval has been obtained.

5.6.3 The actual sequence of construction proposed by the Contractor shall be subject to 'the Engineer's a approval before construction starts on any part of the structure, and this sequence shall not be varied without the Engineer's approval.

5.6.4 The concrete after it has been mixed shall be placed as soon as it is practicable. Once the concrete has left the mixed, no more water shall be added, although the concrete may be mixed or agitated to help maintain workability. The concrete shall not be used if, through any cause, the workability of the mix at the time of placing is too low for it to be compacted fully and to an acceptable finish by whatever means available.

The time between mixing and placing should be reduced, if the mix is richer or the initial workability of the mix is lower than normal, or if a rapid hardening cement or an accelerator is used, or if the work is carried out at a high temperature or exposed to a drying atmosphere.

The Contractor shall ensure that the delay between mixing and placing including consolidation does not exceed 45 minutes under any circumstances. Any concrete which does not satisfy this requirement shall be rejected.

5.6.5 Concrete shall be deposited as nearly as possible in its final position to avoid segregation due to re handling or flowing. In no circumstances may concrete be railed or made to flow

along the forms by the use of vibrators, Concreting shall be carried on as a continuous operation using methods, which shall prevent segregation or loss of ingredients.

5.6.6 The free fall of concrete shall not be allowed to exceed 6 feet. Where it is necessary for the concrete to be lowered more that this depth, it is not to be dropped into its final position, but shall be placed through pipes fed by a hopper. When a pipe is used for placing concrete the lower end shall be kept inside or close to the freshly deposited concrete. The size of the pipe shall be not less than 9 inch in diameter.

5.6.7 'Mass-concrete' shall be placed in layers approximately 18 inch thick. Vibrator heads shall extend into the previously placed layer.

5.6.8 The workmen carrying concrete to the site, and all other workmen moving about on the reinforcement before the concrete is placed, shall move only along runways or planks placed for the purpose and no person shall be allowed to walk on the reinforcement itself.

5.6.9 Prior to the laying of concrete on load bearing masonry walls, bearing plates and at other points, as may be directed by the Engineer, the surface will be brought to a true, hard and smooth level surface using cement sand mortar in the ratio of 1 volume of cement to 3 volumes of sand. Two layers of building paper weighing .082 Ib./will then be laid flat to separate the concrete from the surface on which it is to be laid.

5.7 Construction Joints

5.7.1 Concreting shall be carried out continuously up to construction joints, the position and arrangement of which shall be predetermined by the Engineer.

5.7.2 Joints not shown on the drawings shall be so made and located as to least impair the strength of the structure and shall need prior approval of the Engineer. In general, they shall be located near the middle of the spans of slabs and beams unless a secondary beam intersects a main beam at this point, in which case the joint in the main beam shall be offset a distance equal to twice the width of the secondary beam. Joints in walls and columns shall be at the underside of floors, slabs or beams and at the top of footings or floor slabs. Beams, brackets, columns capitals, haunches and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the r:nain reinforcement.

5.7.3 All reinforcing steel shall be continued across joints. Keys and inclined dowels shall be provided as directed by the Engineer. Longitudinal keys at least 1-1/2 inches deep shall be provided in all joints in walls and between walls and slabs or footings.

5.7.4 When the work has to be resumed; on a surface which has hardened, such surface shall be roughened in an approved manner which will expose the aggregate uniformly and will not leave laitance, loosened particles of aggregate or damaged concrete at the surface.

5.7.5 The hardened concrete of construction joints and of joints between footings and walls or columns, between walls or columns and beams or floors they support, joints in un-exposed walls and all others not mentioned herein shall be dampened (but not saturated) immediately prior to placing of fresh concrete.

5.7.6 The hardened concrete of joints in exposed work, joints in the middle of beams, and slabs; and joints in work designed to contain liquids shall be dampened (but not saturated) and then thoroughly covered with a coat of cement grout similar in proportions to the mortar in the concrete. The grout shall be as thick as possible on vertical surfaces and at least 1/2 inch thick on horizontal surfaces. The fresh concrete shall be placed before the grout has attained initial set.

5.7.7 Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle, and brushed, care being taken to avoid dislodgment of particles of aggregate. The surface shall then be coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 6 inch in thickness, and shall be well rammed against old work, particular attention being paid to corners and closed spots. 5.7.8 Stop ends for movement joints or construction joints shall be made by splitting them along the lines of reinforcement passing through them, so that each portion can be positioned and removed separately without disturbance or shock to the reinforcement or the concrete. Stop ends made of expanded metal or similar material may only be left permanently in' the concrete with prior written approval of the Engineer. Where such stop ends are used, no metal may be left permanently in the concrete closer to the surface of the concrete than the specified cover to the reinforcement.

5.8 Expansion Joints

Expansion joints shall be provided wherever indicated on the Drawings or as directed by the Engineer. In no case shall the reinforcement, corner protection angles, or other embedded' items be permitted to extend continuously through any expansion joint.

All expansion joints shall be carefully placed so as not to be displaced during concreting. The method of placing the expansion joints shall be strictly in accordance with the Drawings and/or as directed by the Engineer. All materials for use in the expansion joints shall have prior approval of the Engineer before placing order for supply.

5.9 Embedded Items

5.9.1 The material, design and location of water stops in joints shall be as indicated in the Contract Documents. Each piece of pre molded water stop shall be of maximum practicable length in order that the number of end joints will be held to a minimum. Joints at intersections and at ends of pieces shall be made in the manner most appropriate to the material being used. Joints shall develop effective water-tightness fully equal to that of the continuous water stop material, shall permanently develop not less than 50 percent of the mechanical strength of

the parent section and shall permanently retain their flexibility.

5.9.2 Electric conduits and other pipes which are planned to be embedded shall not, with their fittings, displace more than four percent of the area of the cross section of a 'column on which Stress is calculated or which is required for fire protection. Sleeves, conduits, or other pipes passing through floors, walls, or beams shall be of such size or in such location as not to impair unduly the strength of the construction; such sleeves, conduits, or pipes mi1Y be considered as replacing structurally in compression the displaced concrete/ provided that they are not exposed to rusting or other deterioration, are of uncoated or galvanized iron or steel not thinner than standard steel pipe, have a nominal inside. diameter not over 2 inch and are spaced not less than three diameters on centers. Except when plans of conduits and pipes are approved by the Engineer, embedded pipes and conduits other than those merely passing through, shall not be larger in outside diameter than one third the thickness of the slab, wall, or beams in which they are embedded nor so located as to impair unduly the strength of the construction. Sleeve pipes, or conduits of any material not harmful to concrete and within the limitations of this section may be embedded in concrete with the approval of the Engineer provided they are not considered to replace the displaced concrete.

5.9.3 All sleeves, inserts, anchors, and embedded items required for adjoining work or for its support shall be placed prior to concreting. All Contractors whose work is related to the concrete or must be supported by it shall be given ample notice and opportunity to introduce and/or furnish embedded items before the concrete is placed.

5.9.4 Expansion joint material, water stops and other embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

SECTION – 10 MASONRY

1. Scope

The work covered by this section of the specifications consists of furnishing all plant, labour, equipment, appliances, and materials and in performing all the operations in connection with masonry work, complete in strict accordance with the specifications herein and the applicable drawings subject to the terms and conditions of the contract. The work under this section includes the brickwork in foundations, walls and partitions both load bearing and non-load bearing.

2. Materials

2.2.1 Bricks

All bricks shall be sound, of well burnt clay, uniform in shape and size, when struck, the brick should produce ringing sound. The brick shall be free from flows, cracks, and shipped corners, nodules of line, kankar, other blemishes and salt. When the brick is soaked in water for one hour, it should not absorb more than one sixth of its own weight. Bricks of only one size shall be used in the works. Bricks from different kilns not having the same size and colour shall not be accepted. The minimum compressive strength of the bricks tested in accordance with B.S. 1257 shall be 1300 psi subject to the condition that average compressive strength of five bricks tested shall not be less than 1500 psi.

2.2.2 Cement

Cement shall be Ordinary Portland Cement as specified in respective section.

2.2.3 Aggregates

Aggregates used shall meet the requirements specified under respective concrete section. All the aggregates dry and properly screened from approved source, shall also be acceptable for block making.

2.2.4 Brick Masonry Units

i) Concrete masonry blocks shall be made on the project site and shall be of the sizes required as per drawings and/or as directed by the Consultants and shall generally conform to the requirements of British Standard 2028, 1364:1968 until and unless specified or otherwise in the specifications.

ii) The brick shall be solid as required and shall be carefully made so that they are true in line and face with square corners and free from all defects. The ends of the bricks, masonry, shall be double grooved or a directed by the Consultants.

iii) The blocks shall be cured by keeping moist continuously for a period of at least ten (10) days and then shall be allowed to dry in shade for least twenty (20) days before used in masonry.

iv) All bricks shall have clean cut straight and true edges, smooth dense faces of uniform appearance without voids,

honeycombs, projections and shall be free from cracks spalls, chips, rugged edges or other defects detrimental to their use.

v) Where bricks are to be plastered or rendered, the bricks surface shall have a coarse texture suitable for bonding the plaster as approved by the Engineer.

vi) All bricks shall be stacked at site in a quantity not exceeding 5,000 bricks in each stack. The stacking shall be done in such a manner as to avoid smearing of the bricks in the lowest part of the stack with clay. Bricks smeared with clay show very poor bond with mortar sand, therefore, any bricks thus affected be rejected out of hand without recourse. When transported to the site the bricks shall not be dumped from the vehicle, the bricks shall be manually unloaded and stacked as aforesaid.

2.2.5 Cement Concrete Block Masonry

Proportion

Cement Mortar shall be composed of one part of Ordinary Portland Cement to 6 (six) parts of all brick masonry walls. Hand mixing, when permitted by the Engineer shall be done on clean hard platform as much as required for immediate use with only just sufficient water, to produce mortar of a proper consistency. If directed by the Engineer, the mixing shall be done by mechanical mixers. Sand shall b of an approved quality and shall pass 100% through 3/16 inch sieve.

2.2 Pre-Cast Concrete

Pre-cast concrete units shall be fair faced, cast to the sizes and dimensions as indicated on the Drawings. The concrete used for pre-cast units shall conform to the specifications laid down for cast in situ reinforced cement concrete unless otherwise required and directed by the Consultant.

The Contractor shall be required to submit a sample of pre-cast unit for the approval of the Engineer; all pre-cast units shall strictly conform to the approved sample.

Pre-casting platform of the size and at the location approved by the Engineer shall be constructed. The concrete in one pre-cast unit shall be placed in one operation, in accordance with the details shown on the Drawings.

The material and design of formwork .and the method of pre-casting the units shall be approved by the Engineer. The erection/installation and removal of the pre-cast units from the pre-casting platform shall not be permitted until and unless they are properly cured to the satisfaction of the Engineer.

All pre-cast units shall be smoothly finished to the required lines, grades, angles, etc. Holes, grooves, pockets and hooks shall be provided as shown and/or as directed by the Engineer. The units shall be properly stacked on a platform without causing any cracks and damages. Curing of all the pre-cast units shall be done in accordance with the relevant BS code/approval of the Engineer.

2.2.1 Erecting Pre-cast Units

All the pre-cast units shall be transported and erected into position in a manner as approved by the Engineer.

The Contractor shall submit his proposal in this regard and obtain approval from the Engineer in advance.

2.2.2 Lifting Beams

The Contractor shall use lifting beams at his own cost for erecting pre-cast members where the Engineer so directs. Lifting beams shall be supplied and erected by the Contractor, at his own cost, at all points where lifting is necessary for maintaining the plant but is inaccessible to mobile/cranes or, alternatively, covered by overhead traveling cranes. The Contractor, however, is to supply the trolleys and erect them on the lifting beams, and to test operation of installed equipment.

3. Cement Concrete Pavements

For all concrete work relevant specifications of this section shall apply.

3.1 Side Forms and Construction

Side forms shall be of steel or any other suitable material and of a design as approved by the Engineer.

In general, only materials and methods that have proved their acceptability by past performance will be considered. All form shall be constructed so that they can be removed without hammering or prying against the concrete.

Horizontal joints in the forms will not be permitted. Forms shall be thoroughly cleaned and oiled with linseed/mineral oil shall be given two coats of niter-cellulose lacquer each time they are used.

The forms shall be set on a thoroughly compacted base true to line and level and firmly secured in position by appropriate methods. Conformity with the alignment and levels shown on the Drawings shall be checked as and when required by the Engineer. Where necessary corrections shall be made immediately before placing the concrete; where any form has been disturbed it shall be reset and rechecked.

Pavements shall be constructed in panels of sizes as shown on the Drawings. The panels shall be laid alternately, the adjoining panels being concreted when the side forms are struck and the jointing materials placed, inspected and approved by the Engineer. Each panel is to be concreted in one operation and no interruptions shall be permitted during the operation. The concrete shall be tipped from the trolley slightly in advance of the working place and then shoveled into position. The spreading shall be carried out very carefully. Compaction shall be done by means of vibrators compactors of approved surface vibrators. If a vibrators compactor is used,' if. shall be operated on the concrete and will not be allowed to strike or displace the forms. The spreading and compacting,. of the successive layers shall proceed without interruptions and as quickly as practicable so as to ensure that the slab is ' monolithic throughout its depth.

The wearing surface shall be laid while the base concrete is still wet and screeded to line and level. When the initial set takes place the

surface shall be troweled smooth with a steel trowel to provide a dense closed surface.

All the joints shall be carefully formed as shown on the Drawings or as directed by the Engineer. The joint filler together with performed groove shall provide complete separation of adjacent slabs. The joints shall all be sealed with bitumen as shown on the Drawings and as directed by the Engineer.

3.2 Protection and Curing

General Requirements:

Concrete shall be protected adequately from injurious action by sun, rain, flowing water and mechanical injury, and shall not be allowed to dry form the time it is placed until the expiry of the minimum curing periods specified hereinafter. Water curing shall be accomplished by keeping the surface of the concrete continuously wet by covering with water or with approved water saturated covering. Where wood forms are left in place for curing, they shall be kept sufficiently damp at all times to prevent openings at the joints and drying out of the concrete. All portions of the structure shall be kept moist for the full curing periods, specified hereinafter.

When liquid membrane curing compound is used the surface of the concrete shall be protected .form traffic or other abrasive action, that may break the membrane, for the full period of curing. The membrane curing compound shall be colorless or light colored and shall be approved by the Engineer and shall comply with ASTM Designation C 309.

Curing Periods:

The curing period shall be at least 10 days, or as directed by the Engineer.

Removal of Forms:

The Contractor shall exercise great care in avoiding damage to joints, arises, dowel bars etc., while removing the forms. Under no circumstances will the use of pry bars between the forms and pavement be permitted. Side forms shall not be removed until at least 40 hours have elapsed from the time of completing the concreting of the slab, which they contain. In no case shall forms be removed until the concrete has hardened sufficiently to permit removal without damage to the concrete. Concrete work shall be protected from injury resulting from the storage or movement of material during construction.

3.3 Finishing

All unformed surfaces shall be finished with a wood float except as otherwise specified. Visible vertical surfaces shall have all projections and irregularities removed. The entire surface shall be rubbed if required by the Engineer, with a No. 16 carborundum brick, or other abrasive until even, smooth and of uniform appearance, and shall be shed clean. Plastering of surface, application of cement or other coating will not be permitted.

All exposed corners shall be chamfered, 1"x 1" (2.5 cms x 2.5 cms) unless otherwise mentioned or shown on the plans or directed by the

Engineer. Concrete surfaces which will be covered with other materials shall be screeded without floating.

3.4 Spreading, finishing and floating of concrete in pavements General Requirements

The striking of, compacting and floating of concrete shall be done by mechanical methods, if approved by the Engineer. Where the Engineer determines that it is impracticable to use mechanical methods, manual methods of spreading, finishing and floating may be used on pavement lines as indicated on the Drawings.

Mechanical Methods

The concrete shall be spread uniformly between the forms, immediately after it is placed, by means of an approved spreading machine. The spreader shall be followed by an approved finishing machine equipped with two oscillating or reciprocating screeds. The spreading machine or the finishing machine shall be equipped with vibrating equipment that will vibrate the concrete for the full paving width. internal vibrators shall be used adjacent to the longitudinal edge of the pavement. These vibrators shall be attached to the rear of the spreading machine or to the finishing machine. Vibrators shall not rest on new pavements or side forms or in contract with any dowel bars and the arrange:-'1ent of power supply to the vibrators shall be such that then the motion of machine is stopped, vibration shall cease. The rate of Vibration shall be not less than 8000 vibrations per minute. The concrete shall be spread to full width before being struck of and compacted so that the sure will conform to the finished grade and cross-section as shown on t plans and at the same time leave sufficient material for the floating operation. The spreading & finishing machine shall move over the pavement as many times and at such intervals as may be required by the Engineer to ensure thorough compaction.

Except as otherwise specified, after the pavement has been struck of and compacted, it shall be finished with an approved longitudinal float. The Contractor may use a longitudinal float composed of one or more cutting and smoothing floats suspended from and guided by rigid frame. The frame shall be carried by four or more visible wheels riding on and constantly in contact with the forms.

The contractor may use a longitudinal float which works with a sawing motion, while held in a floating position parallel to the road centre line and passing gradually from one side of the pavement to the other. Movements ahead, along the centre line of the road, shall be in successive advances of not more than half the length of the float.

Instead of using other type of longitudinal float a single machine, which will afect satisfactory compaction, finishing and floating may be used. This machine may be towed by a spreading machine. This combination, finishing floating machine shall be equipped with screeds and vibrators as hereinafter specified for spreading and finishing machine. Floating shall be. accomplished by means of a non-oscillating float held in a suspended position form the frame.

If any spreading, finishing and floating equipment is not maintained in full working order or if the equipment as used by the Contractor

proves inadequate to obtain the results prescribed, such equipment shall be improved or satisfactory equipment substituted or added at the direction of the Engineer.

Manual Methods

When striking-off and compacting by manual methods is permitted, the concrete shall be leveled and then struck-off to such an elevation that, when properly compacted, the surface will conform to the required grade' and cross-section. The strike board shall be moved forward with a combined longitudinal. and transverse motion, the manipulation being such that neither ends is raised from the side forms during the process. While striking off, a slight excess of concrete shall be kept in front of the cutting edge at all times. Prior to tamping, the concrete along the forms shall be thoroughly spaded or vibrated The entire area of pavement shall be tamped or vibrated a manner that will ensure maximum compaction. The concrete shall be brought to the required grade and shape by the use of a tamper consisting of a heavy plank whose length exceeds the width of the pavement by 1 foot or by the use of a mechanical vibrating unit spanning the full width of the spread. The tamper shall be constructed with properly trussed roads to stiffen it and prevent sag and shall be shod with a heavy strip or metal for a tamping surface. The tamper shall be moved with a combined tamping and longitudinal motion, raising it form side form and dropping it so that the concrete will be thoroughly compacted and rammed into place. A small surplus material is compacted and rammed into front of the tamper or vibrating unit and tamping or vibrating shall continue until the true cross-section is obtained and the mortar flushes slightly to the surface.

On grades in excess of 5 percent where hand methods are permitted, a little strike board shall follow at a speed of 25 ft to 50 ft per hour back of the heavy strike board, and shall be used in the same way, so as to remove waves caused by flow of concrete.

Where hand tamping is permitted, not less than two strike boards or tampers shall be used for production in excess of 350 CU.ft. After the concrete has been compacted, it shall be smoothed with a wooden float where necessary, as directed by the Engineer.

Longitudinal Floating

Manual floats shall be at least 12 ft. in length not less than 6 inches in width and shall be properly stiffened to prevent bending or warping. In using the float, it shall be held parallel to centre line of the pavement at all time and shall be moved laterally across the pavement from one side or edge to the other until all high areas are cut down and floated into depressions, leaving a surface that is smooth and true to grade. Batch transverse passage of the longitudinal manual float shall lap the proceeding passage by half.

First Straight Edge Testing

Immediately following final floating the entire area of the pavement shall be tested with a 10-ft. (approx. 3. meters) straight edge. Any depressions found shall be immediately fillet." with fresh concrete which shall be struck off compacted and finished. High areas shall be

worked down and refinished. The straight edge testing and refloating shall continue until the pavement has the required surface contour.

After the first straight edge testing and when most of the water sheet has disappeared from the surface. and just before the concrete becomes non-plastic, the surface shall t.',: dragged with a strip of burlap (coarse canvas) 3 ft. to 10 ft. wide and having a length 4 ft. more than the width of the slab. The burlap shall be dragged along the surface of the pavement in a longitudinal direction. Burlap shall be clean and kept free from coatings of hardened concrete. It shall be moist at the time of use.

Second Straight Edge Testing:

After the concrete has hardened sufficiently to permit walking on it, the surface of the pavement shall again be tested with a 1 a-ft. straight edge. 'Any portion of the pavement which shows a variation from the testing edge of more than 1/8 inch shall be corrected by cutting, or shall be removed and replaced at the expense of the Contractor.

3.5 Expansion and Construction Joints

i) All the expansion and contraction joints shall be carefully formed as shown on the Drawings or as directed by the Engineer. As regards dowel bars and joint assemblies, such stakes, brackets or other devices shall be used, as necessary to keep the entire joint assembly in true vertical and horizontal position. The joint filler together with the preformed groove shall provide complete separation of adjacent slabs. The joints shall all be sealed with the specified non-extruding sealing compound set in a 3/4 inch wide preformed chase as shown on the Drawings. The preformed chase shall be thoroughly cleaned of all dust, debris, stones or other hard material prior to its sealing. The riser of all joints shall be rounded to a radius as shown on the Drawings before the concrete hardens.

ii) The joints sealing compound shall be hot poured bitumen or approved sealing compound for concrete pavements complying with BS-2499 for hot tropical climates and heavy duty industrial site subject to severe exposure. All joints)o be filled with flex cell expansion joint filler, or an approved elastic, compressible, durable and rot-proof equivalent of sufficient rigidity to enable it to be satisfactorily installed in the joint and resist deformation during the passage of the concreting equipment. The filler is to be of the same thickness as the joint Width. Holes to accommodate the dowel bars shall accurately be drilled or punched out. Where shown on the Drawings, dowel bars of required diameter shall be placed at the specified spacing. The bars shall be lubricated with an approved lubricant. One end of the dowel bar at expansion joints shall be provided with a closely fitting sleeve 3 inch long, consisting of bitumen coated plastic or other approved material to permit expansion. A loose plug 1 inch deep of approved compressible filling material shall be inserted into the sleeve as shown on the Drawings at the end of the bar. All the dowel bars shall be mild steel bars of the size shown on the Drawings and shall conform to the requirements as specified in the section 'Concrete.

iii) Contraction joints shall be provided as shown on the Drawings. The assembly and method of constructing the expansi9n joints/contraction joints shall be subject to the approval of the Engineer.

3.6 Consolidation

3.6.1 All concrete shall be consolidated by vibration, spading, rodding or forking so that the concrete is thoroughly worked around the reinforcement, around embedded items and into corners of forms, elimir'3ting all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Internal vibrators shall have a minimum frequency of 8000 vibrations per minute and sufficient amplitude to consolidate the concrete effectively. They shall be operated by competent workmen. Use of vibrators to transport within forms shall not be allowed. vibrators shall be inserted and withdrawn at points approximately 18 inch apart. At each insertion, the duration shall be sufficient to consolidate the concrete but not excessive so as to cause segregation, generally from 5 to 15 sec. A spare Vibrator shall be kept on the job site during all concrete placing operations.

Where the concrete is to have an as-cast finish, a full surface of mortar shall be brought against the form by the vibration process, supplemented, if necessary, by spading to work the coarse aggregate back from the formed surface.

3.6.2 If there is any tendency for the mix to segregate during consolidation, particularly if this produces excessive laitance, the mix proportions shall be modified to effect an improvement in the quality of the concrete to the satisfaction of the Engineer and in ' conformity with the provisions of Clause 5.

3.6.3 Vibrator shall not be allowed to contact the formwork for exposed concrete surfaces.

3.6.4 Mechanical vibrators shall be of a type suited in the opinion of the Engineer to the particular conditions.

3.6.5 Over-vibration or vibration of very wet mixes is harmful and should be avoided.

3.7 Curing and Protection

3.7.1 Beginning immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures and mechanical injury and shall be maintained with minimum moisture loss at a relative constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing shall be subject to approval of the Engineer.

3.7.2 For concrete surfaces not in contact with forms, one of the following procedures shall be applied immediately after completion of placement and finishing: Ponding or continuous sprinkling. Application of absorptive mats fabric kept continuously wet. Application of waterproof sheet materials approved by the Engineer. Application of other moisture-

retaining covering as approved. Application of a curing compound conforming to ASTM C 309. The compound shall be applied in accordance with the recommendations of the manufacturer immediately after any water sheen, which may develop after finishing has disappeared from the concrete surface. It shall not be used on any surface against which additional concrete or other material is to be bonded unless it is proved that the curing compound will not prevent bond, or unless positive measures are taken to remove it completely from areas to receive bonded applications.

3.7.3 Moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed. After form removal the concrete shall be cured until the end of the time prescribed for curing.

3.7.4 Curing in accordance with sub-clause 5.13.1 & 5.13.2 above shall be continued for at least 10 days in the case of all concrete except concrete with rapid-hardening Portland Cement for which the period shall be at least 3 days. Alternatively, if tests are made of cubes kept adjacent to the structure and cured by the same methods, moisture retention measures may be terminated when the average compressive, strength has reached 70 percent of the minimum specified works cube strength. If one of the first four curing procedures of sub-clause 5.13.2 is used initially, it may be replaced by one of the other procedures of that sub-clause any time after the concrete is one day old provided the concrete is not permitted to become surface dry during the transition.

3.7.5 When the mean daily outdoor temperature is less than 5 degree C (41 deg. F) temperature of the concrete shall be maintained between 10 and 20 degrees C (50 to 68 deg. F) for the required curing period of sub-clause 5.13.4.

When necessary, arrangements for heating, covering insulation or housing t/ie. Concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature without injury due to concentration of heat. Combustion heaters shall not be used during the first 24 hours unless precautions' are taken to prevent exposure of the concrete to exhaust gasses, which contain carbon dioxide.

3.7.6 During hot weather when necessary, provision for wind-brakes, shading for spraying, sprinkling, ponding or wet covering with a light coloured material shall be made in advance of placement. Such protective measures shall be taken as quickly as concrete hardening and finishing operation will allow.

3.7.7 Changes in temperature of the air immediately adjacent to the concrete during and immediately following the curing period shall be kept as uniform as possible and shall not exceed 3 deg. C (37 deg. F) in anyone hour or 10 degree C (50 deg. F)in any 24 hour period.

3.7.8 During the curing period, the concrete shall be protected from

damaging mechanical disturbances, such as load stresses, heavy shock and excessive vibrations. All finished concrete surfaces shall be protected from damage by construction equipment, materials or methods by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to over stress the concrete.

3.8 Works in Extreme Weather

3.8.1 Unless adequate protection is provided and approval is obtained from the Engineer, concrete shall not be placed during rain. Rainwater shall not be allowed to increase / ease the mixing water nor to damage the surface finish.

3.8.2 When the temperature of the surrounding air is expected to be below 5 deg. C during placing or within 24 hours thereafter, the temperature of the plastic concrete, as placed, shall be no lower than 13 deg. C for sections less than 12 inch in any dimension nor 10 deg. C for any other sections.

When necessary, concrete material should be heated before mixing and carefully protected after placing, in general, heating or mixing water alone to about 60 deg. C may be sufficient for this purpose. Dependence should not be placed on salt or other chemicals for the prevention of freezing. No frozen material or materials, containing ice shall be used. All concrete damaged by frost shall be removed. It is recommended that concrete exposed to the action of freezing weather should have entrained air and the water content of the mix should not exceed 5.5 gallon/bag of cement.

If water or aggregate is heated above 38 deg. C the water shall be combined with the aggregate in the mixer before cement is added.

Cement shall not be mixed with water or with mixtures of water and aggregate having a temperature greater than 38 deg. C.

3.8.3 During hot weather, the temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set, or cold joints and should not exceed 32 deg. C. For massive concrete, this temp. should not exceed 21 degree C. When the temp. of the concrete exceeds 32 degree C, precautionary measures approved by the Engineer shall be put into effect. When the temperature of the steel is greater than 50 deg. C, steel forms and reinforcement shall be sprayed with water just prior to placing the concrete. The ingredients shall be cooled before mixing, or flaked ice or well crushed ice of a size that will melt completely during mixing may be substituted for all part of the mixing water if, due to high temperature, low slump, flash set or cold joints are encountered. Other precautions recommended by ACI Standard 305-72 shall also be adopted.

4. EST of Concrete Quality

4.1 The Contractor shall provide samples of concrete for testing at the Engineer's direction. Proper facilities shall be provided for making and curing the test specimens in accordance with PS 560 and PS 849. A competent person shall be employed by the Contractor whose first duty shall be to supervise all stages in the preparation and placing of the concrete. All Test specimens shall be made and site tests carried out under his direct supervision. .

4.2 Preliminary cube tests and works cube test shall be performed in accordance with PS 560 and PS 849 at the discretion of the Engineer. Works transverse tests shall be performed in accordance with sub-clauses 208 c and 610 d of CP 114. The standard of acceptance for preliminary and works tests shall be as given below.

4.3 The usual test for concrete with maximum size of aggregate up to 1-1/2 inch is the 6 inch cube tested in compression. Details of making and curing compression test cubes are given in PS 560, PS 849 and BS 1881 and details of the testing are given in Part 8 of BS 1881.

For all grades of concrete, preliminary cube strength test with the mixes and materials to be used shall be performed in accordance with PS 560, PS 849 and BS 1881 before the work is begun and subsequently whenever any change is to be made il1l the materials or in the proportions of materials to be used, or as required by the Engineer. The strengths shall comply with the standard of quality specified in accordance with. Table 1 for preliminary tests. The cost of such testing hall be borne by the Contractor.

4.4 Test sample shall be taken at the mixer or as directed by the Engineer. The test specimens shall be cured in accordance with PS 560, PS 849 and BS 1881.Records shall be kept of all test cubes identifying the mix used the section of work for which the concrete was used and the date poured. !

4.5 Five test cubes are to be tested for compressive strength as specified in BS 1881. These tests shall be carried out at site or in a laboratory approved by the Engineer. Two cubes shall be tested at the age of seven days and three at 28 days and the strengths determined are to comply with the standard of quality specified. The laboratory tests shall be carried out by an independent organization, such as Government Testing Laboratory or such other undertakings approved by the Engineer. The original test reports received from the above authorities should be submitted to the Engineer.

4.6 For all grades of concrete, the appropriate strength requirement shall be considered to be satisfied if none of the strengths of the cubes is below the specified cube strength or if the average strength of the three cubes is hot less than the specified cube strength and the difference between the greatest and the least strength is not more than 20% of the average.

4.7 When the results of works cube tests show that the strength of any concrete is below the minimum specified, the Engineer may give instructions for the whole or part of the work concerned to be

removed and replaced at the expense of the Contractor. The Contractor shall bear the cost of any other part of his, or any other contractor's work, which has to be removed and replaced as a result of the defective concrete. If any concrete is held to have failed, the Engineer may order the proportions of that class of concrete to be changed in order to provide the specified strength.

5. Finishing of Formed Surfaces

5.1 General

5.1.1 After removal of forms, the surfaces of concrete shall be given one or more of the finishes specified below in locations designated by the Contract Documents.

5.1.2 When finishing is required to match a small sample furnished to the Contractor, the sample finish shall be reproduced on an area at least 100 Sq. ft. in an inconspicuous location designated by the Engineer before proceeding with the finish in the specified location.

5.1.3 Allowable deviations from plumb or level and from the alignment profile grades, and dimensions are specified in clause 9. Tolerances for concrete construction and defined as tolerances that are to be distinguished from irregularities in finish as described herein. The finish requirements for concrete surfaces shall be as generally specified in this clause and as indicated on the Drawings. Finishing of concrete surfaces shall be performed or, by workmen who are skilled in concrete finishes. The Contractor shall keep the Engineer advised as to when finishing of concrete will be performed. Unless inspection is waived in each -specific case, finishing of concrete shall be performed only in the presence of the Engineer. Concrete surfaces will be tested by the Engineer where necessary to determine whether surface irregularities are within the limits herein after specified. Surface irregularities are classified as abrupt or gradual.

Offsets caused by displaced or misplaced form sheeting or lining or sections, or otherwise defective form lumber will be considered as abrupt irregularities, and will be tested by direct measurements. All other irregularities will be considered as gradual irregularities, and will be tested by use of a template, consisting of a straight edge or the equivalent thereof for curved surfaces. The length of the template will be 6.5 ft. for testing of formed surfaces and 10ft. for testing of unformed surfaces.

5.2 As-cast Finishes

Unless 9therwise specified 9 indicated on the Drawings the classes of finish shall apply as follows:

5.2.1 Rough form finish:

No selected form facing materials Shall be specified for rough form finish surfaces. Tie holes and defects shall be patched. Fins exceeding 1/4" in height shall be chipped off or rubbed off. Otherwise, surfaces shall be left with the texture imparted by the forms.

5.2.2 Fair face finish:

Fair face finish applies to concrete formed surfaces, the appearance of which is considered by the Engineer to be of special importance, such as surfaces of structures prominently exposed to public inspection. Surfaces of concrete structures requiring fair face finish is shown in the Drawings. Surface irregularities, measured as described in sub-clause 7.2.1, 'Rough form finish', shall not exceed 1/4 inch for gradual irregularities and 1/8 inch for abrupt irregularities, except that abrupt irregularities will not be permitted at construction joints. Abrupt irregularities at construction joints and elsewhere in excess of 1/8 inch and gradual irregularities in excess of 1/4 inch shall be reduced by grinding so as to conform to the specified limits. Abrupt irregularities at construction joints shall be ground on level of 1 to 20 ratio of height to length.

Unless otherwise approved, repair of imperfections in formed concrete shall be completed within 24 hours after removal of forms. The form facing material shall produce a smooth, hard, uniform texture on the concrete. It may be plywood, temperated concrete-form-grade hardboard, metal, plastic paper, or other approved material capable of producing the desired fair face finish. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the practical minimum. It shall be supported by studs or other backing capable of preventing excessive deflection. Material with raised grain, torn surfaces, worn edge, patches, dents, or other defects which will impair the texture of the concrete surface shall not be used. Tie holes and defects shall be patched. All fins shall be completely removed.

5.2.3 Architectural Finish Concrete:

Architectural finish concreting formed surfaces as shown on the Drawings IS required by. The Engineer where the architectural appearance of surfaces of structures exposed to public view is of special consideration and importance. The Contractor shall use approved special material for formwork and design the forms in conformity with the specified architectural patterns, textures and finishes in order to obtain first class architectural finish on formed concrete surface without any defect, irregularities, blemishes, imperfections and encrustation's.

Samples:

Submit to the Engineer a minimum of two units or portions of units of each precast item required. Each pair of samples when accepted will describe the allowable limits between which variations can be acceptable.

Similar samples of in-situ concrete for approval by the Engineer submit two samples, 2 Sq. ft. of each type of exposed in-situ concrete. All in-situ samples will remain at the construction site.

Sample approvals of precast & in-situ concrete:

These samples will be reviewed and approved on the basis of colour, dimensional accuracy, and finish of surfaces and general appearance. The same requirements for sample approval will be required for both precast and in-situ concrete exposed surfaces.

Forms:

The contractor must maintain the forms unusually tight and braces to prevent movement, mal-alignment and bleeding that will result in sand streaks, honeycomb, fins, stain or unsightly appearance. / .

If wood forms are chosen to be used by the Contractor they shall be constructed of 3/4 inch minimum thickness plywood constructed in a fashion to allow many re-uses with all surfaces sealed with a polyurethane varnish.

Edges, surfaces and corners of forms shall be sealed to prevent loss of any matrix or unequal absorption of water. Corners of wood forms shall be filled with suitable compound and all contact surfaces sealed with a polyurethane varnish.

Re-use of forms shall be subject to approval by the Engineer.

Curing:

Curing shall be done in shade (out of direct sunlight) and shall be for a minimum period of 4 days.

Finishing Procedures:

"Finishing procedures for filling air void smooth finished concrete developed by a formed surface":

While the concrete surface is still damp (not more than three days after removal of forms), apply a thin coat of medium consistency neat cement slurry by means of bristle brushes to provide a bonding coat within any pits or blemishes in the parent concrete; avoid coating large areas of the finished surface. Before slurry has dried or changed colour, apply a dry (almost crumbly) grout comprised of one part cement, of the type and brand of cement used in the original concrete, to one and one-half parts clean masonry sand with f3 fineness modulus of approximately 2.25 and complying with the graduation requirements of the ASTM Specifications C 144. Mix proper amounts of white cement and colouring with the parent mortar to produce a satisfactory colour match with the parent concrete after hardening. Use samples previously prepared.

Apply the finishing grout uniformly with damp (neither dripping wet nor dry) pads of coarse burlap approximately 6 inch square used as a float. Scrub the grout well into ’ the pits to provide a dense mortar in all the imperfections to be filled. Allow the mortar to partially harden, from one to two hours, depending upon the weather. Avoid direct hot sunlight. If the air is hot and dry, keep the concrete surface damp during this period using a fine fog spray. When the grout has hardened sufficiently so it can be scraped from the surface with the edge of a steel trowel without damaging the grout from the small

pits of holes, cut off all that can be removed with a trowel without delay; next allow the surface to dry thoroughly and rub it vigorously with clean, dry burlap to completely remove any dried grout. No visible film of grout shall remain after this rubbing. Complete the entire cleaning and grouting operation for the grout to dry after it has been cut with the trowel, so it can be wiped off clean with the burlap.

On the day after the repair work, the concrete surfaces should again be wiped off clean with dry burlap to remove any inadvertent dust; leave no built-up surfaces on the parent surfaces. Employ, if possible, a used piece of burlap containing old hardened mortar to act as a mild abrasive. Use of fine abrasive stone if needed to remove any remaining built-up film without breaking through the surface film of the original concrete. Such scrubbing should be light and sufficient only to remove excess material without working up a lather of mortar or 'changing the texture of concrete.

Following the final b?l9.9ing or stoning operation, provide a thorough wash down with stiff bristle brushes 10 remove all extraneous materials and spray the concrete surface with a fine fog spray periodically to maintain a continually damp condition for at least three days after application of the pit repair grout.

Rust Stains:

All rust stains are to be removed employing the following procedure:

The rust stain shall be soaked for 10 minutes with a solution of 0.055 lb. of sodium citrate in 0.33 lb. water "(brushing the solution at short intervals is satisfactory). Then the surface is sprinkled with crystals of sodium hydrosulfite and covered with a paste of Fuller's Earth and water. On a vertical surface, the paste is applied with a trowel, with the crystals first sprinkled on the paste so they will be in direct contact with the stain. The paste is allowed to dry for 10 minutes then scraped off and the treatment repeated if necessary.

Repairing of Formed Surfaces:

It is the intention of Specification to require form mixture of concrete and workmanship so that concrete surfaces, when exposed, will require no patching. Any concrete which is not formed as required and conforming to approved samples or for any reason is out of alignment or level or shows a defective surface, shall be removed from the job by the Contractor at his expense unless the Engineer grants permission to repair the defective area. Permission to patch any such area shall not be considered a waiver of the Engineer's right to require a complete removal of defective work if the repair does not, in his opinion, satisfactorily restore the quality and appearance of the surface. The Engineer shall be the sale judge of acceptability of appearance.

5.3 Finishes of Unformed Surfaces:

5.3.1 Monolithic Concrete Floor Finish

Where monolithic concrete floor finish is shown on the Drawings, placing shall proceed continuously for the full thickness of the course or RCC slab without change in concrete mix. Mixing water shall be the minimum required for proper placing, and will be as specified by the Engineer. After placing, floors, and other surfaces shall be floated with a wood float to a true surface and to elevation as shown on the Drawings. Where indicated on the Drawings, floor surfaces shall be steel trowel finished. Toweling shall be the minimum amount consistent with . maintaining a smooth dense surface, and shall not be done until the mortar has hardened sufficiently, to prevent excess fine material from being worked to the surface, and shall produce a dense uniform surface, free from blemishes and trowel marks.

Gradual surface irregularities shall not exceed 1/16 inch. The addition of water, dry cement, or dry cement mortar, to the surface of the concrete to facilitate finishing will not be permitted.

5.3.2 Equipment Foundations'

Unless otherwise specified, exposed, surfaces of equipment foundations shall be given steel trowel finish to produce a surface similar to the specified concrete floor finish.

6 Repair of Surface Defects

6.1 General

6.1.1 Any concrete failing to meet the specified strength or not formed as shown on drawings, concrete out of alignment, concrete with surfaces beyond required tolerances or with defective surfaces which cannot be properly repaired or patched in the opinion of the Engineer shall be removed at Contractor's cost. The Engineer may reject any defective concrete and order it to be cut out in part or in whole and replaced at the Contractor's expense. All ties and both less and all repairable defective areas shall be patched immediately after form removal.

6.2 Repair of Defective Areas

6.2.1 All honeycombed and other defective concrete shall be removed down to sound concrete. The area to be patched and an area at least 6 inch wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared using c. mix of approximately 1 part cement to 1 part fine sand passing NO.25 BS Sieve and shall then be well brushed into the surface.

6.2.2 The patching mixture shall be made of the same material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2-1/2 parts sand by damp loose volume. White Portland cement shall be substituted for a part of the gray Portland cement on exposed concrete in order to produce a colour matching the colour of the surrounding concrete, as determined by a trial patch.

6.2.3 The quantity handling of mixing water shall be no more than necessary for allowed and placing. The patching mortar shall be mixed in advance and of to stand with frequent manipulation with a trowel, without addition placing water, until it has reached the stiffest consistency that will permit

6.2.4 After surface water has evaporated from the area to be patched, the bon coat shall be well brushed into the surface. When the bond coat begins to loose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least 1 hour before being finally finished. The patched area shall be kept damp for 7 days. Metal tools shall not be used in finishing a patch in a formed wall, which will be exposed.

6.2.5 Where as-cast finishes are specified, the quantity of patched area shall be strictly limited. The combined total of patched areas in as cast surfaces shall not exceed 2 sq.ft. in each 1000 sq.ft. of as-cast suri'3ce. This is in addition to form tie patches, if the project design permits ties to fall within as-cast areas.

6.2.6 Any patches in as-cast architectural concrete shall be indistinguishable from surrounding surfaces. The mix formula for patching mortar shall be determined by trial to obtain a good colour match with the concrete when both patch and concrete are cured and dry. After initial set, surfaces of patches shall be dressed manually to obtain the same texture as surrounding surfaces.

6.2.7 Patches in architectural concrete surfaces shall be cured for 7 days. Patches shall be protected from premature drying to the same extent as the body of the concrete.

6.3 Tie and Bolt Holes

After being cleaned and thoroughly dampened, the tie and bolt holes shall be filled solid with patching mortar. If architectural appearance requires, these holes may be filled partially creating the desired round clear holes pattern on surfaces exposed to view.

6.4 Proprietary Materials

If permitted or required by the Engineer, proprietary compounds for adhesion or as patching ingredients may be used in lieu. of or in addition to the foregoing patching procedures. Such compounds shall be used in accordance with the manufacturer's recommendations with prior approval of the Engineer.

Where tolerances are not stated in the specifications or drawings for any individual structure or feature thereof, maximum permissible deviations from established lines, grades and dimensions shall conform to the following. The Contractor is expected to set and maintain concrete forms so as to ensure complete work within tolerance limits. These allowable tolerances shall not relieve the Contractor of this responsibility for correct fitting of indicated materials. These tolerances are not cumulative.

6.5 Variation from the plumb (or the specified batter for inclined walls.)

6.5.1 In the lines and surfaces of columns, piers, walls and in arises: In any 10 feet of length or height In any storey or 20 feet length Maximum for the entire length or height. In any bay or 20 feet maximum 1/4 inch Maximum for the entire length or height ½ inch

6.5.2 Variation from the level or from the grades indicated on the drawings.

6.5.3 In floors, ceilings, beams soffits and in arises measured before removal of supporting shores.

In any 10 feet of length	1/4 inch
In any bay or in any 20 feet length	38 inch
Maximum for the entire length	3/4 inch

6.5.4 For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines.

In any bay or 20 feet length	1/4 inch
Maximum for the entire length	1/2 inch

6.6 Variation of the linear building lines from established position in plan and related position of columns, walls and partitions.

In any bay or 20 feet of length Maximum for the entire length 1/2 inch 1 inch

6.7 Variation in the sizes and locations of sleeves, floor openings and wall openings. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs And walls.

Minus	¼ inch
Plus	½ inch 9.6 Footing

6.7.1 Variation in dimensions in plan Minus ½ inch

Plus (plus variation applied to concrete only, not to reinforcing bars or dowels). 2 inch

6.7.2 Misplacement or eccentricity

2 percent of the footing width in the direction of misplacement but not more than (applies to concrete only, not to reinforcing bars or dowels). ½ inch 2 inch

6.7.3 Thickness Decrease in thickness 5%

6.7.4 Increase in Specified thickness No limit

6.8 Variation in Steps

6.8.1 In a flight of stairs

Rise	+1 / 8 inch-
Tread	+1 / 4 inch-

6.8.2 In consecutive steps

Rise	+1 / 16 inch-

	Tread	+1 / 8 inch-

6.9 'Tolerances for Precast concrete construction'

Forms must be true to size and dimensions of concrete members shown on the plans and be so constructed that the dimensions of the finished products will be within the following limits at the time of placement of these units in the structure, unless otherwise noted' on structural-architectural drawings:

6.9.1	Overall dimensions of members	1/16 inch per 10 feet
6.9.2	Cross-sectional dimensions Sections less than 3 inch.	1/16 inch
	Sections over 3 inch and less than 18 inch.	1/8 inch 1/4 inch
	Sections over 18 inch.	1/8 inch
6.9.3	Deviations from straight line in long sections.	1/16 inch per 10 feet
	Not more than	+1/16 inch per 10 feet span
	Maximum differential between adjacent units in erected position	1/4 inch

7 Acceptance of Structure

7.1 General

7.1.1 Completed concrete work which meets all applicable requirements will be accepted subject to the other terms of the Contract Documents.

7.1.2 Completed concrete work which fails to meet one or more of the requirements and which has been repaired to bring it into compliance will be accepted subject to the other terms of the Contract Documents.

7.1.3 Completed concrete work which fails to meet one or more of the requirements and which cannot be brought into compliance may be accepted or rejected as provided in these Specifications or in the Contract Documents. In this event, modifications may be required to assure that remaining work complies with the requirements.

7.2 Dimensional Tolerances

7.2.1 Formed surfaces resulting in concrete outlines smaller than permitted by the tolerances of clause 9 shall be considered potentially deficient in strength and subject to the provisions of sub clause

7.2.2 Formed surfaces resulting in concrete outlines larger than permitted by the tolerances of clause 9 may be rejected and the excess material shall be subject to removal. If removal of the excess material is permitted, it shall be accomplished In such a manner as to maintain the strength of the section and

to meet all other applicable requirements of function and appearance. Permission is required if excess material is to be removed in accordance with this clause.10.2.3 Concrete members cast in the wrong location may be rejected if the strength, appearance or function of the structure is adversely affected or if misplaced items interfere with other construction.

7.2.3 Inaccurately formed concrete surfaces exceeding the limits of Clause 9 or of Clause 5.6 of Section 'Formwork' and which are exposed to view, may be rejected and shall be repaired or removed and replaced if required.

7.3 Appearance

7.3.1 Architectural concrete with surface defects exceeding the limitations of Sub-clause 5.6 of Clause 5 of the Section, 'Formwork' shall be removed and replaced.

7.3.2 Other concrete exposed to view with defects which adversely affect the appearance of the specified finish may be repaired only by approved methods.

7.3.3 Concrete not exposed to view is not subject to rejection for defective appearance.

7.3.4

7.4 Strength of Structure

7.4.1 The strength of the structure in place will be considered potentially deficient if it fails to comply with any requirements" which control the strength of the structure, including but not necessarily limited to the following conditions. Concrete strength requirements not considered to be satisfied in accordance with Clause 6 hereof.

7.4.2 Reinforcing steel size, quality, strength, position or arrangement at variance with the requirements as listed under specification of 'Reinforcement' or in the Contract Documents. Concrete which differs from the required dimensions or location in such a manner as to reduce the strength. Curing less than that specified. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development. Mechanical injury, construction fires, accidents of premature removal of formwork likely to result in deficient strength. Poor workmanship likely to result in deficient strength.

Structural analysis and/or additional testing may be required when the strength of the structure IS considered potentially deficient.

Core tests may be required when the strength of the concrete in place is considered potentially deficient.

7.4.3 If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be required and their result evaluated in accordance with British Standard BS 8110 or ACI Standard 318.

7.4.4 Concrete work judged inadequate by structural analysis or by results of a load test shall be reinforced with additional construction if so directed by the Engineer or shall be replaced, at the Contractor's expense.

7.4.5 The Contractor shall pay all costs incurred in providing the additional testing and/or analysis required by this section.

7.4.6 The Employer will pay all costs of additional testing and/or analysis which is made at his request and which is not required by these Specifications, or by the Contract Documents.

8 Testing of Material

a) A site laboratory shall be established by the Contractor for all the required testing of concrete, aggregates and other materials etc. All tests shall preferably be done at site. Only the test which are not possible to be carried out in the site laboratory shall be referred to the laboratory approved by the Engineer. All testing charges thereof shall be borne by the Contractor.
For testing of reinforcement steel bars, the samples shall be referred to the laboratory approved by the Engineer at the cost of the Contractor.

b) Cement shall be tested as prescribed in -STM C -150.

c) Aggregates shall be tested as prescribed in British Standard BS 812 - 882. addition fine aggregate shall be tested for organic impurity in conformance with ASTM Standard CAO.

9 Measurement and Payment

9.1 General

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bills of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bills of Quantities.

The rates quoted by the Contractor in the Bill of Quantities shall include work to be executed under these specification in any floor and at any height except where otherwise specifically stated in the relevant item of Bill of Quantities and the Contractor shall not be entitled to any claim or claim any compensation on this account.

9.1.1 Providing, fixing, striking, etc. of formwork.

9.1.2 Providing, placing and fixing of anchor bolts or any other embedded parts.

9.1.3 Providing and installing all type of joints in concrete structure, including expansion joints.

9.2 Plain and Reinforced Concrete

9.2.1 Measurement

Concrete shall be measured as executed but no deduction shall be made for the following: Volume of any steel embedded in the concrete.

Volume occupied by water pipes, conduits etc. not exceeding 10 square inches each in cross-sectional area.

Voids not exceeding 4 square inch in work given in square feet. If any void exceeds 4 square inch, total void shall be deducted.

Voids, which are not to be deducted as specified above, refer only to openings or ,vents which are wholly within the boundaries of measured areas. Openings or vents which are at the boundaries of measured areas shall always be subject to deductions irrespective of size.

Concrete work shall be classified and measured separately as listed under items of Bills of. Quantities. Junction between straight and curved works shall in all cases be deemed to be included with the work in which they occur.

Measurement of walls shall be taken between attached columns piers or pilaster. The thickness of attached columns, piers or pilaster shall be taken as the combined thickness of the wall and the columns, piers or pilaster.

Attached or isolated columns, piers, pilaster, and the like (except where caused by openings) having a length on plan not exceeding four times the thickness shall be classified as columns. Those having a length over four times the thickness and are caused by openings in wall shall be classified as walls.

Columns shall be measured from the top of footing/footing beams or floor surfaces to the underside of beams or slabs as the case maybe. Where the width of beams is less than the width of columns, the extra width at the junction shall be included in the beams.

The depth of the beams shall be measured from bottom of the slab to the bottom of the beams except in case of inverted beams where it shall be measured from top of slab to the top of beam. The cross-section of the beam shall be the actual cross-section below or above the slab. .

Measurement of acceptably completed works of plain and reinforced cement concrete will be made on the basis of number of cubic feet concrete placed and compacted in position within the neat lines of the structure as shown on the Drawings or as directed by the Engineer.

9.2.2 Payment

Payment will be made for the acceptable measured quantity of plain and reinforced cement concrete on the basis of unit rate per cubic feet quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item.

9.3 M16 Hilti System Dowels

9.3.1 Measurement

Measurement of acceptably completed works of drilling and fixing of anchoring dowels as per M16 Hilti's System HIT-

HY150 injection adhesive with HAS rod will be made on the basis of number of dowels drilled and fixed in position as shown on the Drawings or as directed by the Engineer.

9.3.2 Payment

Payment will be made for the acceptable measured quantity of drilling and fixing of anchoring dowels as per M16 Hilti's System HIT-HY150 injection adhesive with HAS rod, on the basis of unit rate per number quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item.

9.4 For Mortar

9.4.1 Sand

Sand for mortar shall comply with the requirements for BS-1200. It shall be graded in accordance with the following table and the various sizes of particles shall be uniformly distributed. Sand that has been in contact with seawater shall not be used unless it has been thoroughly washed to the satisfaction of the Engineer.

Sieve Size (No.)	Percent Passing by weight	
	Min.	Max.
#4	100	
#8	95	
#16	70	100
#30	40	75
#50	10	35
#100	2	15
#200		

Sand up to .0025 inch shall not be more than 8% by weight of the total.

9.4.2 Cement:

Cement shall be Sulphate Resistant conforming to BS-12.

9.4.3 Water:

Water shall be clean and free from any harmful impurity. Where the quality of the water is doubtful, it shall be tested in accordance with BS- 3148.

9.4.4 Additives:

Additives where used, shall be proprietary products used in the proportions and manner recommended by the manufacturer. The additives shall in no way adversely affect the mortar strength or contain chemicals, which may be harmful to other building materials To add gypsum to cement is strictly forbidden.

9.4.5 Mortars and Grout:

Materials for mortar, sand binding agent and water, shall be mixed by volume or by weight for at least 3 minutes with the

minimum amount of water to produce a correctly mixed mortar ’or grout of workable consistency in a mechanical batch mixer. For small jobs, hand mixing may be permitted, the ingredients being mixed with sufficient water to produce a correctly mixed workable mortar.

Mortar shall be as strong, but no stronger than the materials it bonds together:

Mortars shall be mixed in batches, which can be used within a period before the setting process commences. Once a mix begins drying off, it shall be rejected. No ingredients shall be added to it once the setting process has begun.

9.4.6 Reinforcement:

For reinforcement refer specification section no. 2200.

10 Concrete Block Making

10.1 The Solid and Hollow blocks shall be machine moulded. The block making machines shall be of the standard approved by the Engineer. They shall be operated according to the instructions laid down by the manufacturers.

10.2 The blocks shall be continuously water cured by sprinkling water for a minimum of 10 days and covered between sprinkling operations with 4 mils thick polyethylene sheeting. After 10 days water curing period the blocks shall be air-dried. Under no circumstances will blocks be used in the work until they are completely dry. During curing period no surfaces of the block will be allowed to dry.

10.3 Cured concrete blocks shall be stored of the ground, stacked on level platforms which allow air circulation under stacked units. Units shall be covered and protected against wetting Care shall be exercised in the handling of all concrete blocks. No damaged blocks shall be used in the work. .

10.4 The hollow blocks shall be manufactured as per pattern shown on the drawing. These block units shall be provided by the Contractor for use where required in building structures from approved type of materials. Units shall have uniformly fine smooth surfaces of uniform colour. These shall be free of any honey combing or other imperfections or deformations, all edges true and straight, and at right angles with each other and without any chipped or otherwise broken edges.

10.5 The blocks cast on different dates shall be stacked separately and must be labeled showing the date on which they were cast.

10.6 Reinforced cement concrete hollow block masonry shall be provided where shown on the drawings. Hollow block manufactured by moulding machine shall have well formed cavities, sharp and well defined edges and corners, smooth surfaces without any imperfections or deformations.

11 Properties of Blocks

11.1 All blocks shall be of the size and shape required to complete the work shown in the Drawings or as instructed by the Engineer.

11.2 The cement, sand and coarse aggregate shall be volume batched and their proportion may be adjusted so as to provide the concrete of the required strength when tested and shall be mixed in a concrete mixer in accordance with clause 5.4 of the section 'Plain and Reinforced Concrete'.

11.3 All blocks shall comply with ASTM C145 198,8 edition. The compressive strength of various solid and hollow block shall be as follows:

S. No	Type of Concrete Masonry ASTM 1988 Edition	Compressive Average of 3 Units	Strength Psi Individual Unit (MPa)	Location
1	Solid load bearing	1800 (12.4)	1500 (10.4)	Exposed to frost action
2	Masonry Unit	1200 (8.30)	1000 (6.90)	
3	(ASTM-C-145) Solid/Hollow non	600(4.14)	500 (3.45)	Not exposed to moisture & weather
4	load bearing Masonry units (ASTM-C-90) Hollow load bearing masonry	1000 (6.90)	800 (5.50)	Exposed to moisture & weather
5	(ASTM-C-90)	700 (4.80)	600 4.10	Not exposed to moisture &

11.4 The Contractor shall provide test certificates providing the average minimum crushing strength of the blocks prior to the commencement of the construction. Further test certificates shall be provided as required by the Engineer, to ensure that all batches of blocks have the minimum specified crushing strength.

11.5 A laboratory approved by the Engineer shall carry out the test. Evidence shall be produced that the block manufacturer has an efficient method of quality control. The Engineer will require to test samples of blocks periodically and the Contractor shall make necessary arrangements accordingly. The method of sampling for all tests shall be in accordance with.

11.6 All properties or specifications of blocks, not explained in these Specifications shall comply with the requirements of ASTM C145 1988 edition as directed by the Engineer.

12 Suction Rate

The Contractor shall, at his own cost, satisfy the Engineer that the suction rate of the block when determined in accordance with Appendix "A" of BS 3921 does not exceed 20 g/dm2/ min. or that the Contractor is able to adjust it so that it does not exceed this value on site.

13 Soluble Salt Content

For exposed block work, the contents by weight percent of soluble sulphate, calcium, magnesium, potassium ·and sodium radicals, shall not exceed 0.30, 0.10, 0.30, 0.03 andO.03, percent respectively when ascertained in accordance with BS 3921, at the cost of the Contractor.

14 Reinforcing and Anchors of Block Masonry

Unless otherwise stated reinforcing and anchors shall conform to under mentioned sizes:

14.1 Joint reinforcing shall be 1.32mm (0.05-inch) diameter mild steel wire. Mesh design, galvanized after fabrication. Steel wire woven into 12mm mesh 75rrym wide. Reinforcing bar anchors shall be 250mm dia. deformed bar minimum 10 inch long.

14.2 Two 6mm dia bar shall be provided at every fourth course for anchoring of block masonry to columns. Two # 10 bars at every fourth horizontal course shall be provided for anchoring masonry walls to plinth beam/floor beam, as shown on the drawings.

14.3 Dovetail anchors and slots (if used as an alternate anchorage) shall be not less than 18 gauge galvanized steel.

15 Erection

15.1 Blocks shall be laid true to line, level and laid in accurately spaced courses in stretcher bond with vertical joints of each course located at centre of units in alternate courses below. Vertical joints shall be buttered in the entire height of blocks. Each course shall be bonded at corners and at intersections of walls and shall be properly bonded. Courses of block shall be kept plumb throughout and corner reveals shall be true and in plumb.

15.2 Standard width of mortar joints for both horizontal and vertical joints shall be 10mm (maximum). Mortar joints in walls shall have· full mortar coverage on vertical and horizontal faces between the blocks. Mortar joints on wall including struck joints, shall be thoroughly compacted and pressed tight against the edges of the blocks with proper tools. Blocks terminating against soffits of beam or slab construction shall be wedged tight with wedges and the joints shall be packed solidly with mortar between the top of the block and the bottom of slab or beam. Control expansion joints shall be kept free from mortar or other debris.

15.3 Unless otherwise shown on the drawings or specified by the Engineer, the spaces around doorframes and other material or built in items shall be solidly filled with mortar. Spaces around the door and window holdfasts shall be filled in with Class 'C' concrete.

15.4 Work required to be built in with masonry including doorframe anchors, wall plugs, and dovetail anchors and accessories shall be built in as the erection progresses.

15.5 The block work shall be carried up in a uniform manner and no portion shall be carried more than one meter above the adjoining one at any time. All masonry shall be kept strictly true and square and the whole properly bonded together and leveled round each floor.

15.6 Sleeves, Chases, holes, sinking and mortices for other trades shall be correctly located and formed to the sizes as required by the relevant trades. Chiseling of completed walls or the formation of holes shall only be carried out.

15.7 Walls of blocks indicated, as being non-load bearing shall be constructed on the concrete floor slab unit after the floor formwork is struck and the concrete has obtained sufficient strength to support their weight Too thing into load-bearing walls shall not be permitted.

15.8 All bolts, anchors, ties, pipe sleeves, flushing metal attachments, lintels and the like required to be built into the work shall be correctly inserted and executed as the work proceeds.

15.9 Walls or partitions abutting concrete columns or walls shall be securely anchored and tied with metal anchors or ties at not more than 450mm vertical centres. Wall ties cast in with concrete shall be bent down after the removal of formwork and shall be securely jointed into the mortar beds of walling.

15.10 Care shall be taken during construction of cavity walls so as to avoid the filling up of cavity with mortar. G.1. flashing and weep holes shall be provided where ever specified on the drawings or as per the instructions of the Engineer. Wheep holes will be formed by oiled rods, removed after the mortar is set, at specified locations.

16 Scaffolding

Contractor shall provide safe scaffolding of adequate strength for use of 00rkmen at all levels and heights at his own expense. Scaffolding which is unsafe in the opinion of the Engineer shall not be used until it has been strengthened and made safe for use of workmen. Cost of scaffolding etc., shall be included by the Contractor in the unit rate for masonry items.

Damage to masonry from scaffolding or from any other object shall be repaired by the Contractor at his own cost.

17 Jointing

Jointing is the forming of joints as work proceeds. Joints shall be as follows:

17.1 Exterior exposed joints shall be tightly formed to a weather joint with the point of the trowel.

17.2 Interior exposed joints shall be tightly formed to a concave joint

17.3 Joints which are subsequently covered with plaster or other finish materials shall be struck flush.

18 Tolerances

All block work shall be erected plumb and true to line and level with the maximum variation in any storey height or any length of wall being one mm in one meter. The maximum tolerance in the length, height or width of any single masonry unit shall be! 3mm.

19 Damp Proof Course

Damp-proof course shall be laid on an even mortar bed, free from projections, which may puncture the material. Where the damp-proof course is to be stepped only flexible membrane shall be used.

All damp proof course, unless otherwise specified, shall consist of class ’C’ cement concrete 50mm thick, mixed with 2.5 kg. of pudlo per bag of cement or other approved quality water proofing compound as per manufacturers specifications and shall be laid at required levels as per drawings and instructions of the Engineer. The D.P.C shall be tamped consolidated, leveled, edges and corners made to the requirements of concerned drawings including finishing and curing complete.

20 Solid Block Work Around Opening of Hollow Masonry

Around all openings in hollow block masonry, the Contractor shall provide solid block work c:f same thickness as that of hollow block masonry wall and of width as indicated on the Drawings .. Solid block shall be laid around openings in such a manner that these are bonded integrally with hollow block masonry.

21 Reinforced Hollow Block Masonry

Where specified on the Drawings, reinforced hollow block masonry shall be provided. Horizontal and vertical reinforcement shall be cold worked deformed bar. Two bars of No. 8 (8mm) diameter shall be provided at every third horizontal course at 600mm centers, while the vertical reinforcement shall be two bars of No. 12 (12mm) diameter at 800mm centers. Bars shall be anchored and held firmly vertical in respective beams and columns in the manner shown in shop Drawings. The reinforced hollow part of ',he block wall shall be solidly filled with Class 'D' concrete at intervals of one meter maximum height as the laying of block masonry work proceeds. The filled concrete shall be consolidated thoroughly by rodding to avoid formation of voids. Contractor shall submit shop drawings of anchoring and placing of reinforcement in hollow block masonry for approval of the Engineer.

22 Curing and Repairs

22.1 All block masonry shall be water cured and shall be kept wet for at least seven days, by an approved method, which will keep all surfaces to be cured continuously wet. Water used for curing shall meet the requirements of the specifications for water used in the manufacture of blocks.

22.2 If, after the completion of any block masonry, the work is not in alignment or level, or does not, conform to the lines and grades shown on the Drawings •or shows a defective surface, it shall be removed and replaced by the Contractor at his expense unless the Engineer grants permission in writing, to patch or replace the defective area.

23 Masonry Short of Height

In case of different thickness of slab in different areas or rooms or for any other reasons, whatsoever if chiseling of masonry is required, the Contractor shall do so at his own cost. Where for any reason whatsoever, the height of the wall is short of ceiling height the actual height shall be made good with Class 'C' nominal mix concrete. This concrete shall neither be measured nor be paid under item of concrete but will be paid for under the item of wall masonry. Similarly where the lintel heights' are such that the Contractor has to chisel the masonry or provide cast-in-place concrete to make up the height of the course, no payment will be made for chiseling, but where such cast-in-place concrete is provided, payment for the same will be made at the unit rate of masonry.

24 Measurement and Payment

24.1 General

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bills of Quantities. The cost thereof shall be deemed to have been included

in the quoted unit rate of the respective items of the Bills of Quantities.

24.1.1 Chiseling of masonry, wherever required

Providing and fixing all joints reinforcing bars dovetail anchors, Cement sand mortar used in laying blocks, curing of masonry works and making of weep holes, Wastage of material etc.

Providing and filling Class 'D' Concrete in the cavity of hollow block masonry.

Providing and laying damp proof courses including damp proof materials and GI sheet flashing within cavity wall.

24.2 Solid Block Masonry

24.2.1 Measurement:

Measurement for acceptably completed works of respective type of solid block masonry will be made' on the basis of number of cubic feet provided and installed in position as shown on the drawings or as directed by the Engineer. Each measurement shall be taken to the nearest W'. All opening$ left in the masonry wall shall be deducted.

24.2.2 Payment:

Payment will be made for acceptable measured quantity of respective type of solid block masonry work on the basis of unit rate per cubic feet quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item.

SECTION – 11 CARPENTRY AND JOINERY

1. Scope

The work covered under this section of Specifications consists of providing all material, labour, plant, equipment, appliances and performing all operations in any floor and at any height. connected with the fabrication and erection of all woodwork, mill work, construction assembly, surface finish treatment and building in of all cabinet type items, supports etc. of wood or metal and incidentals, associated woodwork appurtenances, procuring and applying preservatives, installation of "Finish Hard Ware" in connection with finish woodwork as per details shown on the Drawings or as directed by the Engineer.

2. Materials

2.1 Timber

2.1.1 Hard Wood:

Hard wood shall comprise of Oak, beech, Walnut Mahogany, Teak, lroko and Sheesham.

2.1.2 Soft Wood:

All soft wood shall consist of pines, spruce, hemlock and douglas fir or cedrous deodar (referred in the document as deodar), wood locally known as 'Partal' to be used in shutter core where specified.

2.1.3 General Characteristics:

All the timber shall be in accordance with the requirements of BSI No: 1186, 'Quality of Timber and Workmanship in Joinery.

The whole of the timber shall be from the heart of sound and fully grown tree, uniform in substance, straight first class quality properly seasoned, free from large or loose dead-knots, open shakes and excessive sapwood. The scantlings of all timbers shall be brig t: sound and square edged. The moisture content of timber shall not be more. than 10 (ten) percent in case of soft wood and 7 (seven) percent in case of hard wood.

2.1.4 Preservation of Wood:

Prior to installation of all finish wood works in their respective positions, preservatives shall be applied to safeguard the wood work against fungus, termite and bores.

The Preservatives shall be of the best available quality as approved by the Engineer. The method of application shall be strictly in accordance with the manufacturer's instructions. The treatment and application of all the preservatives shall comply with the requirements of BS-CP 98:1964.

2.1.5 Adhesive:

The adhesives shall conform to the requirements of BSI No. 745 "Animal Glues for Wood" manufactured by M/s Host shall

be considered approved for this Project or as directed and approved by (he Engineer.

2.1.6 Nails and Screws:

All nails and screws shall comply with requirements of BSI NO. 1202 and BSI NO. 1210 respectively.

2.1.7 Ply Wood

The ply wood shall comply in all respects with BSI No. 1455:1963. All the ply wood shall only be obtained from KDC Board (Pvt.) Limited, Jhelum as approved by the Engineer.. All plywood shall be manufactured with phenol pharamaldihide or any other approved water proof adhesive but not with urea pharamaldihide.

Ply wood used for doors, and other similar works shall be to the thickness and size as shown on the Drawings or as directed by the Engineer. The grade shall be first quality and the face and back shall be free from end joints, dead knots, overlaps, patches and other similar defects. The surfaces shall be free, smooth for painting or polishing.

2.1.8 High Density Fibre (MDF) Board

Medium density fibre board to be used on the project shall be LASANI of thicknesses as specified in the drawings. Board shall be manufactured with water proof resinous glues and shall be guaranteed by the manufacturer. All boards required for the exterior surfaces of cabinets shall be laminated with farmica in approved colour and texture in factory as specified elsewhere.

3. Samples

All samples of the material used for the work under this Section of Specification shall be approved by the Engineer and same type of material shall be used throughout the work. If the Engineer desires to get the material tested, this will be got done by the Contractor· at his own cost from a laboratory approved by the Engineer.

4. Fabrication

Unwrought' timber shall be used. Sawing shall be done with sufficient oversize margin to finally meet the requirements of specified sizes and dimensions of the finished work.

All framing shall be joined and glued properly as shown n on the Drawings or as directed by the Engineer. All joints shall be secured with sufficient number of nails. The Contractor shall perform all necessary mortising, tenoning, grooving, matching, tangoing, housing, rebating and all operations required for the correct jointing. The Contractor shall also provide all metal plates, screws, nails and other fixing material that may be ordered by the Engineer for the proper execution of the joinery work. Fabrication that develop defects due to bad workmanship or unsound materials not conforming to these specifications and the directions of the Engineer, shall be cut out and replaced at Contractor's own expense before the expiry of the maintenance period.

5. Protection Of Materials

All materials and assembled units shall be protected from weather and stored in such a way as to prevent decay, warping and attack by fungus and termites.

6. Wooden Doors

6.1 Materials

6.1.1 First class Deodar wood as approved by the Engineer shall be used for door frames and door shutters except the core of shutters which shall be partial wood as specified and shown on drawings.

6.1.2 Architraves, beads, lippings shall be of Deodar wood of specified sizes and fixed as per details shown on Drawings.

6.2 Ground, Blocking & Nailing Strips

6.2.1 Ground, blocking and nailing strips shall be provided as necessary to receive the work included herein and as required for the work of other trades.

Except as otherwise shown or specified, ground blocking and nailing strips shall be secured in place as follows:

6.2.2 To steel--- by means of 3/8" diameter bolts spaced not over 3 feet.

6.2.3 To brick wall ---- by the use of cut nails spaced not more than 1.5 feet apart and driven directly into the block. .

6.2.4 To poured concrete --- by means of 1/4" diameter galvanized expansion bolts spaced not more than 1.5 feet part or by any approved method.

6.3 Exterior and Interior Door Frames

All exterior and interior door frames shall be fabricated of wooden sections of first class deodar wood frame as shown on drawings.

All exposed surfaces of frames and architraves/beads shall be painted with synthetic matt finished enamel paint of approved shade as per the instructions of the Engineer.

The door frames shall be secured in place by means of 4 inches screws and matching Rawal plugs and built into the plastered masonry after the same has dried 4 number screws in each jamb and 2 number for upto 3.5 feet width and 3 number for upto 5 feet width of doors in the head shall be used.

6.4 Door Shutters

The shutters will be fixed to the frames with approved quality fittings as per hardware schedule.

6.5 Squareness Maximum diagonal difference 1/8" (between length of diagonal measured on face of door from upper right corner to lower left corner and length of diagonal measured from upper left corner to lower right corner).

Doors, shutters shall be fabricate in a workman like manner strictly to the correct sizes and shapes as shown on the Drawings or as directed by the Engineer.

Manufacturer's Qualifications:

The manufacturer of doors herein specified shall have been in business of manufacturing doors of type specified for minimum period of five years. The door shutters shall be built in sections, properly jointed and glued together.

The surfaces shall be prepared for painting or polishing. All door shutters shall be paneled, fabricated from first class deodar wood as shown on drawing . Fitting, Hanging and trimming All the doors shall be fitted, hung and trimmed as Here in after specified and as indicated on the Drawings.

Doors shall have a clearance of 1/8" at sides and top unless otherwise directed by the Engineer and shall have 3/16" clearance at bottom. Doors shall be hung and trimmed with hardware as specified. All the locks shall be installed at the same height and shall be located at height as directed by the Engineer. Where directed by the Engineer margin for carpet shall be incorporated in the door shutter.

6.6 Hardware

Hardware shall be of best quality local make extra heavy duty and first class finished material except door locks and door closures which shall be imported of Japanese origin as per attached hardware schedule. The Contractor shall obtain prior approval from the Engineer for quality, shape, pattern, and brand of all the hardware materials by providing samples and catalogues, etc., and shall provide and fix only the approved hardware materials.

Completed doors shall be sound, rigid and free from defects and warp. All edges shall be aligned and smooth, joints shall be close fitting, hard wood doweled or mortised framed and of a strength to maintain frame and of strength to maintain the structural properties of the member connected. All adjoining faces and edges shall be flush and smooth. Edges shall be rectangular and solid.

6.7 Quality Assurance

6.7.1 Tolerances: Doors shall be fabricated to following tolerances Size: Plus or minus 1/16 in overall dimensions Maximum Warp: 1/8"

6.8 Submittal

6.8.1 Provide manufacturer's literature completely describing products.

6.8.2 Provide shop drawings showing door types, details and locations, referred to the door type and hardware group shown on door and hardware schedules.

6.8.3 Provide certificates stating that doors were constructed with timber of the Species specified having moisture content and meeting equilibrium and relative humidity requirements.

6.8.4 Submit samples of plywood for selection of colour and grain.

6.8.5 Procurement of materials shall be made only after the shop drawings and samples have been approved by the Engineer.

6.9 Product Delivery, Storage and Handling

6.9.1 Deliver and store products in waterproof, protective containers with seals unbroken and labels intact until time to use.

6.9.2 Keep products dry, stack products off ground on level platforms, fully protected from weather, including direct sunlight.

6.9.3 Identify type, size and location of each door before delivery in order to permit. installation at correct location.

6.10 Installation

6.10.1 Install doors at correct openings and assure smooth swing and proper closer with frames.

6.10.2 Install finish hardware in accordance with manufacturer directions.

6.10.3 Hardware shall be carefully and securely fitted. Upon handing over the work, hardware shall be demonstrated to operate freely. Keys shall be placed into a respective locks and upon acceptance of the work keys shall be tagged and delivered to the Engineering work at site.

7. Wooden Railing

Material for wooden hand railing in stairs shall be superior quality teak wood/ deodar wood & 1/2 inch dia mild steel pipes. It shall be fabricated and installed in accordance with the design shown on the drawings/details and as per the instructions of the Engineer. Sample of railing shall be fabricated & mock up samples installed at locations designated by the Engineer for approval, prior to s

Shop/detail drawing indicating the basic details at various locations including details at turnings shall be submitted by the Contractor for Engineer's approval. Hand railing shall be installed to line level and plumb. The surface of railing in stairs shall be prepared for polishing. The railing shall be polished/painted with clear lacquer and the steel surfaces shall be painted with matt finished enamel paint.

8. SS & Glass Railing

Material for hand railing in stairs shall be 3" dia stainless steel pipe handrail, 1" dia stainless steel balustrades, W' thick unbreakable Security glass and clamps including all fixing accessories complete in all respect as shown on the drawings, It shall be fabricated and installed in accordance with the design shown on the drawings/details and as per the instructions of the Engineer. Sample of railing shall be fabricated & mock up samples installed at locations designated by the Engineer for approval, prior to starting work at site. Shop/detail drawing indicating the basic details at various locations inclu9ing details at turnings shall be submitted by the Contractor for Engineer's approval. Hand railing shall be installed to line level and plumb.

9. Defective Work

In the event of non-conformance to specification and drawings, the wood works shall be rejected by the Engineer and the Contractor shall remove and replace the rejected work by new work of same specifications.

10. Surface Preparation

The surfaces of all wood works shall be prepared in the (manner as directed by the Engineer for polishing or painting.

11. Mock-Up Sample

After approval of shop drawings and tests etc., the contract shall submit at his own cost one mock-up sample of each type of wood works complete with all fixing, fixtures accessories prior to the actual fabrication of the bulk.

The samples shall be returned to the Contractor for incorporation in the works after installation of at least 80% of the works.

12. Measurement & Payment

12.1 General

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective/items of the Bills of Quantities.

The rates quoted by the Contractor in the Bill of Quantities shall include work to be executed under these specification in any floor and at any height except where otherwise specifically stated in the relevant item of Bill of Quantities and the Contractor shall not be entitled to any claim or claim any compensation on this account.

12.1.1 Glazing where required and all finished hardware fittings in carpentry and joinery works, including locks, kick and push plate, architrave, beading, handles, locking arrangements etc.

12.1.2 Prime coat, painting with synthetic enamel paint/lacquer polish in carpentry and joinery works/hand railing.

12.1.3 Anti termite treatment to wood works and adhesives

12.1.4 SS / Steel balusters, steel base and steel strip for wooden railing.

12.1.5 Deodar wood blocking, shipping & base frame work in cabinets/hand railing.

12.1.6 SS Plate in the door bottom.

12.2 Wooden Door

12.1.1 Measurement

Measurement of acceptably completed works of all types of wooden doors will be made on the basis of net actual area in square feet fabricated and installed in position as shown on the Drawings or as directed by the Engineer. Net area will be

measured in accordance with plastered masonry opening in between jambs and plastered head and bottom of shutter.

12.1.2 Payment

Payment will be made for acceptable measured quantity of all types of wooden doors on the basis of unit rate per square feet quoted in the Bill of Quantities against respective item and shall constitute full compensation for all the works including all hardware & fittings like locks, tower bolts, push plates etc. as per details mentioned in Volume III & IV of Tender & Contract Document related to the item.

SECTION – 12 ALUMINIUM WORKS

1. Scope

The work covered under this section of the specifications consists of providing all material, labour, equipment, performing all operations required for providing and installation of aluminium. doors, windows, ventilators & louvers including all related items such as sealants, gasket, netting, rollers, hinges, latches, fastenings, anchor bolts, door locks, locking devices and glass complete in strict accordance with this section of specifications, the applicable drawings and as scheduled. Any additional information required in this connection and not stated in these specifications, shall be obtained from the Engineer's Representative.

2. Applicable Standards

Latest editions of following ISO and British Standards are relevant to these Specifications wherever applicable.

2.1 ISO (International Organization for Standardization)

1804	Doors Door	Terminology
6442	Leaves	Measurement of defects of general flatness
6443	Door	
	Leaves	Measurement of dimensions and defects of squareness.
6444	Door	
	Leaves	
6613	Windows & Doors	Test of behaviour under humidity variations (successive uniform climates) wind resistance tests. Air permeability test.

2.2 BSI (British Standard Institution)

1227 Hinges
4873 Aluminum alloy windows.

3. General

3.1 Door, Windows, ventilators, louvers and other items to be provided shall be aluminium, of profile pattern and design shown on drawings and shop drawings manufactured by reputable manufacturer approved by the Engineer. The contractor shall provide manufacture literature completely describing the product instructions for installation and maintenance.

3.2 All the sections used for doors, windows, ventilators & louvers fly screens shall be of best quality aluminium products such as equal and unequal angles, channels, tubes, corrugated strips, mouldings etc., in accordance with International standards conforming to ASTM B 308 & B 221.

3.3 All doors, windows. Ventilators and louvers shall be of type and size indicated on drawings and shall conform to the requirements shown and specified herein.

3.4 Contractor shall arrange tests and analysis if directed by the Engineer of scaled models of each door, window, ventilator and louvers type at the maker's works or any laboratory specified by the Engineer for the material supplied by him to be tested in the presence of the Engineer's Inspector, to whom test certificates, proof sheets, etc. shall be furnished. The models shall be submitted to the Engineer for approval prior to testing. Nevertheless, neither the fact that the materials have been tested in the presence of the inspector nor that the Engineer may have been furnished with test certificates in lieu of sending an inspector to the works shall affect the liberty of the Engineer to reject, after delivery of materials found not in accordance with these specifications.

3.5 The contractor shall submit shop drawings conforming to design concept which shall show full construction details, quantities and locations, fastenings, stiffening members and attachments to adjacent construction and materials. Shop drawings and calculations shall be submitted at the proper time to allow for checking, revisions, and agreement and to permit manufacturer's product delivery and start of site work to suit the building programme. The Contractor shall submit representative samples of finished doors, windows, anchoring mechanism, embedded parts, fastenings, glass panes, accessories and other materials for the Engineer's approval.

After approval of shop drawings and tests etc., the Contractor shall submit at his own cost one mock-up sample of each type of aluminium works complete with glazing, all components assembly method and required fittings and accessories prior to the actual fabrication of the bulk. The samples shall be returned to the Contractor for incorporation in the works after installation of at least 80% of the works.

Fabricate and assemble all work in the shop of the approved manufacturer to reduce field fabrication to a minimum unless otherwise directed by the Engineer.

The glass shall conform to specification laid down under chapter 'Glazing' and shall free from all blemishes, bubbles, distortions and other flaws of any kind and shall be properly cut to size as shown on drawings, so as to fit the grooves in window members.

3.6 The structural shape of the Aluminium members shall be of uniform quality, colour temper, clean, round, commercially straight and free from injurious defects.

3.7 All doors, windows, ventilators and louvers shall be fabricated as a complete unit, fully airtight and watertight, including rubber gasket for glazing, hinges, stays, rollers, latch, locking arrangement, handles, etc anodized in specified colour, inclusive of glass sheet, necessary holes for fixing, door locks, door closures and window locking requirements, all as approved by the engineer.

Contractor shall, provide certificate signed by the manufacturer stating that each lot has been sampled, tested and respected and has met the requirements in accordance with these specifications and the same shall be furnished to the Engineer.

3.8 The shop drawings shall clearly show that there shall be no penetration of rainwater from the exterior to the interior in case of severe wind and rainstorm. This has to be specially ensured in bill section.

4. Material

4.1 Frames/shutters

The frames of aluminium door, windows and ventilator shall be formed from rolled, strip or extruded aluminium. The thickness of sectional members shall be at least 1.6 mm. All outer / frame sections of open able / fixed windows. Ventilators and louvers curtain wall shall be 95 mm minimum in width. The Frames for doors and door/windows curtain wall shall be at least 97 mm in width.

4.2 As shown on the drawings, aluminium frames shall be provided as per international standard approved by the Consultant.

4.3 Fasteners shall be stainless steel of a type selected to prevent galvanic action with the components fastened.

4.4 Gaskets shall be vinyl glazing channel gasket to commercial standard CS-230-60.

4.5 Hardware shall be manufacturer's standard hardware. Flush to match doors, windows, ventilators and louvers finish. Floor mounted concealed type double action/swing imported door closures shall be provided to all doors. Heavy duty in-matching finish stays shall be provided to all open able windows, ventilators and louvers. Stays shall be attached to the window frame so as could be replaced easily.

4.6 Joint sealant shall be approved elastomer.

4.7 All Aluminium sections shall be powder coated in accordance with the standards of Aluminium Association of USA. The anodisation shall be of not less than 70-90 microns. The anodic oxide surface shall be properly sealed.

4.8 For powder coated finish aluminium sections to be coated shall be mill finish. The sections shall be firstly degreased with a degreasing chemical to remove all/any stains. The sections will then be given a chromating coating and electro static powder coating in the desired colour with a powder-coating machine. After colour coating the sections will be baked at baking temperature of 220 degree Centigrade for 25 minutes.

4.9 All sliding/open able windows shall be sliding/open able wire/fly screen shutters in window matching finish with wire/fly screen of size so as not to permit the entry of flies and mosquitoes. The wire mesh shall be 30 SWG. 14 mesh (14 x 14 openings per square inch).

5. Design Requirement

The Contractor shall design the installation to meet or excel the following requirements,

5.1 Tolerances

The Contractor shall be responsible for agreeing to all dimensions with the Engineer before proceeding with the manufacture and for making provision to allow for building tolerances required by the Engineer. Contractor shall also take site measurements of the structure completed before manufacturing.

5.2 Thermal & Seismic Movements

The window and glazing assemblies are to be constructed and installed in the openings with sufficient tolerance and, where necessary, to provide for Joints incorporated in couplings, to provide for pansion and 'contraction as will be caused by the local seismic and climatic conditions and temperature changes, winter to summer - day to night without buckling, distortion of joints, or other harmful effects.

6. Workmanship

The Contractor shall be responsible for the protection and installation of all items furnished. All items shall be installed plumb and square and shall be solidly anchored in a good workman like manner in accordance with the manufacturer's instruction and as specified herein. The Contractor shall be responsible for the protection of installed items from damage by other trades. All items shall be left in operating, neat and clean condition, free from dirt, finger marks, etc. The Contractor shall be responsible for final cleaning before the final acceptance.

The glass panes shall firmly be secured in the rebates with the rubber gasket. Ensure that the beads and grooves are clean, dry and unobstructed at the time of glazing. The complete unit shall be airtight and watertight on completion. No doors, windows and ventilator shall be considered complete until and unless the fingerprints and other stains and marks have been removed from the surface of glass and aluminium.

7. Product Delivery and Storage

7.1 Deliver doors, windows, ventilator and louvers in a manner preventing damage to units,

7.2 Applicable Standards

Latest editions of following British Standards are relevant to these Specifications wherever applicable.

Store materials off the ground under cover in a manner preventing deterioration or All embedded parts and anchor bolts shall be delivered to the site carefully and keeping the fabricated shape and configuration. All these parts shall be suitably marked for identification.

SECTION – 13 GLAZING

1. Scope

The work under this section of the Specifications consists of furnishing all labour, equipment, tools, appliances, scaffolding and providing in any floor and at any height glass, gaskets, sealants, compound and other materials required for performing all operations in connection with' the installation and setting of all types of glass and glazing complete in every respect in accordance with the Drawings or as directed by the Engineer. The scope of this section of Specifications is covered with detailed Specifications as laid down herein.

2. Applicable Standards

Latest addition of following British Standards are relevant to these specifications where ever applicable:

2.1 BSI (British Standards Institution)

952	Glass for glazing
5051	Security glazing part I & II
CP.152	Glazing

3. General

3.1 Each type of glass shall have the manufacturer's label on each pane, and the labels shall remain on the glass until final cleaning.

3.2 Glazing sealant shall be as recommended by the manufacturer for the particular application.

3.3 Spacer shims distance (pieces) shall be plasticized polyvinyl chloride (PVC). Thickness shall be equal to space shown on drawings between glass and rebates bead or cleat. Depth shall give not less than 1/4" cover of glazing sealant.

3.4 Contractor shall submit samples for each type of glass, minimum 4' x 4' in size with protective edges. Samples of glazing sealant minimum 0.1 liter of specified types shall be submitted.

3.5 Contractor shall submit 1 feet long sample c; each type of glazing gasket.

3.6 Contractor shall also submit printed materials manufacturer's installation instructions for specified glazing gaskets, compounds sealants and accessories including description of required equipment and procedures and precautions to be observed.

4. Delivery Storage and Handling

4.1 Contractor shall deliver materials in manufacturer's original, unopened containers clearly labeled with manufacturer's name and address, material, brand, type, class and rating as applicable.

Contractor shall store the materials in original unopened containers with labels intact/protected from ground contact and from elements which may damage glass.

Contractor shall handle the materials in a manner to prevent breakage of glass and damage to surfaces.

Examine each piece of glass and discard and replace glass with edge damage or face imperfection. All glazing shall be wind tight and fully water tight on completion.

Clean glazing channels and other framing members indicated to receive glass. Remove coatings which are not firmly bonded to the substrate, Remove lacquer from metal surfaces wherever elastomeric sealants are to be used. Apply primer and sealer to joint surfaces wherever recommended by the sealant manufacturer and as shown on the drawings.

Trim and clean excess glazing materials from surrounding surfaces immediately after installation and eliminate stains and discolorations.

Cure glazing sealants and compounds in compliance with manufacturer's instructions to obtain high early bond strength internal cohesive strength and surface durability.

While glazing operation is in progress great care shall be taken to avoid breakage or damage to the glass and adjoining glazing. The Contractor shall make good at his own cost, all glass broken by his workmen while cleaning or carrying out other operations. On the completion of the glazing work, all glass that has been set by the Contractor shall, if it becomes loose, within the maintenance period, be refixed at Contractor's expense.

No glazing shall be considered complete until and unless paint and other stains have been removed from the surface of the glass ad checked by the Engineer for water tightness.

5. Protection and Cleaning of Glazing

5.1 Remove all smears labels and excess glazing sealant, leave clean inside and outside free from scratches. The Contractor shall be responsible for the protection of installed glass. Before final acceptance, damaged or broken glass shall be removed and replaced with the new glass at no additional expense to the Employer and replaced with new glass at no additional aged or broken glass shall be removed.

5.2 All glass surfaces shall be washed clean both inside and outside within two weeks prior to final acceptance by the Consultant.

6. Measurement snd Payment

No payment shall be made for the works involved within the scope of this section specifications unless otherwise specifically stated in the Bill of Quantities or herein. The cost there of shall be deemed to be included in the quoted unit rate of the relevant item of the Bill of Quantities.

SECTION – 14 BITUMEN COATING

1. Scope

The work under this section of the Specifications consists of furnishing all plant, labor, equipment, appliances and materials and in performing all operations related to water proof treatment to foundations and basement structures complete in strict accordance with this section· of the specifications and the applicable drawings and subject to the terms and conditions of the Contract.

2. Submittal

2.1 Samples of all materials proposed for use under this section. shall be submitted to the Engineer for approval.

3. Materials

3.1 Bitumen 10/20 grade.

4. Delivery Storage and Handling

Materials shall be protected from damage during loading shipment delivery and storage Non staining materials shall be used for blocking and packing

5. Preparatory Work

5.1 All surfaces to be treated shall be dust free and dry. Application of finishes shall not start unless the preparatory work has been inspected and approved by' the Engineer.

6. Bitumen Coating/Painting In Foundation Sub-Structures, Under Floors

a) Bitumen Painting:

All surfaces to be bitumen painted shall be thoroughly cleaned of any accretion, dust, dirt etc. by scraping, wire brushing or as directed by the Engineer. The surface shall be primed with a coat or asphalt oil used at the rate of not less than 1.08 gallon /10 square meter. Two coats of hot bitumen paint shall be applied at the rate of 1.0 kg/ Sq.m. each coat. The first coat shall be allowed to dry for about 6 hours before applying the second coat. During operation of painting great care shall be taken to avoid air bubbles. The manufacturers shall be taken to avoid air bubbles. The manufacturer's instructions and Engineer's directions shall be followed.

7. Measurement and Payment

7.1 General

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bills of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bills of Quantities.

7.1.1 All preparatory work, scrapping, scratching, cleaning, cant strips, gravel strips, etc.

7.1.2 Coats of bitumen.

7.2 Bitumen Painting/Coating

7.2.1 Measurement

Measurement of acceptably completed works of bitumen painting/coating will be made on the basis of net actual area in square foot as shown on the Drawings or as directed by the Engineer.

7.2.2 Payment

Payment will be made for acceptable measured quantity of bitumen painting/coating on the basis of unit rate per square foot quoted in the Bills of Quantities. The unit rate shall include all cost of surface preparation and shall constitute full compensation for all the works related to the item.

SECTION – 15 CEMENT PLASTER

1. Scope

The work under this section of the Specifications consists of furnishing all plant, labour, equipment, appliances, and materials and in performing all operations in any floor and at any height connection with providing and installation of cement plaster, and specified external rendering complete in strict accordance with this section of the Specifications and the applicable drawings and subject to the terms and conditions of the contract.

2. General

2.1 Except as may be otherwise shown on surfaces specified, all plaster work, both internal and external shall be ordinary Portland Cement plaster of the required thickness as shown on the drawings.

2.2 Plastering shall not commence until all electric conduits, drainage and sanitary pipes, inlets to tanks, brackets, clamps, doors and window frames and all sort$ of inserts and embedded items are fixed in position. It shall be the responsibility of the Contractor to make sure that all such work is carried out by other contractors before starting of plaster work. Chiseling and repairing of cement plaster shall not be permitted without the approval of the Engineer.

2.3 Sample of materials shall be submitted to the Engineer for his approval prior to use in the works.

3. Material

3.1 Cement for plaster shall be Ordinary Portland Cement (B.S 12 or P.S 232) or Sulphate resisting cement (B.S 4027 or P.S. 612) as specified ’and shall conform to requirements specified in the section "Plain and Reinforced Concrete".

3.2 Sand for plaster shall coy with the requirements of BS 1199, BS 1200 or the draft Pakistan Standard "Sand for Plaster" as directed by the Engineer.

3.3 Water for plaster shall conform to requirements specified in the section for "plain and reinforced concrete".

3.4 All materials and workmanship for plaster, not explained in these Specifications, Shall comply with the requirements of relevant BS CP 211 and CP 221 as directed by the Engineer.

4. Proportioning and Mixing

4.1 Measurement of materials by volume shall be by containers of known capacity to maintain consistent proportions. No lumpy or caked material shall be used. Mixing equipment boxes and tools shall be clean. Materials shall be proportioned as specified on the Drawings, in the Bill of Quantities or as directed by the Engineer. Mixing shall be continuous until all ingredients are evenly distributed and thoroughly mixed.

4.2 Only limited water shall be added for proper workability and such quantity of ortar shall be prepared which can be consumed in thirty minutes after preparation. Preparation of mortar in bulk quantity for use

during the entire day or for any other time more than that stipulated above is expressly prohibited. Retempering shall not be permitted and all mortar which has begun to stiffen shall be discarded.

4.3 Plaster ingredients shall be thoroughly mixed either by hand on a clean cement concrete platform or by a mechanical mixer, as directed by the Engineer.

5. Preparation of Surface to be Plastered

5.1 Concrete surface to be plastered shall be cleaned to remove all grease, form oil and other surface impurities, which will otherwise adversely affect the adhesion of plaster to the surface concerned. The surface of all-concrete ceilings, beams and columns shall be lightly hacked by approved means to give the required key for plastering.

5.2 All masonry surfaces to be plastered shall be cleaned to remove all matter, which will otherwise adversely affect the adhesion of plaster to the surface concerned. The surface shall be washed with clean water and kept damp for 24 hours before further treatment. The surface thus prepared shall be treated uniformly with cement and sand slurry. The slurry to be used shall be one part cement to one part sand by volume with water added to make a stiff creamy mix. The slurry shall be applied with a stiff brush on surface, which has previously been well wetted. The surface so treated shall be left to cure for 3 days.

6. Application of Plaster

6.1 The plaster of thickness less than the specified thickness shall be rejected. If the plaster is to be more than 1/2" thick, it shall be done in two coats. The surface of first coat shall be made rough before the second coat is applied. The plaster shall not have wavy surface and shall be perfectly in plumb. The edges and corners shall represent a straight line. The plaster shall be kept wet continuously for at least ten (10) days. No extra payment shall be allowed for jambs, junctions, corners, edges, round surfaces or for more than one layer of plaster required due to any unevenness in the work done by the Contractor. The plasterwork is to cover all conduits, pipes etc fixed in the walls and ceiling. Wherever specified, metal lath shall be nailed firmly before plastering is commenced. The plaster surface shall be tested frequently with a 10 feet straight edge and plumb bob.

6.2 Plaster containing cracks, blisters, pits, dis coloration or any, defects shall not be acceptable. Any such plaster or loose plaster shall be removed & replaced with plaster in conformity with these specifications and as additionally directed by the Engineer. Contractor shall cut out and patch all defective work at his own cost. All damaged plaster shall be patched as directed by the Engineer. Patching plaster shall match appearance of and shall be finished level with adjoining plaster.

7. Metal Lath

Metal lathing shall be fabricated from sheet steel and shall be of uniform quality and free from flaws broken strands, cracks and corrosive pitting, shall be rectangular and true to shape and shall comply with BS-1369.

All lathing shall be galvanized. Where plastering material depends entirely on the lathing for its key, these shall be not less than two complete mesh openings per 1-1/8"in one direction and the width of the aperture shall not be less than 3/16".

Sheets shall not be less than 1.6 kg/sq.m when fabricated, using 0.7 mm thick steel sheet. Where used on smooth surfaces to form a key it sh~11 be not less than 1.2 kg/sq.mm when fabricated, using 0.5 mm thick steel sheet. Tying wire shall be 1.2 mm diameter galvanized annealed iron wire.

Sheets shall be welded to angle iron frame as shown on drawings. 8.

8. Angle and Beads

Angle beads, stop beads, depth gauge beads, edging profiles, plaster dividing profiles, interior angle profiles, plaster borders and the like shall all be manufactured from sheet steel and galvanized after fabrication, all beads shall be perforated at edges to ensure good adhesion of the plaster work. Thickness and dimensions shall suit particular locations and plaster thickness.

All angle beads, stop beads, depth gauge beads and the like are to be ffixed in accordance with the manufacturer's instructions, at all corners, stops, joints, etc. as per directions of Engineer In charge.

9. Internal / External Plaster

9.1 Where specified in the Drawings external surface shall have an average 20mm thick. plaster finish, consisting of a base coat of 1:4 cement sand mortar in Grey cement and the finish coat of smooth plaster as shown on the Drawings and as directed by the Engineer.

9.2 Where specified in the Drawings all internal plaster shall have an average 12mm thick consisting of base coat of 1 :3l1:4 cement sand mortar in grey cement and finish coat of smooth plaster as shown on the Drawings and as directed by the Engineer.

9.3 Stucco Plaster

Wherever specified in the drawings external stucco plaster shall consist 'of 1 :2, one part white cement & 2 parts approved shade of marble chips zero size mixed with approved pigment to achieve desired shade. Wherever shown on drawings, groves shall be provided with aluminum U/Y channels. The contractor shall prepare mockup samples of stucco plaster for the approval of Engineer. The plaster shall be applied with machines and the final rough surface/texture/shade shall be as per the approved sample, direction and approval of the Engineer-In charge.

10. Cleaning and Protection

10.1 Rubbish and debris shall be removed as necessary to make way for work of other trades and as directed by the Engineer. As each room or space is completed all rubbish, debris, scaffolding and tools should be removed to leave the room clean.

10.2 Prior to plastering all aluminum windows, finished metals should be covered by sheet of plastic or tarpaulin to protect it from damage.

10.3 Protect finished plaster from injury by any source. Contractor shall also protect walls, floors and work of other trades from Plastic materials.

11. Tolerances

Surfaces of plaster work shall be finished with a true plane to correct line and level with all angle and corners to a right angle unless otherwise specified and with walls and reveals plumb and square.

Maximum permitted tolerances shall not exceed 1/8" in 6 feet variation from plumb or level in any exposed line or surface and 1/16" variation between planes of abutting edges or ends.

12. Measurement and Payment

12.1 General

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective item of the Bill of Quantities.

The rates quoted by the Contractor in the Bill of Quantities shall include work to be executed under these specification in any floor and at any height.otherwise specifically stated in the relevant item of Bill of Quantities and the Contractor shall not be entitled to any claim or claim any compensation on this account.

12.1.1 Metal lath over reinforced concrete and masonry joint.

12.1.2 Joints, junctions, corners, beads, drip course edge, roundings, and aluminum UN channels in groves. Etc.

12.1.3 More than one layer due to any unevenness in the finished works and base coat plaster in stucco plaster including marble chips/colour pigments.

12.1.4 Cutting & patching of all defective works.

12.1.5 Surface preparation, cleaning and protection as specified.

12.1.6 Marble chips & pigments in stucco plaster.

12.1.7 Roughning of first coat of plaster before application of 2nd coat incase where overall required plaster thickness exceeds 1/2 inch.

12.2 Plain Plaster/Stucco plaster Measurement

Deductions shall not be made for ends of joints, beam posts, etc., and openings not exceeding 5 square feet each and no addition shall be made for reveals, jambs, soffits, sills, etc. of these openings non for finishing the plaster around ends of joints, beams posts, etc.

In case of opening of area exceeding 5 square, feet each, deduction shall be made for the openings and also no addition shall be made for reveals jambs, soffits, sills, etc., of these openings.

Measurement of acceptably completed works of plaster will be made on the basis of number of square feet of the surface area plaster as shown on the Drawings, or as directed by the Engineer.

12.3 **Payment**

Payment will be made for acceptable measured quantity of plaster on the basis of unit rate per square feet quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the item.

SECTION – 16 MARBLE

1. Scope

The work under this section of specifications, consists of providing all material, labour, plant, equipment, appliances in any floor and at any height and performing all operations required for providing and installing marble natural stone slab for toilet counters, where shown on the drawings, complete in strict accordance with this section of the specification and the applicable Drawings.

2. Submittals

The Contractor shall submit manufacturer's specifications and other product data for each type of marble stone and fixtures required, including instructions for handling, storage, installation and protection.

Shop Drawings shall be submitted showing sizes, dimensions, sections and profiles of slab, arrangement and provisions for jointing, anchoring, fastening and supports and other necessary fixing details. Indicate locations, layouts and pattern arrangements for each stone type and colour.

Submit three ranges samples 300mm x 300mm in size of each type of stone showing colour, grade, finishing and texture for approval of the Engineer.

3. Delivery, Storage and Handling

Materials shall be protected from damage during loading, shipment, delivery and storage. Non staining materials for blocking and packing shall be used. Stack marble at site in accordance with manufacturer's recommendations and as required to prevent staining,. scratching, etching or breakage.

4. Materials

4.1 General

Marble shall be compact, dense, metamorphic rock of lime stone origin obtained from quarries within Pakistan. It shall have a specific gravity of 2.7 and hardness number on Moh's scale shall range from 3 to 4.

Obtain each marble stone type from a single quarry and ensure consistent colour range and texture throughout the work. All pieces shall be of uniform thickness and truly square in shape.

Provide marble slabs/sills and tiles of specified sizes in floors, stair tread & risers and counter tops as shown on drawings.

Provide marble slabs/ sills and tiles of type, colour and finish for each area as directed by the Consultant/Engineer.

Provide stone of specified thickness. Saw cut the back surfaces that are meant to be concealed in finished work.

Provide irregular shaped units, staircase units and skirting base units to the profiles of required shapes & sizes and polished exposed surfaces wherever specified.

4.2 Marble Stone Type

All marble stone types are to be selected and approved by the Engineer for quality, colour and texture.

Marble: Marble of approved type and colour of local origin, first class quality and high class finish acceptable to the Engineer.

4.3 Beds and Backings

Where applicable, standard cementious screed and mortar beds and backings, mixed and proportioned by volume shall be as follows: -

Grey ordinary Portland	: 1 part
Cement Sand Water	: 3 parts
	: Clean, fresh and free from deleterious substances

4.4 Adhesives, Grouts and Sealants

Proprietary adhesives, joint grouts and sealants of approved type as required and recommended by the manufacturer for specific application shall be used. The colour of the joint grout and the sealants shall match with the colour of stone.

5. Execution

5.1 Flooring, Skirting/dado and Stair

Apply cement slurry coat over surfaces of concrete substrate immediately prior to placing setting bed. Limit area of application to avoid premature drying out. Install setting bed of required thickness and set stone units before initial set occurs. Apply a thin layer of cement paste to bottom of each unit. Set tamps and level units immediately. Set units in required pattern with uniform joint widths.

Point joints as soon as possible after initial set. Force grout into joints, strike flush and tool slightly concave.

Remove mortar and grout from surfaces well still moist and as the work progresses.

Do not permit traffic on finished surface during setting and for a minimum of 24 hours after final pointing of joints.

5.2 Marble Toilet Counters

Marble toilet counter tops of the specified size shall be installed in areas shown on Drawings with M.s. angle framing and fixing accessories in accordance with approved shop drawing. Joints shall be cement grouted with matching colour or with matching colour sealant.

5.3 Repair and Cleaning

Remove and replace stone units which are broken, chipped, stained or otherwise damaged. Where directed, remove and replace units which do not match adjoining stonework or are not in line and level as shown on Drawings. Provide new matching units, install and point joints to

eliminate evidence of replacement. Repoint defective and unsatisfactory joints to provide neat, uniform appearance.

6. Product Delivery, Storage and Handling

6.1 Material shall be delivered in original; unopened, protective packaging, with manufacturer's labels indicating brand name, pattern, size, thickness and fire rating.

6.2 Material shall be stored in original protective packaging to prevent soiling, physical damage or wetting.

6.3 Cartons shall be stored in the installation area, opened at each end to stabilize moisture content and temperature, for 48 hours prior to installation.

7. Job Site Conditions

7.1 Work which will be concealed by false ceilings shall be completed, tested, inspected and accepted before ceiling work is started.

7.2 False ceiling installation shall not begin until the area has been closed in, and temperature and humidity approximate occupancy conditions. Wet work shall be cured and dry before ceiling work is started.

7.3 Surface which will support the ceilings, and those to which the ceiling abut, shall be inspected and accepted for completeness and adequacy to receive the ceilings before the work begins.

8. Installation and Workmanship

False ceiling suspension system and panels shall be installed in accordance with the requirements of BSI-CP.290 and with the manufacturer's recommendations as approved by the Engineer.

8.1 Suspension System

The hangers as specified shall be evenly disposed as per drawings, details and place and position as indicated. The suspension system should be installed by . making holes direction in the roof and shall be made good as directed by the Engineer. Their lengths clear of roofing slab shall be as per shop drawing details.

The framing of the specified section and run at spacing as per shop drawings. The jointing of runners to hangers shall be as per approved shop drawing details. The extra framing if required shall be provided for light receptacles as per approved shop drawing details.

Wall hangers shall be positively and rigidly connected to the structure and to cross runners.

8.2 False Ceiling tiles.

Tiles shall be installed in the grid system after completion of installation of the suspension of lighting and air conditioning fixtures.

Forming ceiling panels shall be laid out in pattern including border of uniform width around all sides of each ceiling area. The pattern shall be as per shop drawings approved by the Engineer.

All panels shall be furnished and installed in an approved manner and as per approved types, sizes and surface design.

9. Fixtures

Light fixtures shall be installed as per approved pattern and supported in accordance with manufacturer's recommendations.

10. Finishing

After installation, dirty, soiled or discoloured surfaces shall be cleaned and left free from defects and ready to receive any painted finish if required.

The panels which are damaged or improperly installed shall be removed and replaced' by the Contractor at his cost.

11. Measurement and Payment

11.1 General

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

The rates quoted by the Contractor in the Bill of Quantities shall include work to be executed under these specification in any floor and at any height except where otherwise specifically stated in the relevant item of Bill of Quantities and the Contractor shall not be entitled to any claim or claim any compensation on this account.

Aluminum approved suspension system including main channels, main tee/cross tee bars, wall moulding and edge trims, hanger strips and accessories hold down clips, Aluminum tiles / strips etc. complete for aluminum tile / strips ceiling.

11.2 False Ceiling

11.2.1 Measurement

Measurement of acceptably completed works of respective types of false ceiling will be made on the basis of net actual area in square feet of false ceiling provided and installed in position as shown on the Drawings or as directed by the Consultant/Engineer.

11.2.2 Payment

Payment will be made for acceptable measured quantity of respective type of false ceiling on the basis of unit rate per square feet quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the item.

SECTION – 18 FLOOR AND WALL FINISHES

1. Scope

The work under this section of the Specification consists of furnishing all plant. labour, equipment, appliances and materials and performing all operations in any floor and at any height in connection with the installation of cement concrete floors and floor finishes including bases, skirting and external surface treatments, complete in strict accordance with this section of the specifications and the applicable drawings and subject to the terms and conditions of the Contract.

2. Aterial

2.1 Cement

Cement shall be ordinary Portland cement conforming to B.S. 12 or PS 232.

2.2 Sand

All fine sand shall be obtained from sources approved by the Engineer. The grading shall conform to B.S 882 Grading Zone 1 and 2 of which the gradation limits are as follows:

Percentage (by weight) passing

B.S. Sieve	Grading Zone 1	Grading Zone 2
3/8" (9.53 mm)	100	100
3/16" (4.765 mm)	90-100	90-100
No. 7	60-95	75-100
No. 14	30-70	55-90
No. 25	15-34	35-59
No. 52	5-20	0-10
No. 100	0-10	

2.3 Coarse Aggregate

Coarse aggregate shall be crushed or uncrushed gravel or crushed stone, angular or rounded in shape and shall have granular, crystalline or smooth surface free from friable, flaky and laminated pieces, mica and shale. It shall not contain matters injurious to concrete. All coarse aggregate shall conform to BSS NO.882 and shall be graded as follows:

B.S. Sieve	% Passing by weight
1" (25.40 mm)	100
3/4" (19.05 mm)	90-100
3/8" (9.53 mm)	20-55
3/16"(4.765 mm)	0-10

The aggregate shall be stored on properly constructed paving or as directed by the Engineer.

There shall be a physical partition between the stockpiles of coarse and fine aggregate. If required aggregates shall be washed and screened to the satisfaction of the Engineer. Sieve analysis of all the aggregates to be used in the works shall be carried out as and when required by the Engineer. All aggregate shall be subject to the approval of the Engineer.

Any aggregates not found to be of the specified/approved standard shall be rejected by the Engineer and all such rejected material shall be removed from site with-out delay.

Floors, sub-base or base constructed with rejected aggregates shall be dismantled and rebuilt at the expense of the Contractor.

2.4 Stone Ballast

Stone ballast to be used as soling shall comprise of strong, hard, durable stone of approved size. The stone shall be obtained from approved quarry and shall be sound, free from laminations and weak cleavages and shall conform to specifications of "Stone Soling".

2.5 Water

Water used for mixing concrete, curing or any other operation of the works specified herein shall be fresh, clean and free from organic or inorganic matters in solutions or in suspension. Only water of the approved quality shall be used for all constructional purposes:

2.6 Ceramic/Porcelain tiles

Ceramic tiles shall be imported, premium quality, plain white/ coloured or printed. Porcelain tiles shall be imported Italian or Spanish or Granitto. The tiles shall be of sizes as specified on the drawings and shall conform. to BS 1281 as per samples.

2.7 Cleaning Compound

The compound used for all cleaning of terrazzo shall be an approved neutral chemical cleaner free from acid and alkali or any other material that will affect the colour or otherwise damage the terrazzo and shall not affect the conductivity of terrazzo floors.

2.8 PVC Vinyl Tiles

PVC vinyl tiles shall be imported best quality of size 300mm X 300mm Colour and shade shall be as per sample to be submitted by the Contractor and approved by the Engineer.

2.9 Division Strips

Division strips shall be of marble as approved by the Engineer. Standard division strips for floor finishes shall be not less than 5mm (3/16") in thickness and shall not be less than 1-3/4" in depth.

2.10 Marble Chips

Marble chips shall have an abrasive hardness of not less than 16, as determined by the test of wear resistance in National Bureau of Standards Reports MBS 98. Size shall vary from No. zero to 8.

2.11 Preservative Material

Preservative treatment for terrazzo floor shall produce a water-proof finish which will not be impaired by immersion in water at room temperature for a period of 2-1/2 hours, approximately 18 hours after the floor is finished by buffing, as specified. The preservative material shall not discolour the terrazzo nor leave a tacky or sticky finished film on the surface after buffing.

3. Cement Concrete Flooring

The materials for C.C flooring shall be same as already specified under clause 3, "Materials".

3.1 Composition of Concrete

Concrete shall be composed of Portland Cement, sand, coarse, aggregate and water, all well mixed and brought to the proper consistency. The Contractor shall mix the ingredients as indicated on the Drawings. The proportions of the various ingredients shall be determined from time to time during the progress of the work and tests shall be made of samples of the aggregates and the resulting concrete. The mix proportions and appropriate water-cement ratio will be determined on the basis of the production of concrete having required workability, density, impermeability, durability and required strength.

3.2 Mixing Concrete

The concrete ingredients shall be mixed in a batch mixer for not less than 1-1/2 minutes after all ingredients, except the full amount of water, are in the mixer. The Engineer reserves the right to increase the mixing time when the charging and mixing operations fail to produce a concrete batch in which the ingredients are uniformly distributed and the consistency is not uniform. The concrete shall be uniform in composition and consistency from batch to batch except when changes in composition or consistency are required. Water shall be added prior to, during and following the mixer charge. Excessive over-mixing requiring addition of water to preserve the required concrete consistency will not be permitted. The concrete ingredients shall be mixed by volumetric measurement in purpose made boxes approved by the Engineer.

3.3 Construction

The base course of the floor shall comprise of stone ballast of 2 inches (approx: 50 mm) mesh size. The base course shall be thoroughly compacted by suitable power rammers to the total consolidated

thickness as shown on the Drawings and as approved by the Engineer. The interstices shall be filled with smaller size stones. The base course shall be blinded with sand and the whole surface watered. Over the well compacted base course, a layer of concrete of the required grade and thickness shall be laid, in panels of the sizes as indicated on the Drawing and as approved by the Engineer.

After the C.C bed has been cured, as directed by the Consultant/Engineer, it shall be roughened and well watered before floor finishing is laid. The floor finish shall comprise of cement concrete of required grade and shall be laid in panels to the required thickness as shown on the Drawings or as directed by the Engineer. The concrete after laying will be thoroughly rammed and mortar worked up to the top and smoothed with a steel trowel. The edge of each section into which the floor is divided should be defined by wooden screeds of the approved width and of a depth equal to the depth of the floor concrete.

Freshly placed concrete floor and completed floor portions as finished shall be protected to prevent loss of water by covering with damp hessian, water proof paper, damp sand or other approved material, and shall be kept constantly damp for a period of four days or longer after concreting as directed by the Consultant/Engineer. The concrete shall be allowed to dry out slowly over a period of three days after wet curing is completed.

The expansion joints shall be filled in with hot bitumen, of the approved grade, as directed by the engineer.

4. Terrazzo Flooring

4.1 Mix

The terrazzo mixes shall be composed by weight as follows:

Plain terrazzo for all floors and bases indicated as terrazzo and not otherwise specified, shall be composed of one part cement, white or grey, and 2 parts of marble chips of the sizes and colours hereinafter specified.

4.2 Preparation for Terrazzo

The grade and thickness of concrete as shown on the Drawings shall be laid as under bed to receive terrazzo. The surface of the bed shall be roughened for bounding with the terrazzo finish. If the surface is too smooth it shall be roughened with a toothed chisel and, prior to laying the terrazzo the bed shall be cleaned of all dirt, oil grease and extra loose material.

4.3 Division Strips

Terrazzo floors and bases shall be divided up by marble strips of specified thickness and depth. The division strips between field work and borders shall have exposed tops in full width of the strips. The division strips shall be set immediately after the spreading of the under bed, the strips being partially embedded therein, securely anchored to the subfloor and grouted solid.

All division strips shall be set, straight to lines and to the proper level to ensure that the tops of the strips will show uniformly after grinding and smoothening operations are completed and joints and intersections shall be fitted tight. Strips shall be braced to prevent bulging during the placing of terrazzo.

Unless otherwise shown on the drawings, the divisions in field work of large areas shall not exceed 4 feet x 4 feet and in small areas shall not exceed 2 feet x 2 feet.

Edging strips shall be placed at doorways between terrazzo and other types of flooring and along the edges of all terrazzo bases or borders and adjoining other types of floor finishes or floor covering. The edging strips at doorways shall be placed in line with the step face of doors. All edging strips shall be anchored and grouted solid in the under bed or to the concrete sub-floor and braced to prevent bulging as specified for division strip.

4.4 Laying Terrazzo

4.4.1 The sub-surface shall be swept clean, thoroughly moistened, but not saturated, and slushed with a coating of neat cement grout approximately 1/8" in thickness. The under bed consisting of class 'C' cement concrete screed shall be spread and brought to a level not less than 3/4" below the finished floor level. The dividing strips shall be installed in the green under bed. The terrazzo mix shall be spread, tamped and rolled into a compact mass not less than 3/4" thick. After rolling additional aggregate mix shall be sprinkled over the surface to fill up all depressions, to take up excess moisture and to permit the terrazzo to be trowelled to a level, dense and even surface, slightly above the finish line of floor. This level, shall allow for the surface grinding necessary to expose the specified area of aggregate, and to produce smooth, level floors free of waves and depressions.

4.4.2 Seasoning

The completed terrazzo shall be allowed to season for 6 days during which time it shall be kept moist by (1) covering with approximately 1" thickness of sand; or (2) covering with building paper or mats; or (3) sprinkling with water at every 10 hour interval.

4.4.3 Surface

Following the curing period, the terrazzo shall be machine ground to a true, even surface using a No. 24 grit followed by a No. 80 grit or finer abrasive stone. After the first grinding, the floors shall be thoroughly grouted with the same cement and colour composition as specified for the matrix of the terrazzo mix. The grout shall be of the consistency of thick cream, and shall be brushed over the floor to eliminate all pits and thoroughly fill the surface for final grinding.

4.4.4 Finishing

Not less than 72 hours after application, the grouting coat shall be removed by grinding. In the later stages of grinding, the grit stones or other abrasive used in the grinding machine shall be of a grain or fineness that will give the surface smooth finish. Small areas, inaccessible portions and corners which cannot be reached by the grinding machine shall be ground and rubbed by hand.

4.4.5 Protection

The walls and all surfaces of the finished work of other trades shall be properly protected from damage and spoiling during the process of grinding and washing of the terrazzo. After the finish grinding has been completed and the surface treatment applied, the terrazzo work shall be covered and protected with material approved by the Engineer until completion of the work of all other trades.

4.4.6 Cleaning and Coating

Prior to placing the protective covering, the terrazzo floor shall be approved by the Engineer. After the work of all other trades has been completed and the protective covering removed, all terrazzo work shall be washed with cleaning compound, mixed with warm water and using a fine abrasive where necessary to remove any stains or cement' smears. The terrazzo' shall be allowed to dry thoroughly and shall be given a sealing application of preservative material. The sealing material shall be applied in accordance with the manufacturer's directions, leaving all terrazzo work in clean condition as approved by the Engineer.

4.4.7 Dado/Skirting

The ingredients of dado/skirting shall be one part of cement and two parts of marble chips varying from Nos. zero to 2. Striking shall be laid over a base of plaster of specified thickness. The thickness of dado/skirting layer shall be as specified. The surface shall be grinded and polished to the satisfaction of the Engineer.

5. Installation of Tile Flooring

When setting out the tiles, care shall be taken to establish the correct elevation for the floor. A gauge rod shall be used, indicating the overall measurement of a given number of tiles with specified joint width to reduce cutting.

After the floor has been machine finished, it should be covered with white, non-staining sand or rags to protect it while other work is being done. After removal, the floor shall be thoroughly scrubbed.

5.1 General

The base shall be prepared by laying cement concrete of specified grade and of thickness as shown on the drawings, or specified in the Bill of Quantities.

The curing period of the setting bed shall be as directed by the Engineer. As large an area of setting bed shall be spread at one time as can be covered with tiles before the mortar has set. Surplus mortar shall be removed. The thickness of setting bed in any space shall not be less than 1/2".

Floor and wall surfaces to receive the tiles shall be thoroughly cleaned of all dirt, dust, oil and other objectionable matters. Tiles shall be laid out from the centre line of each space in an outward direction and the pattern should be made symmetrical with a minimum number of cut tiles as directed by the engineer.

Joints between the tiles shall be of uniform width. Tiles shall be cut with a suitable cutting tool and rough edges shall be rubbed smooth. Tiles shall be laid to the straight edges.

5.2 Ceramic/Porcelain Tiles

The ceramic/porcelain tiles shall be laid to the required lines, levels and grades over a setting bed of cement sand mortar comprising of one part of cement and 4 parts of sand by volume and the joints filled with neat white or grey cement including vertical and horizontal covers. The tile floor shall be kept wet for at least 72 hours and no traffic should be allowed on the tiles during curing period.

6. Measurement and Payment

6.1 General

Except otherwise specified herein or elsewhere in the Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities.

The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities.

6.1.1 Loss and wastage of material due to consolidation, erosion and settlement.

6.1.2 All type of joints (expansion, contraction and construction joint etc.).

6.1.3 Class 'C' cement concrete screed base and 1:4 cement sand mortar under floor.

6.1.4 Rough plaster base under skirting / dado.

6.1.5 Finishing/grinding, washing & polishing works of ceramic, concrete, terrazzo tile, terrazzo floors and marble tiles.

6.1.6 Marble strips in terrazzo floors

6.1.7 1 :2 and 1:4 cement sand rough cast plaster.

6.1.8 Sand cushion under concrete pavers

6.1.9 Adhesives used in the laying of PVC flooring.

6.1.10 Bedding / Jointing Material of Envicrete jali

6.1.11 Pigmented grouting

6.1.12 Cleaning of tiles after installation.

6.1.13 Bull-nozing, chamfering of edges of marble tops including base mortar and making holes for wash basin including all necessary fixing accessories.

6.2 Cement Concrete Floor

6.2.1 Measurement

Measurement of acceptably completed works of cement concrete floor steel trowelled finish will be made on the basis of net actual area in square feet laid in position as shown on the Drawings or as directed by the Engineer.

6.2.2 Payment

Payment will be made for acceptable measured quantity of cement concrete floor steel trowelled finish on the basis of unit rate per square feet quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item.

6.3 Ceramic/Porcelain Tile Floor

6.3.1 Measurement

Measurement of acceptably completed works of ceramic/porcelain tile in floor will be made on the basis of net actual area in square feet-of floor laid in position as shown on the drawing or as directed by the Engineer.

6.3.2 Payment

Payment will be made for acceptable measured quantity of ceramic/porcelain tile floor on the basis of unit rate per square feet quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item.

6.4 Ceramic/Porcelain Tile Dado/Skirting

6.4.1 Measurement

Measurement to acceptably completed works of ceramic/Porcelain tile in dado/skirting will" be made on. the basis of net actual area in square feet of dado/ skirting laid in position as shown on the Drawing or as directed by the Consultant/Engineer.

6.4.2 Payment

Payment will be made for acceptable measured quantity of ceramic/porcelain tile in dado/ skirting on the basis of unit rate per square feet quoted in the Bills of Quantities. The unit rate

shall include all cost of cement, sand, mortar and shall constitute full compensation for all the works related to the items.

6.5 Terrazzo Flooring/Skirting

6.5.1 Measurement

Measurement of acceptably completed works of terrazzo flooring/skirting will be made on the basis of net actual area in square feet laid in position as shown on the Drawings or as directed by the Engineer.

6.5.2 Payment

Payment will be made for acceptable measured quantity of terrazzo flooring/skirting on the basis of unit rate per square feet quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item.

6.6 PVC Vinyl Tile

6.6.1 Measurement

Measurement of acceptably completed works of PVC vinyl tile flooring will be made on the basis of net actual area in square feet laid in position as shown on the Drawings or as directed by the Engineer.

6.6.2 Payment

Payment will be made for acceptable measured quantity of PVC vinyl tile flooring on the basis of unit rate per square feet quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item.

SECTION – 19 PAINTING

1. Scope

The work under this section of the Specifications consists of furnishing all materials, plant, labour, equipment, appliances and performing all operations in any floor and at any height in connection with surface preparation, mixing, painting concrete works, gates, frames, walls, ceilings and all . such surfaces as shown on the Drawings and/or as directed by the Engineer. The scope of this section of specification is covered with detailed specifications as laid down herein.

2. Applicable Standards

Latest editions of following British Standards are relevant to these specifications wherever applicable.

2.1 BSI (British Standards Institution)

245 Specification for mineral solvents (white spirits and related hydrocarbon solvents) for paints and other purposes.

2521 Lead - based-priming paint for wood work .

2523 Lead based priming paint for iron and steel.

2569 Sprayed metal coatings.

4800 Paint colours for building purposes. Painting of building.CP2

3. Cleaning and preparation of metal surfaces

3.1 Except as otherwise specified, all painting shall be applied in conformity with BS CP 231 "Painting of Building" as applicable to the work.

3.2 The Contractor shall repair at his own 'expense all damaged" or defective areas of shop-painted metal and structural steel work. Metal surfaces against, which concrete is to be placed will be furnished shop-painted and shall be leaned prior to being embedded in concrete.

3.3 Except as otherwise specified all concrete and plastered surfaces are to be painted.

3.4 The Engineer will furnish a schedule of colours for each area and surface. All colours shall be mixed in accordance with the manufacturer's instructions.

3.5 Colours of priming coat (and body coat) where specified, shall be lighter than those of finish coat. The Engineer shall have unlimited choice of colours.

Samples of all colours, and finishes shall be prepared in advance of requirement so as not to delay work and shall be submitted to the Engineer for approval before any work is commenced. Any work done without such approval shall be redone to the Engineer's satisfaction, without additional expense to the

Employer. Samples of each type of paint shall be on separate 12" x 12" x 1/8" tempered hard board panels. Manufacturer's colour chart shall be submitted for colour specifications and selection.

4. Materials

4.1 All materials shall be acceptable proven first grade products and shall meet or exceed the minimum standards of reputable manufacturers as approved by the Engineer.

4.2 Colours shall be pure, non-fading pigments, mildew-proof sun-proof, finely ground in approved medium. Colours used on-plaster and concrete surfaces shall be lime proof. All materials shall be subject to the Engineer's approval.

4.3 All synthetic enamel paints and primers for structural steel works, metal work and wood works will be the best available of its type and shall be approved by the Engineer prior to its procurement.

4.4 Approved quality Weather Shield Weather Coat paint shall be used for painting the exteriors of the structures or other surfaces where specified on the drawings as directed by the Engineer.

4.5 The plastic emulsion paint, vinyl emulsion paint or similar as approved by the Engineer shall be used for interior surfaces.

4.6 All material for Bitumen painting shall consist of Bitumen grade 10/20. It shall be used for foundations or wherever recommended by the Engineer.

4.7 Only paints manufactured by ICI, Berger or approved equivalent shall be used in this Project. All material shall be delivered to site in their original unbroken containers or packages & bear the manufacturer's name, label, brand & formula & will be mixed and applied in accordance with his directions.

5. Delivery Storage And Container Sizes

Paints shall be delivered to the site in sealed containers, which plainly show the type of paint, colour (formula or specifications number) batch number, quantity, date of manufacture, name of manufacturer and instructions for use. Pigmented paints shall be supplied in containers not larger than 20 liters. All materials shall be stored under cover in a clean storage space, which should be accessible at all times to the Engineer. If storage is allowed inside the building, floors shall be kept clean and free from paint spillage.

6. Surface Preparation

6.1 All oil, grease, dirt, dust, loose mill scale and any other foreign substance shall be removed from the surface to be painted, polished and white washed by the use of a solvent and clean wiping material. Following the solvent cleaning, the surfaces shall be cleaned by scrapping, chipping, blasting, wire brushing or other effective means as approved by the Engineer.

6.2 In the event the surfaces become otherwise contaminated in the interval between cleaning and painting, recleaning will be done by the Contractor at no additional cost.

6.3 Surfaces of stainless steel, aluminum, bronze, and machined surfaces adjacent to metal work being cleaned or painted shall be protected by effective masking or other suitable means, during the cleaning and painting operations.

6.4 All the surfaces to be painted with approved quality paint shall be free from dust, dirt, fungus, lichen, algae etc. Oil paint, varnish and lime wash should always be removed by scraping and washing.

6.5 All surfaces to be bitumen painted shall be thoroughly cleaned of any accretion, dust, dirt etc. by scraping, wire-brushing or as directed by the Engineer. The surface shall be primed with a coat of asphalt oil used at the rate of not less than 0.50 pound per square foot.No work in this section shall be allowed until all surfaces or conditions have been inspected and approved by the Engineer.

7. Application

7.1 All paint and coating materials shall be in a thoroughly mixed condition at the time of application. All work shall be done in a workman like manner, leaving the finished surface free from drips, ridges, waves, laps, and brush marks. All paints shall be applied under dry and dust free conditions. Unless approved by the Engineer paint shall not be applied when the temperature of the metal or of the surrounding air is below 7 degrees centigrade. Surfaces shall be free from moisture at the time of painting.

All primary paint shall be applied by brushing. The first coat of paint shall be applied immediately after cleaning. When paint is applied by spraying, suitable measures shall be taken to prevent segregation of the paint in the container during painting operation.

Effective means shall be adopted for removing all free oil and moisture from the air supply lines of the spraying equipment. Each coat of paint shall be allowed to dry or harden thoroughly before the succeeding coat is applied. Surfaces to be painted that will be inaccessible after installation shall be completely painted prior to installation.

Coats of Weather Shield Weather Coat paint shall be applied in accordance with the manufacturer’s instructions or as directed by the Engineer.

Only as much material should be mixed as can be used up in one hour. Over thinning will not be permitted. After the first coat the surfaces will be soaked evenly four or five times and the second coat shall be applied after leaving for at least overnight.

7.2 Where shown on Drawings all exterior 1.1ishes shall be painted with Weather Shield/weather coat paint in approved colours as

per manufacturer's specifications. The number of coats shall be as shown on the drawings or as directed by the Engineer.

7.3 All wooden doors shall be painted with approved synthetic enamel paint as per manufacturer's recommendation and instructions or after approval of the Engineer.

7.4 Plastic emulsion paint vinyl emulsion paint or matt enamel paint of the approved make and shade shall be applied to surfaces as shown on Drawings as per manufacturer's instructions. The numb7er of coat shall be as indicated on the Drawings or as directed by the Engineer.

7.5 Two coats of hot bitumen paint shall be applied to exposed concrete surfaces in contact with earth. The first coat shall be allowed to dry for about six hours before applying the second coat. During the operation of painting great care should be taken to avoid air bubbles. The manufacturers instructions and Engineer's directions shall be complied with.

8. Job Conditions

8.1 Observe manufacturer's recommended minimum and maximum temperature but do not apply paint or finish to any surface unless ambient temperature is 10 degree C or above and less than 43 degree C. No painting shall be done above 90% relative humidity.

8.2 Place drop cloths to adequately protect all finished work.

8.3 Remove and replace all items of finish hardware, device plates, accessories, lighting fixtures or other removable items.

8.4 In no case shall any finish hardware or other finished item that is already fitted into place be painted, unless otherwise specified.

9. Quality Assurance

All paint for anyone surface shall be top quality, of one manufacturer and approved by the Engineer. Deep tone accent colours shall be used and the unavailability of final coat colours may be the basis for rejecting materials for anyone surface.

10. Schedule of Measurement Of Paint Area

10.1 Irrespective of prime coats and number of paint coats applied to exposed painting surface area of column, walls, projections, ceilings, false ceilings and other surfaces (Except gates, doors windows and ventilators) shall be measured as per actual paint· surface area for single time only and paid in accordance with quoted rate of Bill of Quantities.

11. Measurement And Payment

11.1 General

Except otherwise specified herein or elsewhere in Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of Bill of Quantities.

The rates quoted by the Contractor in the Bill of Quantities shall include work to be executed under these specification in any floor and at any height except where otherwise specifically stated in the relevant item of Bill of Quantities and the Contractor shall not be entitled to any claim or claim any compensation on this account.

11.1.1 Preparatory works, including .preparatory materials, scraping, scratching, sand blasting, c1earjng, prime coating, priming, protection of finished works etc.

11.1.2 Polishing works, including preparatory materials, scraping, cleaning, sanding etc/

11.1.3 Painting work on steel & wooden surfaces.

11.1.4 Before application of paint on existing surface the old paint surface shall be removed existing paint filing of cracks, surface preparation and application of primer coat, if any.

11.2 Measurement

11.2.1 Measurement of acceptably completed respective type of painting works will be made on the basis of net actual areas in square feet of the surface painted as shown on the Drawings or as directed by the Engineer.

11.2.2 Payment will be made for acceptable measured quantity of respective type of painting on the basis of unit rate per square feet quoted in the Bill of Quantities and shall constitute full compensation for all the works related to the item.

SECTION – 20 TEXTURED I GRAFFITO WALL COATING

1. Scope

The work under this section of the Specifications consists of furnishing all materials, plant, labour, equipment, appliances and performing all operations in connection with surface preparation, mixing, and application of graffito wall coating as shown on the Drawings and/or as directed by the Engineer. The scope of this section of specifications is covered with detailed specifications as laid down herein.

2. General

2.1 Except as otherwise specified, all painting shall be applied in conformity with BS CP 231 "Painting of Building" as applicable to the work.

2.2 The Engineer will furnish a schedule of colours for each area and surface. All colours shall be mixed in accordance with the manufacturer's instructions.

2.3 Samples of all colours/coating, stains and finishes shall be prepared in advance of requirement so as not to delay work and shall be submitted to the Engineer for approval before any work is commenced. Any work done without such approval shall be redone to the Engineer's satisfaction, without additional expense to the Employer. Samples of each type of . coating shall be on separate 300 x 300 x 3 mm tempered hard based panels. Manufacturer's colour chart shall be submitted for colour specifications.

3. Material

3.1 Material shall be acceptable, proven, top-grade products and shall meet or exceed the minimum standards of reputable manufacturers as approved by the Engineer.

3.2 The material for textured graffito coating shall be variable granular material and shall composed of Acrylic Copolymer Emulsions spherodial quartz various additives, metallic oxides, inerts of different granulemetries colouring agent, antibacterial and antibacterial agents.

3.3 All materials shall be delivered to site in their original unbroken containers or packages and bear the manufacturer's name, label, brand and formula and will be mixed and applied in accordance with his directions.

4. Surface Preparation

4.1 All oil, grease, dirt, dust, loose mill scale and any other foreign substance shall be removed from the surface to be coated. Following the solvent cleaning, the surfaces shall be cleaned by scraping, chipping, blasting, wire brushing or other effective means as approved by the Engineer.

In the event the surfaces become otherwise contaminated in the interval between cleaning and costing, recleaning will be done by the Contractor at no additional cost.

No work in this section shall be allowed until all surfaces or conditions have been inspected and approved by the Engineer.

The grafito coating material should be applied with stainless steel trowel and finished with plastic trowel in thickness as per manufacturer's specification. To get straight texture plastic trowel should be moved vertically and the trowel is to be rotated to obtain swirl texture.

5. Measurement And Payment

5.1 General

Except otherwise specified herein or elsewhere in Contract Documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bills of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of Bills of Quantities.

5.1.1 Preparatory works, including preparatory materials, scraping, scratching, sand paper rubbing, cleaning, protection of finished works etc.

5.1.2 Providing and applying rough plaster base Corner, pattas, rounding&, arches, borders, grooves etc.

5.2 Measurement

Measurement of acceptably completed works of graffito coating to specified surfaces will be made on the basis of actual area in square foot of the surface coated as shown on the Drawing or as directed by the Engineer.

Payment

Payment will be made for acceptable measured quantity of coating to specified surfaces on the basis of unit rate per square foot quoted in the Bill of Quantities & shall constitute full compensation for. all the works related to the item.

SECTION – 21 LIST OF APPROVED MANUFACTURES AND MAKE

CIVIL WORKS

ORDINARY PORTLAND CEMENT	Falcon Cement, State Cement, Lucky Cement.
SULPHATE RESISTANT CEMENT	Falcon Cement, State Cement, Lucky Cement.
STEEL	Amreli Steel & Razzak Steel. The Contractor must provide a certification from the concerned Steel Mill that the steel reinforcement has been manufactured from Pakistan Steel Mill billet, and should conform to the Technical Specifications.
SAND	Bolari Sand.
CRUSH AGGREGATES	Good Quality Crush from Kot Banglu Origin or as approved by Consultant.
TERMITE PROOFING WORK	Bi Flex FMC / or as Approved By Consultant.
ALUMINIUM DOORS/WINDOWS	Lucky, Krudsons, Pakistan Cables.
DOUBLE TEE RCC ROOF PANEL	M/s. Izhar Concrete Pvt Ltd, Izhar Group of Companies.
GLAZED TILES	Master Tiles, Shabbir Tiles, Karam Cera.
PORCELAIN TILES	Local /Imported of approved manufacturer Full body Porcelain Tiles (Nano Polish) approved by Consultant.
INDUSTRIAL TILES	National Tiles, EMCO Tiles or as approved by Consultant.
BOND FOR TILES	STILE BOND

J	PAINT WEATHER SHIELD, SPD DISTEMPER, SYNTHETIC ENAMEL PAINT, MATT FINISH PAINT, VARNISH.	ICI /Berger.
J	PAINTS / PRIMER & PUTTY	ICI Pakistan Ltd, Berger Paints Pakistan Ltd.
J	ALUMUNIUM EXPANSION, JOINT COVER.STRIP FOR FLOORS/WALLS ETC	Balco, M/s. Chemi Tech. or As Approved By Consultant.
J	HARDWARE & HANDLES	Alfa Brand, Pistol, Sitara
J	GLASS	Tinted Glass imported as approved or Ghani Glass if directed by Consultant.
J	TEMPERED GLASS	Pakistan Safety Glass.
J	LOOKING MIRROR	Imported Belgium Glass or As Approved By Consultant.
J	VENITIAN BLINDS	Protector, MI Décor.
J	FIBER GLASS SHEET (Hollow / Solid)	Toughlite Brand., Poly Ron.
J	GALVANISED IRON (GI) PIPE	M/s. I.I.L. or As Approved By Consultant.
J	RCC PIPE	M/s. RAZIA Brand or As Approved By Consultant.
J	UPVC PIPE	Dadex, Pak Arab, AGM.,EURO GULF Pipes
J	JUMBOLON	M/s. Diamond Foam.
J	FPOXY PAINT	M/s. Cortotech / Stile
J	CONSTRUCTION CHEMICALS	M/s. FOSROC , Mitchels & Co.
J	STEEL GROUTING	M/s. Fischer , M/s. Hilti
J	ALUMINIUM COMPOSITE PANEL	M/s. Dadex, M/s. Aluco MASTER

	(ACP) SHEETS	
J	CONCRETE ADMIXTURTES	Sika, Silver Streak (Pvt) Ltd
J	ALUMINIUM SUSPENDED FALSE CEILING, PANELLING FOR DOORS	Shera, DAMPA Industries, OWA Industries or Al-Noor , Thermic Engineering Karachi,
J	BITUMEN / ASPHALT	National Refinery/ Pak Hy Oils.
J	BITUMINOUS MEMBRANE	Pak Hy Oils.
J	MANHOLE COVER	C.M.P. or As Approved By Consultant.
J	UPVC DOORS	M/s. Framez, M/s. Avitronics Pvt. Ltd.
J	CONCRETE KERB BLOCKS	M/s. Envicrete, M/s. Izhar Crete, M/s. Magna Crete.
J	CONCRETE PAVERS	M/s. Envicrete, M/s. Izhar Crete, M/s. Magna Crete, M/s. National Tiles.

_____ _____

Contractor. **Engineer In-charge.**

SECTION – A
TECHNICAL SPECIFICATIONS

The specification describes the requirements for the supply and installations of electrical/ low current systems.

1. SCOPE OF WORK

The works under these specifications includes providing of all materials & equipments and performing the work necessary for completion of work as shown on the drawings, specified in specification & bill of quantities. The work also include to obtain clearances, certificates etc. from the relevant authorities and also to give the required notices to local electrical authorities and assist the owner in getting electrical connections. The work shall by include but not limited to the following:

a) Electrical Works

i.	Low Voltage Switchgear	(Section - B)
ii.	Low Voltage Cable and Wires	(Section – C)
iii.	Conduits and Pipes	(Section – D)
iv.	Wiring Accessories	(Section – E)
v.	Light Fixtures	(Section – F)
vi.	Earthing System	(Section - G)
vii.	Standby Generator	(Section - H)
viii.	Lightning Protection System	(Section – I)
ix.	Power Transformer	(Section – J)
x.	Underground Trench & pipes	(Section – K)
xi.	Cable Tray System	(Section – L)

b) Low Current Systems

i.	Voice & Data Communication Systems	(Section – M)
ii.	Addressable Fire Alarm System	(Section – N)
iii.	Conventional Fire Alarm System	(Section –O)

iv.	CCTV System	(Section – P)
v.	Public Address/Sound System	(Section - Q)
vi.	Nurse Call System	(Section – R)
vii.	Security Access System- Velocity System	(Section – S)

2. MATERIALS ORIGIN

a) All material and equipment supplied by the Contractor shall be new and shall be in accordance with the details described in BOQ and/or shown on drawings. If the contractor desires to use different materials other than specified, he shall obtain the approval from consultant in writing before using the materials.

b) The Contractor shall also be responsible to supply any other equipment not mentioned in specifications but which is necessary for completion of works, it shall be provided by the Contractor as part of the Contract.

c) Material shall be in accordance with high standard specifications. The contractor shall submit the samples of materials with complete specifications etc for the approval of consultants, before ordering or installation of materials. Approval of materials/installations shall not relieve the contractor of any of his obligations or liabilities under the contract. The Consultants/Owners or Representatives reserve the right to inspect the materials in store or in installed at site and to reject any material not complying with specifications without any extra cost.

d) When choice of manufacturers is allowed for any material/equipment, the contractor shall obtain the whole quantity required to complete the job from one manufacturer otherwise he shall provide evidence to the consultant for non-availability of material/equipment in market.

3. RULES, REGULATION AND STANDARDS

The entire electrical installation / work shall be carried out by licensed electrical contractor, issued by Electric Inspector. The work shall be carried out by qualified & experienced workers having permits/certificates issued by Electric Inspector to undertake such a job. The contractor's license number and supervisors competency certificate shall be submit before commencement of work.

All works shall be carried out in accordance with the latest edition of the Regulations of Electrical Equipment of Buildings issued by the Institute of Electrical Engineers - London, the Contract documents, the Electricity Rules 1937 and bye-laws that are in force from time to time. Any discrepancy between these specifications and any other rules and regulations shall be brought to the notice of Owner or his representative, and his decision shall be final and conclusive.

The Contractor shall be responsible to complete all the formalities/requirements and get the installations passed by the Electric Inspector and submit the test certificates to Owner/Electric Company without any extra cost.

All installations/equipment and materials shall conform to the following standards:

a) International Electro-technical Commission (IEC)
b) British Standards (BS)
c) National Electric Code (NEC)
d) National Standards
e) Any other international standards

In the event of conflict between the standards, the most stringent shall prevail.

Whenever any electrical equipment is to be installed, which does not hold national standards, the Contractor shall take into account the specific standards chosen by the Owner and make sure that the equipment he has to install, meets any one of the above mentioned standards.

4. INSTALLATION AND SERVICE CONDITIONS

4.1 Site Conditions

All material and equipment supplied and installed shall be designed, manufactured and tested to meet the following ambient conditions unless specifically stated otherwise for any material / equipment:

a.	Maximum outdoor ambient temperature	:	45^0
b.	Minimum Indoor ambient temperature	:	15^0
c.	Maximum relative humidity	:	90 %
d.	Minimum relative humidity	:	26 %

4.2 Service Conditions

4.3 Equipment shall be designed and built for continuous service with a minimum of supervision and maintenance.

5. MAIN ELECTRICAL CHARACTERISTICS

5.1 Power Supply System

Unless otherwise specified elsewhere, all equipment and material shall be designed to operate and function satisfactorily with the following minimum requirements without any de-rating:

- Voltage 400V ± 10%
- Phase 3phase, 4 wires system
- Frequency 50 Hz. ±2 Hz.

5.2 Degree of Protection of Enclosures

For indoors, IP31 minimum degree of ingress protection of the enclosures against contact with line or moving parts and against ingress of solid foreign bodies or liquids, shall be selected, in accordance with IEC 60529.

6. GUARANTEE

a) The Contractor shall furnish written grantee that the material & installations meet with this specification and the electrical systems are free from all grounds and all defective workmanship and materials and will remain so far a period of one year after handover of project. Any defect appearing within one year, shall be rectified by the contractor at his own cost.

b) The contractor shall indemnify and save harmless the owner and consultant from and against all liabilities for damages arising from injuries to persons or property occasioned by any act or commission of the worker/sub-contractor/contractor including any or all expenses, legal or otherwise, which may be incurred, any and all expenses, legal or otherwise by the owner in the defense of any claim, action or suit

7. SPECIFICATIONS & DRAWINGS AT SITE

The Contractor shall have for ready access and refer a complete set of drawings/design, BOQ specification at site. He shall incorporate all changes, additions/ alterations made at site during installations and shall prepare a set of drawings indicating the work as actually and finally installed.

8. DISCREPANCIES IN TENDER DOCUMENTS AND DRAWINGS

The Contractor shall carefully examine the documents and drawings and if he finds any discrepancies or omissions from the specifications, bill of quantities or drawings, or is in doubt as to the meaning, he shall consult with the consultants before starting the work. If such defective or modified work is carried out by the Contractor, he shall rectify the same at his own cost.

9. MEASUREMENT OF WORKS

The quantities set out in the bill of quantities are estimated quantities and they shall not be taken as actual and correct quantities of work to be executed by the Contractor. The Contractor

shall carry out actual measurement of works at site and prepare bill accordingly

10. INSTALLATIONS/PROTECTIONS/CO-OPERATION

A. The locations, routings, installation heights, and other details etc. for installations are shown on the drawings. If any information is not stated on the drawings or wherever modifications are required the Contractor shall obtain prior instructions from the Owner or consultants.
B. The contractor shall protect his own work from damage and he shall likewise protect adjoining works of other trades during or after installations.
C. The contractor shall co-operate and work as a team with all other contractors during the installation.

11. DRAWINGS AND WORKMANSHIP

The Contractor shall provide dimensional outline drawings, arrangement drawings and technical data to fit with architectural details as per instructions given to him.

a. The plans are drawn on the basis of architectural drawings. The plans are diagrammatical and do not necessarily show all details to fit the building conditions. The location of outlets, fittings, fixtures & equipments are approximate and may be accommodate to site conditions.
b. No major change shall be made without the approval of consultant. The contractor shall examine all approved shop drawings of other trades in detail and he shall frequently consult to ascertain any change that may have been made.
c. The work shall be executed in the best and most thorough manner under the direction of consultants. The consultants reserved the rights to reject any installation/material, which is not in accordance with the drawings & specifications.

12. IDENTIFICATION

a. For each of the equipment, identification label shall be fitted in front of the casing. The label shall have block letter 7mm high, black on white back ground of trifoliate and fixed with screws.
b. All DB's shall be provided with detail circuit sheet fixed inside the front cover indicating the function and circuit numbers. Spare circuit space shall be left blank.
c. On AC system the phase sequence shall be maintained in the order of Red, Yellow and Blue from top to bottom and/or left to right. Neutral and earthing wires to be connected on respective link or bus-bars.
d. Where 400 volts or above exists the equipment shall be marked "DANGER 400V" engraved in front of the equipment with the requirements of electricity rules and according to engineering practice.

13. SWITCHGEAR TESTS

All switchgear installed by the Contractor etc shall be fully tested at the manufacturer's place to meet the requirements of appropriate standards without any extra cost.

The Contractor shall inform the Engineer in writing about the date and time of test at least 3 days in advance. The witnessing of test by the Owner or his representative shall not absolve the Contractor from his responsibility for the proper functioning of the equipment and for furnishing the guarantees. All test results in the form of certificate/record certificates, signed by all the witnesses, shall be submitted to the Engineer 3 days before delivery to the site.

14. STORAGE

The Contractor shall store the equipment in dry warehouse and protect from damages. Fragile components shall be stored on shelves in their original packing, marked with identification labels.

The Contractor shall handle, store and fix each of the equipment as per the manufacturer's recommendations. He shall inform the Engineer if these conflicts with any other specified requirement and submit copies of manufacturer's recommendations to the Engineer if required.

15. LABOR AND STAFF

The Contractor shall provide all labor materials, tools and equipments for installation and testing of work as detailed below:

- Skilled and unskilled labor required for performing the works as per specifications and drawings.
- Experienced supervising staff with requisite expertise to ensure quality of work in time.
- Administrative staff to ensure smooths functioning of site activities.
- Construction equipment, measuring tools, apparatus and working tools in good working conditions.

The Contractor shall be responsible for the performance of any sub-contractors, worker and manufacturer at his own cost and risk.

16. SMALL INSTALLATION MATERIAL

The Contractor shall supply and install all small installation and consumable materials such as nuts, screws, anchor, bits, bolts, washers, shims, angles, leveling materials, insulation tape, solder, PVC strap-on or heat shrinkable type cable tags, cable ties, bushes, sealing compound,

lugs etc, required to complete the job without any extra cost.

17. INSTALLATION INSTRUCTIONS - GENERAL

The Contractor shall set out the works himself as per specifications and drawings and shall properly install the equipment on specified foundation / location as per manufacturer's instructions. Any defective or faulty operation of equipment the Contractor shall change/repair the same at his own cost.

18. ASSOCIATED CIVIL WORKS

The Contractor shall be carried out associated civil works under the direction of the Engineer.

The Contractor shall prepare drawings giving details of all associated civil works without any extra cost.

The following work to be carried out by the Contractor during installations:

a. The cutting and forming of holes or conduits/pipe fixings in walls, floors, ceilings, partitions, roofs, etc., and bringing back the finish to the position that it was before.
b. Formation of concrete bases or foundation pads.
c. Excavation forming for underground services of ducts and courses and then covers it.
d. Excavation for and lying of cables or pipes etc.
e. The painting of all pipes, tube and conduits etc. after fixing unless specified to the contrary.
f. Sleeves through floors/walls, flush with walls/ceilings or finished floors of a size to accommodate the raceways.

All required holes through walls, floors and beams for pipes and ducts will be left out by the Contractor during the process of building and he should workout in advance the position of holes channels etc to the civil contractor where it’s not possible for cutting or chipping etc.

Cutting, fitting, repairing, patching of plaster and finishing of carpentry work shall be done by skilled workers in their respective trades, when cutting is required it shall be done in such a manner as not to weaken structure, partitions or floors. The holes required to be drilled without breaking out around the holes. Where patching is necessary in finished areas of building, the Engineer shall determine the extent of such patching or refinishing.

19. TESTING

Upon completion of installations, the Contractor shall perform all static, semi-dynamic (by simulation), and dynamic field testing on all the equipment and systems.

All tests shall be conducted in the presence of the Engineer for the purpose of demonstrating equipment or system compliance with specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the test procedure, test observations and expected results.

The Contractor shall furnish all tools, instruments, test equipment, materials, etc., and all qualified personnel required for the testing, setting and adjustment of all electrical equipment and material including putting the same into operation.

All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests. The cost of any damages or rectification work due to any accident during the tests shall be the sole responsibility of the Contractor. The Contractor shall record all test values and submit the same to the consultants.

The witnessing of any tests by the Engineer does not relieve the Contractor of his guarantees for materials, equipment and workmanship, or as any obligations of Contract.

In addition to installation testing, the Contractor is to carry out operation testing of all sections to ensure that the entire installation is sound, complete and safe and will function properly and as intended.
The acceptance shall be made by the Owner.

The Contractor shall formally engage his direct responsibilities to the Owner or his representative, and likewise, shall assume all responsibility for work performed by sub-contractors and materials he has supplied and installed.

19.1 Insulation Resistance Test

Insulation resistance test shall be made on electrical equipment and wiring by using a meager of 1000 volts for circuits between 250 and 500 volts. The insulation resistance of distribution boards, cables, etc., shall be as per IEC, IEEE, BSS and Pakistan Electricity Rules.

The distribution boards shall be tested before wire connections. Insulation tests shall be made between open contacts of circuit breakers, switches and between each phase and earth.

If the insulation resistance of the circuit is less than specified values, the cause of the low reading shall be determined and removed. Corrective measures shall include dry-out procedure by means of heaters, if equipment is found to contain moisture. Where corrective measures are carried out, the readings shall be taken and repeated twice at 12 hours interval. The maximum range for each reading in the three successive tests shall not exceed 20% of the average value. After all tests have been made, the equipment

shall be reconnected as required.

19.2 Earth Resistance Test

Earth resistance tests shall be made by contractor on the earthing system, separating and reconnecting each earth connection as may be required by the Engineer. If it is indicated that soil treatment or other corrective measures are required to lower the ground resistance values, the Engineer will determine the extent of such corrective measures.

The electrical resistance of the E.C.C. together with the resistance of the earthing lead measured from the connection with earth electrode to any other position in the completed installation shall not exceed one ohm.

Earth resistance test shall be performed as per Electrical Inspector's requirements. Where more than one earthing sets are installed, the earth resistance test between two sets shall be measured by means of Resistance Bridge Instrument. The earth resistance between two sets shall not exceed one ohm.

19.3 Phase sequence test

Each circuit breaker shall be operated electrically and mechanically. All interlocks and control circuits shall be checked for proper connections in accordance with the wiring diagrams given by the manufacturer.

The Contractor shall properly identify the phases of all switchgear and cables for correct rotation of all motors and entire installation before final connection to supply line.

Trip circuits shall be checked for correct operation and rating of equipment served. The correct size and function of fuses disconnect switches, number of interlocks, indicating lights and alarms shall be in accordance with approved manufacturer drawings. Name plates shall be checked for proper designation of equipment served. Protective relays shall be tested and set at site prior to commissioning of the equipment.

19.4 Low Current Systems Tests

The testing of Low Current systems shall be carried out as per procedures or recommended by the manufacturer/supplier.

19.5 Complete Tests

After any equipment has been tested, checked for operation, etc., and is accepted by the Engineer, the Contractor shall be responsible for the proper protection of that equipment so that subsequent testing of other equipment do not cause any damage to the already tested equipment.

20. ELECTRICAL CONNECTION

Electrical connection shall be provided by Electric Supply Company but necessary but necessary arrangement coordination to be done by the Contractor. The temporary arrangements (including materials and labor) for installation/testing purpose to be made by the contractor without any extra cost.

21. DRAWINGS, SAMPLES AND MANUALS

1. The contractor shall prepare shop drawings showing all routes, switches, sockets, DBs and junction/pull boxes locations etc. and submit to the consultant for approval before starting the work without any extra cost.
   a. Single line diagram indicating all cables, with sizes and types, and rating of circuit breakers, fuses, etc.

   b. Lighting, power, telephone, fire alarm, nurse call, public address, CCTV, queue management and data/voice systems, as applicable.

   c. Control and Data/Voice wiring diagrams for the equipments installed by the Electrical Contractor

2. All changes/additions/alterations shall be carefully recorded during the work and the Contractor shall prepare as built drawings. On approval of drawings the Contractor shall provide two set of drawings to the consultant and owner before final payments.

   The Contractor shall submit for approval of the manufacturer's instructions for installation, testing, commissioning, operation and maintenance manuals of the equipment before installation. Upon acceptance, the Contractor shall supply a copy to the Owner. The contractor shall also submit for approval the samples of materials to be used in the project, before starting the installations and approved list of materials/equipments to be handed over to owner.

22. WORK COMPLETION

The Contractor shall further repair/replace all defective works on completion and leave all installations in perfect working order up to the satisfaction of the Owner and consultant. The contractor shall meet all the requirements/instructions given in specifications.

The contractor shall complete each and every work as described and included in these specifications and BOQ as per owner's/consultant's instructions.

23. PAYMENT

Running payments shall be made to the contractors at an interval not less than 15 days at a time. Contractors shall submit running bills to the consultant for verification. After due verification, the owner shall paid the bills to the contractor after deducting applicable taxes.

SECTION - B
LOW VOLTAGE SWITCHGEAR

1. GENERAL

1.1 Purpose

This section describes the minimum requirement for the design, construction and performance of factory assembled LV switchboard.

1.2 Scope of Work

The job consists of supply, installation, testing, connecting and commissioning of switchboards as specified in BOQ or shown on the Drawings.

1.3 Installation

Switchboard shall be installed indoor. The equipment shall be capable of operation under the prevailing ambient conditions without any deleterious effect of any kind. Switchboard shall be suitable for continuous operation at full load rating under combined variation of both voltage and frequency.

2. MAIN ELECTRICAL CHARACTERISTICS

2.1 Power Supply System

Main characteristics of power supply system applicable to all switchboards are:

- Voltage 400 V $\pm$ 10%
- Phase 3 phase, 4 Wires.
- Frequency 50 Hz. $\pm$ 2 Hz.
- Neutral system firmly grounded.

Main characteristics of auxiliary supply system are:

- Control / Command system 24 VDC.
- Space heater system 230 VAC.

2.2 Ratings

The equipment shall be capable of carrying the specified current continuously 24 hours per day, without exceeding the permitted temperature.

The current ratings must be guaranteed at the specified design temperature. Equipment shall be fully rated and constructed for withstanding, making and breaking the specified short circuit duty.

Pins of auxiliary circuits shall be sized for a rated circuit of minimum 10 Amp.

3. ENCLOSURES

The Switchboard shall be prefabricated metal clad cubicle(s), floor standing type, totally enclosed, dust tight and vermin proof and front access only. It shall complete in all respects with material and accessories, factory assembled, tested and finished all according to the specifications and to normal requirements. For indoor installations the international classification shall be IP42.

a) The short service breaking capacity, ICs at 400 VAC, conforming to IEC 60947-2 unless otherwise stated on the drawings.
b) To provide with adequate clearance from live parts so that flash over cannot be

caused by switching, vermin, pests, etc.

c) All components shall be rated for insulation class 600-volt minimum.

d) It shall be designed for flush mounting of all instruments on the front side only.

e) All incoming or outgoing connections from top or bottom shall be completed. The components mounted so as to facilitate ease of maintenance from the front. Common lamp test facility for all lamps.

f) The wiring diagram on the inside of door. Be labeled with name plate on the front side of door.

g) To provide 25% space for extension in future.

3.1 Cable Accessibility

Switchboard shall preferably be arranged for bottom cable entries. Adequate space must be provided for cable entries and termination. It shall be possible to work easily and safely on cable of a main or control outgoing circuit in OFF position with the remainder of the board alive.

Adequate system shall be provided for installation and clamping of cables inside the cable compartment. Position of terminals and cables shall allow use of clamp ammeter.

Power and Control cable termination shall avoid obstruction to other cable termination and provide easy access for terminating cables. Cable supports shall be provided to avoid undue strain on cable termination. Easily accessible locations shall be reserved in the compartment for measuring transformers.

3.2 Heaters

Space heaters shall be provided for prevention of moisture in each cubicle. Heaters shall be wired together and shall be automatically controlled to avoid over heating the equipment. Heater shall be suitable for operation on 230 VAC supply from an external source (to be provide in main Distribution Board)

3.3 Name plates

On the front side, a name plate shall be provided at the top to indicate the name of manufacturer, system voltage and frequency and the current carrying capacity of switchboard.

Each breaker shall have a circuit identification label fitted below the breaker aperture or as suitable.

Drawing indicating the branch circuit names, breaker elements, cable sizes and connecting services shall be placed in a clear plastic pocket provided at the back of the front access.

Labels described shall have block letters 7 mm high on a white back ground, to be made from trifoliate and be fixed with screws.

Each incoming and outgoing circuit shall also be labeled with name plate 75 mm x 15 mm, as described above on the front side of door.

4. CONSTRUCTION

4.1 The switchboard shall be fabricated, welded; grinded, finished with angle iron frame work and clad with 2MM MS sheet, to form a rigid, free standing, flush mounting fronted assembly.

It shall be suitably divided into panels and compartments for accommodating the required number of circuit components, instruments and accessories. Each compartment shall be fully partitioned from its neighbor both horizontally and vertically, allowing safe cable routing / termination without shutting the switchboard down.

All live parts within cubicles, compartments or modules, which have to accessible during normal maintenance operations, shall be adequately protected and / or buried to ensure protection of works and to avoid accidental contact. Barriers may be rigid, transparent, insulating material fitted with warning labels.

The doors shall be provided with hinges on the left-hand side and locking handles on the right hand side for fastening the door. The front assembly shall be fastened to the enclosure by means of self locating fasteners for quick and easy fixing.

All holes, cutouts shall be tool or jib manufactured and free from burrs and rough edges. All structural components shall be of standardized design to provide complete uniformity and inter change ability of common parts. Removable gland plated shall be provided at top and / or bottom as required.

The switchboard shall be supplied complete with foundation bolts and other installation materials as recommended by the manufacturer. Proper size cable clamping channels with galvanized steel clamps and brass cable clamps respectively for PVL/PVC and SWA cables shall be provided.

The cabling inside the Switchboard shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC conduit. All indicating, control and selecting equipment shall be suitably arranged and clearly labeled with indelible labels indicating the rating of fuses, switches, etc.

All metal work of the switchboard shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of color RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

4.2 Bus Bars

Bus bars and droppers supported on non - hygroscopic material are to be high conductivity electrolytic tinned copper, completely isolated and mechanically braced and rated to withstand the specified short circuit currents for one second duration.

Bus bars and droppers shall be housed in a separate compartment and shall be clearly marked with Red, Yellow and Blue colors. Bus bars shall be provided for three phases, neutral and multi - terminal earth. The temperature rise shall not exceed 50 degree centigrade at rated current. Neutral bus assembly shall consist of outgoing screw terminals with one terminal for every MCCB / MCB.

Removable metal covers on the bus bar chamber shall be provided with suitably sized labels at regular intervals, fixed with self tapping screws and warning of live metal work.

All bus bars connectors shall be tinned plated connections and joints. Horizontal bus bars shall be of the same current rating throughout their length.

4.3 Earthling

A copper earth bar of suitable section for the specified fault level shall extend the entire length of the Switchboard. Provisions shall be made for possible future extensions at both ends.

Earthing facilities shall be provided on each incoming and outgoing unit to permit earthing of the connections.

All metallic non-current carrying parts of the Switchboard shall be bonded together and connected to the Switchboard's earth bar.

Each circuit wiring shall be green / yellow color. Earthing mass continuity between withdraw able parts and fixed frame shall be correctly ensured whatever withdraw able part position.

Provision shall be made adjacent to cable termination for earthing cable armor to the earth bus bar.

Earthing switch shall be provided wherever mandatory as per rules and regulations / codes and standards and shall be manually operated. An interlocking system shall provide the following locking and safety functions:

- Impossibility of closing the earth switch if the switching device is closed.
- Visual check of earthing switch positions to be possible.
- Possibility of locking the earthing switch operating handle in open and closed

position.

- The earthing of the bus bar shall be done manually by the operator without provision of general earthing system.

5. DISTRIBUTION BOARDS

The enclosure of the LV Distribution Board shall be fabricated from electro-galvanized / zinc coated sheet steel.

The LV Distribution Board shall be fabricated with 1.6mm sheet steel recess or surface mounting. All components shall be installed on a component mounting plate inside the enclosure and protected from the front with screwed sheet steel safety plate. The door shall be fully gasket with hinges on the left hand side and locking handle on the right hand side for fastening the door. The locking handle should be detachable. The dead / front assembly shall be fastened to the enclosure by means of self - locating fasteners for quick and easy fixing.

The incoming and outgoing cable connections shall be according to the wiring requirements. If required, an adapter box of same material & finish shall be provided for accommodating the cables and conduits.
An earth bar or terminal strips shall be provided for connection of incoming and outgoing earth conductors. The earth bar or terminals shall be permanently connected to the body of Distribution Boards at two points. Flexible copper strip shall be provided for earthing of the door.

Neutral bus assembly shall consist of outgoing screw terminals with one terminal for each MCB. All holes, cutouts, etc., shall be tool or jib manufactured and free from burrs and rough edges. Removable gland plates shall be provided at top/bottom, as required.
The cabling inside the distribution board shall be suitably numbered and harnessed by means of straps or cords. Wiring to door mounted components shall be in flexible PVC pipe. All indicating, control and selecting equipment shall be suitably arranged and clearly labeled with indelible labels indicating the rating of components etc.

All metal work of the distribution board shall be cleaned down to bare shining metal, phosphate and the surfaces chemically prepared for powder coating. Then these shall be coated with powder of color RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

6. COMPONENTS

The switchboards shall be provided with all components as specified or shown on the Drawings and as necessary for the satisfactory operation of the Switchboard and electrical system. Typical

specifications are given here under:

6.1 Circuit Breakers

The circuit breakers shall be panel mounted, compact modular design, trip shall be standard and shall have built in overload and short circuit protection. The breakers shall have high performance, multifunctional type under modern design concept. The breakers should confirm international standards.

The breakers shall have inverse time limit characteristic, instantaneous magnetic trip element for short circuit and thermal overload protection.

a) Molded Case Circuit Breakers (MCCB)

The MCCB shall be three pole 400 / 500 volts rating. The breakers shall have both time delay over current and instantaneous short circuit protection.

The MCCB's shall be installed such that their switching levers are accessible through the dead front plate for operation. Circuit numbers / designation on all circuits shall be clearly marked to facilitate connection and maintenance.

The breakers shall have quick make - quick break toggle mechanism with positive 'ON', 'OFF' color indication and intermediate ' Tripped ' positions.

Trip mechanism shall be trip free on overload or short circuit ensuring that the breaker will not close / remain close even if the close command is given while the circuit breaker has tripped due to short circuit or continuing overload.

b) Miniature Circuit Breaker (MCB)

The MCB's with current rating from 1 to 125 Amps shall be conforming to BS EN 60-898 or IEC 60947-2. The circuit breakers shall be suitable for DIN-rail mounting, maintenance-free and fully tropicalised.

The MCB's shall be designed for horizontal or vertical mounting, or reverse feeding, without any adverse effect on electrical performance.

The operating mechanism shall be quick make, quick break type, trip free, with all poles opening and closing simultaneously (except for the neutral pole, which if required shall be of the advance-closing and late-opening type). The operating toggle shall clearly indicate the ON and OFF color indications.

The individual operating mechanism of each pole of a multiple MCB shall be directly linked within the MCB casing and not by the operating handle.

Each pole of the MCB's shall be provided with bimetallic thermal element for overload protection and a magnetic element for short circuit protection.

c) Earth Leakage Circuit Breakers (ELCB)

ELCB's shall be four pole, current operated type with tripping current of 0.3A and tripping time not more than 0. I seconds.

6.2 Transformers/Meters etc.

a) Current Transformers

Current transformers shall comply with the requirements of IEC 60185 (or equivalent).

Current Transformers shall be polyester resin insulated, ring type, air cooled having transformation ratio as indicated on the drawings. The current Transformers shall be of suitable burden having accuracy class 1.0. The Current Transformers shall have rated secondary current 5A / IA as required.

Current Transformers shall mechanically and thermally withstand the specified short circuit capacity. Test terminal blocks shall be provided for current Transformer secondary circuits having short circuiting provisions to allow portable apparatus to be connected.

b) Voltage Transformers

Voltage transformers shall comply with the requirements of IEC 60186 (or equivalent) and shall be of accuracy class 1.0.

Voltage Transformers shall be equipped with primary fuses with an interrupting capacity of the incoming circuit breakers. Test terminal block shall be provided for each Voltage Transformer system.

c) Ammeters and Voltmeters

Indicating instruments shall be semi-flush Switchboard type, moving Iron, spring controlled with standard scale having white background and black graduations and markings. The front dimensions shall be 144 x 144 mm for instruments on incoming side and 96 x 96 mm on all outgoing circuits.

Indicating instruments shall be 1.0 class percent of full scale basic accuracy class in accordance with IEC 60051.

The ammeter shall be suitable for connection to 5 Amp. Secondary of current transformer or directly through shunt as shown on the drawings. The instruments shall have measuring range indicated on the drawings. A red mark shall be provided at the working voltage on the scale of all voltmeters.

d) Selector Switches

Ammeter and voltmeter selector switches shall be complete with front plate,

grip handle, R-Y-B and OFF position for ammeter and RY-YB-BR-RN and OFF positions for voltmeters.

The selector switches for controls shall be rotary cam type and shall be provided complete with knob and front plate, showing all positions as required.

e) Push Buttons

The push buttons shall be momentary make / break contact type (normally open / normally close) and suitable for flush mounting. The push button for ON and OFF switching shall be red and green respectively.

f) HRC Fuses

HRC Fuses shall be provided complete with fuse bases, fuse, etc. The fuses shall have a fusing factor as specified for class Ql in accordance with BS 88.

g) Pilot Lamps

Switchboard shall be provided with phase indicating pilot lamps. The lamps shall be rated for 250 volts supply and suitable for flush mounting. The front of the lamps shall have colored rosettes for identification of phases.

h) Line up Terminals

Line up terminals wherever provided for Control or Power circuits shall be suitable for voltage and size of conductors as indicated on drawings. The Line up terminals for controls shall be suitable for channel mounting. All necessary accessories such as end-plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

i) Secondary Wiring

All wiring shall be copper conductor, thermoplastic insulated, at least 1.5 sq. mm flexible, neatly arranged and clipped in groups.

Each conductor and its termination are to be identified and marked with numbered ferrules. All live terminals are to be shrouded.

Secondary wiring for Current Transformers shall be carried out with not less than 2.5 sq. mm. Terminals shall be specially marked to avoid opening of the circuit by accident.

7. POWER FACTOR IMPROVEMENT PLAN (PFI)

The power factor improvement plant shall be used for improving the power factor of the system. The plant shall be automatic cum manual.

The PFI plant shall be aligned with main LT switch board and it shall be a part of that LT switchboard as shown on the drawing. The capacitors shall be suitable for three phases, 415 volts 50 Hz system and shall be self cooled, designed for indoor use in tropical climate for maximum ambient temperature of 45 degrees centigrade and relative humidity 90%. The capacitors shall be in the form of banks divided for 12 stages, 6 stages and 4 stages. Each capacitor bank unit shall be 12.5/25 and 50 KVAR. The total KVAR capacity shall be as indicated on the drawings. Each capacitor unit shall be complete with discharge resistors and internal fuses and shall be connected with control panel with proper size of single core PVC insulated cables.

The panels shall be supplied complete with a set of 3-phase, full capacity, isolated tinned copper bus bars, interconnections, risers, designation labels, cable sockets, holding down bolts, wiring with cleats and ferrules, earthing sockets and studs, etc. Each control panel shall comprise.

1 No. Multi stage power factor correction relay for automatic/manual control.
1 No. 3-phase, 4 wire, 415 volts, unbalanced load power factor indicator.
1 No. Auto-off-Manual selector switch
1 No. Current transformers with 5 amps secondary current having suitable output burden and accuracy.
3 Nos. Instrument protection fuses.

Following equipment shall be provided for every 250 KVAR capacitor bank:
1 No. 630 amps, triple pole 415 volts air break contractor with auxiliary contacts (2 N.0+2 NC) Contractor shall be suitable for AC 3 duty.
1 Set of 2 Nos 630 Amps H RC back-up fuses with base and carrier.
1 Set of ON and OFF push buttons.
1 No. Red lamp for “ON” indication to the contactor.

Requirement of Capacitor Banks
According to IEC-83 1 -1 and 831-2.
Fully insulated terminals to be shielded by a cover.
Dielectric: Plastic poly-propylene, impregnated.
Electrodes: Aluminum coating vacuum metalized.
Safety features: Self healing. Over pressure tear-off fuse.
Withstand switching operations safely.
Maximum in rush current 200 times rated current.
Loading capacity: 1.1 times rated voltage. 1.3 times rated current at delta max.
Overloading capacity 1.5 times rated output at delta max.
Acceptable tolerances - 5/+ 10% of rated output at rated frequency.
Static life expectancy > 100,000 operating hours.
Test Specifications: Terminal versus terminal with an AC voltage 2.15 times rated voltage for 10 seconds duration. Terminals to casing with an AC voltage of 3 KV for 10 seconds duration.

8. INSTALLATION

The LV Switchboard shall be installed at location shown on the drawing. The Contractor shall coordinate with civil & allied works for providing any openings, holes, etc. to avoid any breakage. In case the provisions in civil works for the installation of electrical equipment are not made or made incorrect the same shall be rectified by the Contractor at his own cost and to the satisfaction of the Engineer. The Contractor shall provide foundation bolts and grout them in cement concrete floor using non-shrinkable material with the approval of Engineer.

All installation material for physically erecting the switchboard, such as bolts, nuts, washers, supporting steel, etc., shall be provided and installed by the Contractor. The Switchboard shall be installed upright and in level and shall be firmly and rigidly bolted to the floor and concrete supports.

The switchboard shall be completely erected as per manufacturer's instructions and as approved by the Engineer. Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. Any safety locking provided by the manufacturer for safe transportation shall be released only after the switchboard is erected in position.

The incoming and outgoing cables shall be connected as recommended by cable manufacturer. The cable armor shall be connected effectively to ground.

The Switchboard enclosure shall be connected to earth terminal. The Switchboard shall be tested before energizing in the presence of the Engineer.

SECTION - C
LOW VOLTAGE CABLES AND WIRES

1. SCOPE OF WORK

The work under this scope consists of supply installation, testing, connecting and commissioning of all material and services of low voltage cables and wires and the accessories as specified herein or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with project Engineer and coordinate at site with other trades for exact route, location and positions of electrical cables and equipments etc.

2. GENERAL

All multi-core and single core wires for light circuits, socket outlets and circuits operating up to 250 volts shall be 300 / 500 volts grade. All single core sheathed cables shall be of 450 / 750 volt grade. Power cables for main feeders, main to sub-main feeders, power equipment, etc., armored or unarmored shall be of 600 / 1000 volts grade. Armoring of cables shall be done with appropriate size galvanized steel wire as per codes.

The conductors shall be stranded or solid, high conductivity, soft annealed copper. Conductor of single core cables shall be circular, whereas of multi-core cables may be circular or shaped according to standard practices and codes. The PVC insulation shall be extruded with a PVC compound having good flexibility, resistance to aging and ability to withstand the ambient temperatures. Cable should be capable of running 125% of full load current without any damage.

3. STANDARDS

All Cables & Wires shall be manufactured to confirm the following standards as given below:

BS 6004 / 6346	PVC insulated cables for lighting and power.
BS 6746	PVC insulation for electrical cables.
BS 6360	Copper conductors
BS 6500	Insulated flexible cords.

4. MATERIAL

4.1 General

The power, lighting and control cables shall be furnished and installed in accordance with the routes and requirements shown on the drawings. The single core cables shall be delivered as complete coils with wrapping & seal intact.

All cables shall have phase identification colors on insulation of each core. The color code for three phase circuits shall be red, yellow and blue for phases, and green for earthing.

Single phase circuits shall have insulation of red color for phase / line, black color for neutral and green color for earth conductor.

All DC circuits shall have insulation of red color for positive, black color for negative and green for earth conductor.

The ends of each length of multi-core armored or unarmored cables shall be properly marked for clock-wise and anti clock-wise sequence of core colors.

4.2 Cables for Conduit Wiring

All cables / wiring in concealed or surface mounted PVC or MS conduits shall be single core PVC insulated of specified grade and size, unless specifically shown on the drawings or given in BOQ.

4.3 Cables on Surface / Concrete Trenches

Cables for distribution system to be installed on surface, in cable ducts, in concrete trenches or on trays shall be single or multi-core PVC insulated and PVC sheathed of specified voltage grade and size, unless specifically shown on the drawings or given in BOQ.

4.4 Underground Installation

Cables for laying directly underground shall be PVC insulated, PVC sheathed and armored with galvanized steel wire. Cables fully installed in underground ducts / pipes and mechanically protected from end to end shall be PVC insulated and PVC sheathed unless specifically shown on the drawings or given in BOQ.

4.5 Cable Accessories

All cable accessories such as lugs, ties, tapes, glands, flexible pipes, connectors, duets, clips, tags, bushes, etc shall be provided for the complete cabling and wiring system without any additional cost.

5. INSTALLATION

5.1 General

When the laying is effectuated by others, the contractor shall test the cable characteristics insulation and continuity, at all phases of these and communicate them in a report to the Engineer, as per recommendations of the standards according to which the cable is manufactured.

The cables shall be spaced by categories along their entire length as well as upon penetration into buildings and in their interiors, according to their following rated voltages:

- 30 cm at least between a cable carrying I KV - 30KV and other cables.

- 20 cm at least between a cable carrying voltages between 50V - 500V, and any power or control 10 cm at least between a cable carrying voltages lower than 50V and telephone or these possible being grouped.

All installation material, labor, tools and accessories for cable installation shall be furnished by the Contractor. The cable and accessories shall be installed as described in accordance with these specifications, drawings and manufacturer's instructions.

The wiring must be strict in accordance with layouts, details, schematic diagrams given in the drawings.
The light circuit and power circuits shall be run in separate pipe. The circuits/sub-circuits shall be provided identifications by numbers permanently attached. The wiring shall be done to maintain color coding.

5.2 Conduit Wiring

The wiring in conduit shall be started only after the conduit system is completely installed and all outlet boxes, junction boxes, etc., are fixed in position. The filling rate inside the conduits shall not exceed 50 %. Cables directly embedded in the masonry are not accepted.

The wires shall be pulled in conduit with care to prevent damaging the wires, preferably without the use of any lubricant like soap, oil or grease. Where necessary and if approved by the Engineer, the cable manufacturer's recommended lubricant may be used. Where several wires are to be installed in the same conduit, they shall be pulled together along with the earth conductor. All wires of same circuit shall be run in one conduit.

The wires shall not be bent to a radius less than 10 times the overall diameter of the wire, or more if otherwise recommended by the manufacturer.

The wiring shall be continuous between terminations and looping-in system shall be

followed throughout. Any joint in wires shall not be allowed. The use of connectors shall only be allowed at locations where looping-in is rendered difficult. The consent of the Engineer shall be required for using connectors. The connector shall be of suitable rating having porcelain body with sunk-in screw terminals. The connector shall be wrapped with PVC insulation tape after its installation. A minimum of 150 mm extra length of cable / wire shall be provided at each termination to facilitate repairs in future.

The size & quantity of cables contain in one pipe shall not be excess in accordance with IEE regulations.

5.3 Cables on Surface / Trenches

All cables for installation on surface of wall, column, ceiling, trenches, etc., shall be fixed to the surface by means of galvanized steel clips, secured to a steel channel using suitable stud plate, nuts and washers.

The erection of cables and position of support shall be agreed by the Engineer on site, having taken into consideration the accessibility of all such routes. These shall be so arranged that cable crossing one another be minimized if cannot be avoided.

Cables shall be fixed throughout their length by means of approved saddles, clips, etc., at every 600 mm vertically and 900 mm horizontally.

Cables and equipment fixed to a building fabric, i.e., brickwork, concrete, etc., shall be fixed by means of appropriate fixing devices, i.e., Raw bolts, Hilti fixing devices, etc. Contractor shall be responsible for all drilling of steel work, brick work and masonry where necessary for fixing clamps and brackets for supports.

Cables shall not be pulled into conduit until the conduit system has been completed, cleared and free from obstruction and sharp edges cables shall be put into conduits in such a manner that there will be no cuts or abrasions in the cable insulation, protective braid and jackets. There shall be no link in the conductors.

Distance of saddles shall be used for installation of cables in defined condition of the surface of wall etc.

Grease or other injurious lubricants shall not be used in pulling cables. The use of talc or non injurious lubricants is permissible, if desirable.

The number of wires installed in any conduit shall be such that the resulting space factor does not exceed 50 %. Spliced wires shall not be pulled through conduits.

All conduit wiring shall be carried out in the loop - in principle from outlet box to outlet box and in no circumstances shall joints be used except in fixed base connection blocks

housed in outlet boxes.
The vertical clearance between two adjacent cables at any point is 50 mm minimum. Common mounting, channels are to be furnished for cable along the same route. The Contractor can offer alternate cable fixing arrangement, which shall be approved by the Engineer before commencement of installation.

The wall crossings where the outdoor cables penetrate in the building shall be carefully obstructed by means of polyurethane foam. The Contractor shall be fully responsible for the perfect tightness of these cable penetrations.

5.4 Underground Cables

The Contractor shall plan and take special care to prevent any damage to existing underground facilities such as piping, cables, foundations, etc. The Contractor shall notify the Engineer of any obstruction encountered and shall provide protective support or removal of such obstructions as instructed by the Engineer. Excavation adjacent to existing facilities, such as foundations manholes, ducts, underground pipelines and paving shall be braced and / or shored properly to protect those facilities during excavation and construction.

Sufficient slack shall be left in cables for this purpose that cut lengths of cables shall allow about 3% more in the measured lengths between terminations.

Cables, whether installed underground or in concrete trenches, shall not be bent to a radius less than 10 times the diameter of the cable or as recommended by the cable manufacturer, whichever is higher.

All cables shall be marked at least at each end, switch gear and equipment termination, where cable enter or leave underground cable trenches or channels, where cable rises from one level to another, at 30M intervals with predetermined identification numbers, by means of proprietary non-deteriorating type, PVC, heat shrinkable, strap-on type or equivalent, for the identification of cable and circuit. These shall be indelibly marked with cable number and securely fixed to the cable. Where conductors are left to be terminated by another party or left to be connected later, they shall be identified. The earth continuity conductor shall be laid in the trench with the cables.

Cables entering the buildings shall also be laid in protective pipes. The protective pipe ends, after installation of cables, shall be plugged water tight by means of polyurethane foam / bituminized Hessian or equivalent method as approved by the Engineer.

5.5 Cable Termination and Joints

Cables shall be terminated in a safe, neat and approved manner at the associated equipment, included that erected by others.

Compression type connectors (lugs) shall be of the correct size and approved type for the conductors concerned. Compression tools shall be supplied for specific use and shall be maintained in good order. After compression the conductor and terminal shall form a solid mass ensuring good conducting properties and mechanical strength. The compression jointing system used throughout the installation must be approved by the Engineer.

The Contractor shall be responsible for all drilling and if necessary, tapping entries where these have not been provided by others.

When preparing cables prior to fitting glands, the gland manufacturer's instructions for cable preparation shall be observed. In all cases where armored cables are used, care shall be taken to ensure that the lay of the armor is maintained after the gland is completely fitted.

Termination and joints shall be suitably insulated for the voltage of the circuits in which they are used.
Every compression joint shall be of a type, which has been the subject of a test certificate as described in BS 4579.

Cable ends, which are not terminated immediately after cutting, shall be sealed effectively to prevent ingress of moisture and shall be protected from damage until termination.

For all cables above 6 sq. mm in section, if a substantial mechanical clamp is not provided a compression type lug or socket shall be provided. At all equipment, cable shall be installed and terminated so that no strain is imposed on the cable or gland and due allowance made to counter the effect of vibration. At all termination an ample length of 'tail' shall be left.

Where joints in cable conductors and bare conductors are required, they shall be mechanically and electrically sound and they shall be accessible for inspection. Joints in non-flexible cables shall be made either by soldering or by means of mechanical clamps or compression type socket, which shall securely retain all the wires of the conductors.

Any joint in flexible cable shall be affected by means of cable coupler. Cable couplers and connectors shall be mechanically and electrically sound and shrouded in metal, which can be earthed. Where the apparatus to be connected require earthing every cable coupler shall have adequate provision for maintaining earth continuity.

The insulation of cables must be brought into DB’s switch boards or fixtures to which the cables are connected. All openings shall be sealed properly. The outdoor apparatus

shall normally be connected by means of cables with conduit termination down to about 30 cm below ground level or concrete foundation. The conduit shall be firmly secured down to their penetration into the trench or channel.

SECTION - D
CONDUITS AND PIPES

1. SCOPE OF WORK

The job includes supply and installation of all Conduits, Pipes and Accessories as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with others for exact route, location and positions of electrical conduits.

2. GENERAL

The extent of works shown on the drawing does not indicate the exact position of conduit and pipes. The Contractor shall ensure exact location and route of conduit and pipes in coordination with other services drawings, as per site requirements and as directed by the Engineer.

The quality and material for the accessories of conduits and pipes such as sockets, elbows, bushes, bends, inspection / pull boxes, round boxes, etc., necessary for the completion shall be similar to that of conduit or pipes.

3. STANDARDS

The conduits, pipes and accessories shall confirm the following standards:

BS 31	MS Conduit and accessories
BS 1378	Galvanized Iron Pipes and accessories.
BS 3595	PVC Pipes and accessories.
BS 4607	PVC Conduits and accessories.

4. MATERIAL

4.1 PVC Conduits, Pipes and Accessories

The PVC conduits and accessories for lighting and power circuits shall be standard manufactured length of high tensile strength and sufficiently flexible to provide resistance against breakage. It should not dent or flatten under pressure and it should be chemical resistant to chemical action of the atmosphere. The conduit shall be self extinguishing and should not support combustion.

The PVC conduit withstand against concrete additives, electrolysis, corrosive

atmosphere, soils, salts or excessive humidity and should be non-magnetic to reduce voltage drop and minimize power loss. The conduit should be non-conductive & non-sparking.
The PVC bends shall have enlarged ends to receive conduit without any reduction in the internal diameter at joint. Manufactured smooth bends shall be used where conduit changes direction.

The round PVC junction boxes for ceiling light or fan points shall have minimum dimensions of 64 mm diameter and 64 mm depth. The junction boxes for wall light points shall have minimum dimensions of 57 mm diameter and 40 mm depth. Round junction boxes shall be provided with one piece Bakelite cover plate fixed to the box by means of galvanized screws.

The PVC pipe shall be rigid and shall be minimum d class, unless otherwise stated on Drawings or Bill of Quantities. For jointing of pipe, all precautions and procedures recommended by manufacturer shall be followed.

4.2 PE Conduit & Accessories

The PE conduits & accessories shall be corrosion resistant, non-toxic, light weight, impact strength, weld ability and abrasion resistance. It should be manufactured as per ISO 4427 and other international standards.

4.3 MS Conduit and Accessories

All conduits shall be of 16 SWG steel, manufactured and tested in accordance with latest relevant standards.

The conduit shall be protected by two base coats of red oxide (antirust paint) and finished in first quality black enamel paint. The coating shall be of heavy enamel, which shall not flake or crack during installation and handling. Each conduit length shall be furnished with threaded ends and a threaded coupling at one end. Soft metal bushes shall be provided at conduit termination to prevent damage to cable during pulling operation.

Junction boxes shall be 100 mm square, having minimum depths of 38 mm or 65 mm as required for accommodating the number of wires. The junction box shall be 16 SWG sheet steel provided with anti-corrosion paint and finished in heavy black enamel paint. The cast Iron outlet boxes for light points shall be round having 50 mm diameter and 63 mm depth. The above dimensions are given as minimum only, and the exact size shall be determined by the Contractor keeping in view the ease of Installation and maintenance. All outlet boxes and junction boxes shall be provided with one piece Bakelite cover plate of suitable design.

4.4 Galvanized Iron Pipes and Accessories

The G.I. pipes shall be galvanized from inside and outside by hot dip galvanizing method. The pipes shall be free from stains, burrs or any other defect. The accessories for G.I. pipes shall be galvanized from inside and outside. The conduit shall be NPT threaded, with at least 5 complete threads and assembled with TEFLON tape.

4.5 Inspection Boxes / Pull Boxes

The rectangular inspection boxes or pull boxes shall be of 16 SWG heavy gauge, sheet steel having nipples welded to box at entry holes to receive PVC conduit with force fit. The box shall be painted inside and outside with black enamel paint over a base coat of red oxide primer paint. The minimum length of inspection box shall not be less than six times the cable manufacturer's recommended bending radius of the cable. All concealed type pull boxes shall have ebonite sheet of appropriate size fixed to the box by means of galvanized screws.

4.6 Pull Boxes

Pull boxes shall be made of 16 SWG sheet steel box, painted and finished to the same quality as the light Distribution Board. The boxes shall be 50 mm in depth for conduits up to 25 mm diameter, 63 mm in depth for conduits up to 40 mm diameter and 87 mm in depth for conduits up to 50 mm in diameter. For conduits more than 50 mm in diameter, the minimum depth shall be two times the diameter.

4.7 Conduit / Pipe Accessories

Bushes, plugs, glands, etc., shall be of brass and all male bushes shall be of long thread pattern. Covers for boxes shall be screw fixed and finished as the boxes. Gaskets shall be fitted only when finish is galvanized unless otherwise specified.

5. INSTALLATION

The contractor shall provide all conduits & accessories for the installation as required. The drawings shows the approximate & terminal points of conduits. However if for any reason the contractor desire to use any alternative route, he may do so at his own responsibility without interference with other installations and get the prior written permission from Engineer.

Conduits shall be run atleast 150mm from flues, steam or water pipes. Where multiple conduits runs, these shall be arranged symmetrically to present a uniform and neat arrangement. The minimum size of conduit shall be 20mm diameter unless notified otherwise. Conduits are installed to confirm the location of conduit to avoid obstructions, furnaces, hot lines & other places of high temperature.

5.1 PVC Conduits - Concealed

The conduit shall be installed concealed in roof, wall, column, etc.

At all joints and bends, PVC jointing solution of approved make must be used to

strengthen and to seal the joint.

Manufactured smooth bends shall be used. Bending of conduits by heating or otherwise will be allowed in special situations only, for which the consent of the Engineer shall be required. The use of 90 degree bends and tees will not be allowed.

The conduit shall have a minimum of 38 mm cover of concrete. The conduit shall be laid above the steel of the slab and shall be firmly secured by tying to steel. Under any circumstances RCC structures chiseling not to be made.

All outlet boxes to be firmly supported and installed such that they finish flush with the soffit of slab or beam.

Where conduits have to be concealed in cement concrete work or in block masonry, the chiseling shall be made with appropriate tools and shall not be made deeper than required. The conduit shall than be fixed firmly in the recess and covered with cement concrete mixture to have to at least 25 mm cover before plastering. The work of curing in the cement concrete work or block masonry work shall be coordinated with the civil work. The Contractor shall obtain approval from Engineer for the route, to suit the site conditions before starting chiseling and cutting.

The termination of conduits at or near the Switchboard / Distribution Board is shown diagrammatically on the drawing. The exact locations of the termination shall be confirmed with the Switchboard / Distribution Board to be installed. Conduit ends pointing upwards or downwards shall be properly plugged in order to prevent the entry of foreign materials. All openings through which concrete may leak shall be carefully plugged and boxes shall be suitably protected against filling with concrete. At all termination of concrete, soft bushes shall be fixed to prevent sharp edges of conduit ends from cutting or damaging the wires or cables to be pulled through them.

The entire conduit system shall be installed and tested before plastering. Any obstruction found shall be cleared by use of cutting mandrel or other approved device and the conduit shall be cleaned out. Water that has entered in conduit shall be removed by drawing swabs through the conduit. No cable shall be pulled until the water has thoroughly dried out.

Pull boxes / Adaptable boxes shall be provided in conduit runs wherever required to facilitate pulling operation. The drawings are diagrammatic and do not indicate the position and spacing of pull boxes or adaptable boxes. However, these shall meet the following requirements:

- Pull boxes.
  For straight runs the spacing shall not be more than 30 meters.

For runs with one 90 degree bend, the spacing shall not be more than 15 meters.

- Adaptable boxes.
  For conduits up to 25 mm diameter, the boxes shall be 50 mm in depth.
  For conduits up to 40 mm diameter, the boxes shall be 63 mm in depth.
  For conduits up to 50 mm diameter, the boxes shall be 87 mm in depth.

Wherever the conduit lengths cross the expansion joint either along the column or slab, suitable arrangement shall be provided so that when the conduit lengths in the expansion joint are stressed, the conduit neither develops any cracks nor breaks down.

Bending, offsetting and similar operations shall be performed through the help of proper bending tool to give a perfect bend of required angle without Desha ping of conduit to the least.

5.2 Conduits on surface

a. The conduits accessories shall be firmly held with the surface of walls by means of PVC saddles, clamps, brackets etc. Rawal plugs or Phil plugs must be used for fixing such saddles etc. The saddles shall be fixed at an interval of 750mm, depending upon the size & weight of conduit. The MS clamps, brackets etc shall be painted anti-corrosion paint before and after fixing.

b. In all areas where the conduit is exposed to damp or wet conditions, brass or stainless steel screws must be used for fixing.

SECTION - E
WIRING ACCESSORIES

1. SCOPE OF WORK

The job consists of supply, installation and commissioning of switches, switch sockets, etc., and miscellaneous items as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

2. GENERAL

The locations of the wiring accessories such as sockets, switches etc. are tentatively shown on the drawings. The Contractor shall ensure exact positions and locations of wiring accessories in coordination with other services drawings, as per site requirements and as directed by the Engineer. The Contractor shall be responsible for proper functioning of wiring accessories after installation and Commissioning.

3. STANDARDS

All wiring accessories shall confirm to the following international standards:

- BS 67 Ceiling roses.
- BS 1363:1984 13A fused plugs and un-switched socket outlets
- BS 116 Two and three terminal ceiling roses.
- BS 2135 Capacitors for radio interference suppression
- BS 3676 Switch for domestic and similar purposes.
- BS 4934 Safety requirements for electric fans and regulators.
- BS 5060 Performance of circulating fans and their regulators.

4. MATERIAL

4.1 Switches

Switches for controlling light and fan points shall be single pole, rated for 10 Amp, 250 VAC. The body of switches shall be made of poly carbonate / urea with white face plate suitable for flush mounting on sheet steel outlet box. The switches shall be gang type having silver tipped contacts and operate with snap action.

The fixing of plates on outlet boxes shall be means of flat head counter sunk galvanized screws with the head of the screw finish flush with the surface of the plate. Except for switches controlling light points, all single switches for fans, sockets, etc., shall have

identification symbols on the operating levers.

Two way switches shall be used to control lights from two different locations as shown on the drawings.

4.2 Switch Socket Outlets

Switch socket units shall be conformed to BS 1363. 2 and 3 Pin rated for 5 Amps. or 2 Pin rated for 5 Amps, 250V.

3 Pin 5 Amps./15 Amps switch sockets shall be mould type having white plastic face plate, suitable for mounting on a sheet steel box of appropriate dimensions. Switch sockets shall have shrouded live contacts such that the earth pin is engaged to socket earth before making with the live contacts. Where specified, the switch socket unit shall have spring loaded dust tight cover for mechanical protection.

4.3 Sheet Steel Boxes

The outlet boxes for installation of switches, fan dimmers and socket outlets shall be 16 SWG sheet steel having appropriate dimensions. The boxes shall have suitable knockouts or welded nipples for receiving the conduits. An earth terminal shall be provided for connecting at least three earth wires of 4 sq. mm. The outlet boxes shall be given two coats of anti-corrosion red oxide and one coat of enamel before installation. The boxes shall be suitable for mounting flush with the surface of wall or on the surface of wall as may be required. The boxes shall not be less than 75 mm x 75 mm (3" x 3"). All boxes shall be water tight where installed in the vicinity of liquids.

4.4 Ceiling Rose

The ceiling rose shall be suitable for 5 Amps. 250V AC. It shall have white plastic molded base plate, copper or brass terminals for connecting at least two wires of 2.5 sq. mm size. The ceiling rose shall have a cover with cable inlet hole for multi-core PVC insulated and PVC sheathed cable.

4.5 Fans

The fans shall comply with BS 380 as far as constructional requirements, range of fan speed, speed regulator starting, radio interference silent operation and temperature rise is concerned. For testing BS 848 as amended 1 960 shall be complied with.

4.5.1 Ceiling Fans

The ceiling fans shall be three blades capacitor type, mounted with ceiling by means of pre-installed fan hook. The fan shall be suitable for operation on 250V AC with $\pm$ 10% tolerance.

The sweep of the fan shall be as given in BOQ drawings. Fans shall be supplied complete with fan coil unit, capacitor, suitable fan rod, canopy etc.

4.5.2 Bracket Type

The bracket type fans shall be suitable for mounting on the wall and suitable for operation semi-horizontally. These shall operate satisfactorily on 250 volts, single phase, 50 Hz, A.C. supply with + 10 % tolerance.

The sweep of the fan shall be as given in BOQ/drawings.

4.5.3 Exhaust Fan

The exhaust fans shall be three blade types, mounted on the steel/plastic structure of its own, which will be fixed to the structure by means of suitable grouted foundation bolts. The fan shall be suitable for operation on 250 VAC with + 10 % tolerance.

The sweep of the fan shall be as given in Bill of Quantities/drawings. Fans shall be direct driven and supplied complete with electric motor, back draft dampers and anti-vermin screen. The bearings shall be ball, roller or sleeve type of permanently lubricated and sealed type. Wheels shall be heavily and rigidly constructed and accurately balanced both statically and dynamically and free from objectionable vibration or noises.

SECTION - F
LIGHT FIXTURES

1. SCOPE OF WORK

The job consists of supply, installation and commissioning of all light fixtures as specified herein and / or shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact location/positions of light fixtures.

2. GENERAL

The Contractor shall submit samples of each and every light fixture specified and obtain approval of the Owner/Engineer before purchasing. The quality and finishes of local make light fixtures (if mentioned in BOQ) shall be same as that of standard manufacturer.

All fixtures shall be finished in standard color schemes as mentioned in the manufacturer's catalogue for respective fixtures, unless specifically stated in the Specifications, Drawings or Bill of Quantities or directed by the Engineer.

3. STANDARDS

The light fixtures shall confirm the following standards:

- IEC 81 Tubular fluorescent lamps.
- IEC 82 Ballast for tubular fluorescent lamps.
- IEC 155 Starters for fluorescent lamps.
- IEC 400 Lamp holders and starter holders for fluorescent lamps.
- IEC 566 Capacitors for use in TL, HP Mercury and LP sodium vapor.
- IEC 598 Luminaries.
- BS 3677 Discharge lamp circuits.

4. MATERIAL

4.1 Fluorescent Light Fixtures

The fluorescent light fixtures shall have lamps and ballast of proper rating as shown on the drawings. Each lamp shall be provided with independent ballast.

The fluorescent lamps shall be tubular type and 36/18 watts. The fluorescent color shall be warm white characteristics with an average output of 3350 lumens (+5%) for 36

watts and 1350 lumens (+5%) for 18 watts after I00 burning hours. The ballast shall be polyester filled type, totally enclosed and suitable to operate up to 250 VAC. The power loss shall not be more than 9 / 6 watts for watts ballast. A wiring, diagram, wattage, voltage and current figures shall be printed on the body of the ballast.

The lamp holders shall be rotary lock-in type. The starters shall be glow type with radio interference suppressor / by-pass capacitor. The internal wiring of the fluorescent light fixtures shall be done with heat resistant wires at the manufacturer's factory. All light fixtures shall be provided with power factor improvement capacitor to give a minimum power factor of 0.90.

The body of the fluorescent light fixtures shall be minimum 22 SWG sheet steel, de-rusted, degreased, finished in heat resistant paint, stove enameled. Appropriate size bushed wire entry holes, fixing holes and earth terminals shall be provided. Connectors suitable for connecting 2.5 sq. mm cable connectors shall be provided for supply connections. An earth terminal for connection to 2.5mm sq. wire shall be provided.

The light fixtures shall be furnished with perpex diffusing panels " 040 opal acrylic" (minimum sheet thickness 3 mm), polystyrene louvers or metal grid louvers or mirror optic reflectors, etc. as specified on the drawings or in BOQ. The louvers shall be secured firmly and in level. The polystyrene louvers shall be white Egg Crate or as approved. The louvers shall be in one section and not in pieces.

The design of light fixture for recess mounting shall be coordinated with the design of false ceiling prior to commencement of manufacture.

4.2 Incandescent Light Fixtures

The light fixture shall be finished in standard colors unless otherwise stated on drawings or directed by Engineer. All incandescent light fixtures shall be of international standard and quality. This type of fixtures with manufacturer catalogue reference are given on the fixture schedule and in Bill of Quantities. Equivalent fixture may be acceptable provided that the Contractor submits for review all necessary data indicating photo-metric curves to show that the fixture proposed are of the same type, construction and quality.

The lamps for incandescent light fixtures shall be GLS/EPLC lamps and shall be supplied and installed according to the wattage as indicated on drawings.

Weather proof bulk head incandescent light fixture shall comprise of cast aluminum body and gas-kitted clear glass cover secured to the body by means of galvanized nuts / screws to give a weather proof and water tight fit. A wire guard shall be provided for protection of front glass against mechanical injury. The gasket shall be weather resistance type. A G.I. wire guard shall be provided on the glass cover. The lamp holder

shall be of bi-pin brass having porcelain outer ring.

The glass shade of light fixtures shall be opal white or clear and free from any air bubbles or voids. The shade may be spherical, cylindrical, flattened bottom or any other shape as specified in the drawings or BOQ. The glass shall be opal white or clear as furnished by the manufacturer with the light fixture unless specified.

4.3 water proof light fixtures

The underwater lights shall be suitable for 24V, 80Hz Dc. The DC supply shall be available from a step down transformer. The fixture shall be completely water tight and shall have scaled reflector flat lamps.

4.4 flood light fixtures

The flood light fixtures shall have cast aluminum body, angle adjustable stand, polished mirror reflector and clear front glass. The flood light fittings for outdoor use shall be weather proof type having rubber gas-kit ring to fit of the front glass.

5. INSTALLATION

5.1 General

The mounting heights of light fixtures are indicated on the drawings, and position of fixtures according to the mentioned scale.

The Contractor must ensure that the light fixtures are installed uniformly with respect to the dimensions of the area. Any modifications due to site conditions may be made with the approval of Engineer. All fixtures shall be carefully aligned before fixing in position. All fixing accessories such as ceiling rose, flexible cord, lamp holder, suspension rod; pipe or chain with suitable canopy, etc., shall be provided and installed.

The wiring between ceiling rose or terminal box of the fixture shall be carried out with 3 core 0.75 sq. mm, PVC / PVC cable. The wiring inside light fixture body shall be done with heat resistant cables or PVC insulated cable in heat resistant sleeves as approved by the Engineer.

Glasses, shades, reflectors, diffuses, etc., must be in a clear condition after installation.

All light fixtures shall be earthed by an earth wire connected to the earth terminal in the fitting.

5.2 Fluorescent Light Fixtures

The fluorescent light fixtures on the surface of ceiling shall be installed with the back of the body flush with the ceiling surface, and in a manner so as to facilitate wiring. Nylon plugs and galvanized steel bolts or screws shall be used for fixing the light fixture to the ceiling. The recessed type shall be light fixtures installed on false ceiling, the

installation method detail shall be coordinated with ceiling design and submitted for approval of Engineer. The installation shall include cutting and making of holes in false ceiling. Care shall be taken to prevent the weight of the fixture from being transferred to the false ceiling.

Pendent light fixtures shall have two holes in the top of each casing by a 1/4" diameter galvanized pipe or any other standard method as approved by the Engineer. Wiring from ceiling rose to the fixture shall be installed through the pipe. Proper arrangements such as long threads with check nuts, etc. for minor adjustment in the mounting heights of the fixtures shall also be provided.

5.3 Incandescent Light Fixtures

The incandescent light fixture shall be installed on the surface of ceiling or wall by means of nylon plugs and galvanized steel screws, such that their back finish flush with the surface for exposed conduits and flush with outlet box for concealed conduit system. Wherever convenient, screws for fixing light fixtures shall be screwed into the holes of the outlet box. The light on false ceiling shall be installed in a manner as described for fluorescent light fixture.

5.4 Outdoor Lighting

For illumination around buildings during dark hours, light fittings in various arrangements shall be provided in accordance with these specifications. The items not shown on drawings or called for, but which are necessary for a complete working system as required, these shall also be provided and deemed to have been considered as such.

In case, the specified materials and equipment are not used, the Contractor shall then essentially use the standard products of a manufacturer, regularly engaged in the manufacturer of the product and shall meet the requirement of the specifications.

5.5 Emergency lights:

- The emergency light fixtures shall be IP 65 polycarbonate construction suitable for interior/exterior applications. The florescent lamps shall be 2x8Watt, T-5, and batteries shall be self contained version – sealed nickel cadmium.
- The fixtures shall be suitable for ceiling/wall mount.
- The duration for emergency lights shall be 3 hours, maintained and non-maintained operation.

SECTION - G
EARTHING SYSTEM

1. SCOPE OF WORK

The job consists of supply, installation and commissioning of all material and services of the complete earthing system as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

2. GENERAL

All exposed conductive non-current carrying parts of switchgear, boxes, trays, fixtures etc should be efficiently earthed. It should be separate with the earthing of transformer or generator.
The earthing system consists of earth electrodes, earthing leads, earth connecting points, earth continuity conductors and all accessories necessary for the satisfactory operation of the associated electrical system.

3. STANDARDS

Following standards should be applicable:

BS 951 Earthing Clamps
BS 1433 Hard drawn bare copper conductor for earthing.
BS 2874 Nuts, Bolts, Washers and Rivets for use on copper.
BS 6346 PVC Insulated Cables.
CP 1013 Earthing

Any other standard referred to in above standards or these specifications.

4. MATERIAL

4.1 Earth Rod Electrodes

Drive extensible rods of the same diameter into the ground, either manually or by power driven hammer, to a suitable depth to obtain low resistively in the particular soil.
Weld earth connectors to the top of the rods, in sufficient number to take all incoming cables.

4.2 Earthing Lead

The earthing lead shall connect the earth electrode to earth connecting point or equipment in the building. It shall be round hard drawn bare electrolytic copper of size shown on the drawings.

4.3 Earth Continuity Conductor

Earth continuity conductor (E.C.C) shall be hard drawn bare copper wire or single core PVC insulated copper conductor cable of sizes indicated on the drawings. All thimbles, lugs, sockets, nuts, washers and other accessories necessary for the complete installation of ECC shall be provided & installed.

The earth continuity conductor should form a continuous path from any point of installation to the earthing sets. When two earthing sets are provided for same mains, these shall be at least 6m apart. The earthing lead shall be taken up to the earthing electrodes in a 32mm of G.I. pipe irrespective of wiring system, and shall be efficiently bounded to the earth electrodes by means of sweating socket, brass nut, bolts, etc. to make a permanent and positive connection with the earthing electrodes. The other end of the earthing lead shall be sweated into a cable lug of a correct size for the wire for its connections to the main apparatus to be earthed.

5. INSTALLATION

The earthing system shall give earth resistance, including resistance of soil, earth leads and E.C.C. equal to less than one ohm, without ground pits water spraying.

The fastening of the earthing conductors shall be made on a sufficient length so as to prevent crushing or cross section weakening. The parts on which they are connected shall be conveniently cleansed and surface.

Leads sheaths or steel tape amours are not permitted as earthing conductors. The earthing system shall be installed to ensure that when any part of the earthing system is disconnected for the purpose of carrying out periodic testing an alternative path to earth is available.

At all connections of earth continuity conductor to any metallic body, proper size or brass sockets, thimbles or lugs shall be used to which the copper wire shall be connected by copper brazing. The soldering of copper wire at joints or termination shall not be allowed. All tee-off connections shall be by copper brazing using suitable socket and clamps. After brazing, the jointed surface shall be protected by oxide inhibiting compound of low electrical resistance. For connections to metallic body, the surface shall be thoroughly cleaned before bolting the lug or socket.

The earth continuity conductor shall be generally run in cable trench or in conduits / pipes or in cable trays as shown on the drawings. For under floor runs, these shall be installed in pipe / conduit of appropriate sizes. Where laid along underground cables, these shall be laid directly under ground in unpaved areas and in pipes under paved areas.

The electrode plate shall be installed at a minimum depth of 5 meters from finished ground level or I meter below permanent water level, whichever is less. The minimum horizontal distance between earth electrodes shall be 3 meters. Proper mixture of lime and charcoal in the ratio of 1:3 shall be made and buried along with the copper plate in the ground to increase the soil conductivity. The electrode shall be installed as per details shown on the drawings. The

inspection chambers shall be constructed at locations approved by the Engineer.

A 50 mm diameter UPVC pipe shall be provided from inspection chamber to earth plate for watering purposes. The pipe shall have 10 mm diameter holes at 500 mm center to center all along the length. At the ground level an inspection chamber with cast iron cover shall be constructed having dimensions as shown on the drawings. The inspection chamber shall have a copper supported on angle iron frame. The cover shall be hinged type, as approved by the Engineer and shall finish flush with the ground level.

The earth connecting point shall be installed at locations shown on the drawings. It shall be fixed on wall surface by means of brass screws with nuts, washers and other insulating material as instructed by the Engineer.

The earth continuity conductor of sizes shown on the drawing shall be installed all along the cable runs and connected to the earthing bar / terminals provided in the equipment.

At any joint or termination, the E.C.C. shall be connected using proper accessories. No connection shall be made by twisting of earth conductors.

SECTION - H
STANDBY GENERATOR

1. GENERAL

The project is designed to have standby generator. It shall serve lighting, sockets and air handling units, lifts, telephone exchange, fire and security room, server room, CCTV system

and any other use as may be defined by the CONSULTANTS, within the confines of its capacity.

2. GENERATOR INSTALLATION

Generator unit shall comprise of diesel engine and alternator assembly directly coupled by alignment flange mounted on rigidly constructed base frame provided with anti-vibration mounting pad, mounted on skid under base frame (double base frame).

The generator set shall be auto-mains failure type and manufactured as per B.S. 5649 and B.S. 2613.

3. CABLING & CONTROL WIRING

Generator panel shall be separately mounted, cubicle design, floor mounted incorporating circuit breaker, voltmeter, ammeter selector switches, indication lamps KWH meter. The CONTRACTOR will be required to install the panel and make necessary power wiring between generator, generator panel and change over switch. He will also be required to provide necessary interconnections of low current control cabling.

4. EXHAUST PIPING WORK

From engine, exhaust pipe shall be laid to muffler and onward to the exterior. The exhaust pipe shall be 150mm dia. MS pipe. The pipe shall be wrapped with asbestos or glass wool insulation. The pipe shall be securely and firmly supported to structures. The hangers shall be strong enough to hold and withstand thermal expansions and vibrations. At the end of exhaust piping, rain protection canopy shall be provided.

5. BIRD GRILL & RAIN GUARD

At the neck of radiator, the radiator exhaust shall be directed to atmosphere from basement roof through flexible exhaust duct. The duct shall be fabricated of 1.6mm G.I. Sheet having U-section fixed to canvas bellows of good thickness.

Bird grill shall be provided against the canvas bellow and shall match the size of radiator opening and shall be approximately 900 x 1200mm or as per manufacturer's requirements, in size made of 10 SWG G.I. wire. The grill shall be complete with angle iron framing and holding down hardware.

Rain guard shall be provided next to bird grill to protect radiator from rain. It shall be fabricated of 12 SWG G.I. Sheet and shall be complete with framing and holding down hardware.

6. FUEL PIPING & FUEL PUMP

Fuel piping shall be provided from barred drums to daily service tank, from service to engine and residual fuel from engine to daily service tank. The pipe shall be 25mm dia. M.S. with threaded coupling. Necessary gates/valves are required at different stage shall be provided.

For the transfer of fuel from barred drums to daily service tank hand operated mono-pump together with necessary flexible piping shall be provided.

7. APPROVAL FROM ELECTRIC INSPECTOR

The generator installation requires approval from Electric Inspector. The CONTRACTOR will arrange approval from the inspector, and any modifications required for such approvals shall be done by CONTRACTOR at his own cost.

The generator room is required to have necessary operation and maintenance charts, voltage and caution signs, rubber mats, etc the CONTRACTOR will take care of the same.

SECTION – I
LIGHTNING PROTECTION SYSTEM

1. GENERAL

The system of lightning protection shall be installed so as to protect the building against lightning.

2. QUALITY ASSURANCE

Engage an experienced manufacturer who produces system components made of high quality materials as listed herein. Engage an installer who is listed or who is certified by the Lightning Protection Institute as a Master Installer.
Life service of the materials used shall not be less than 30 years.
Lightning protection shall conform to BS-6651.

3. SEQUENCING AND SCHEDULING

Coordinate installation of lightning protection with installation of other building systems and components, including supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

4. COMPONENTS:

a) Air Terminal

It shall be of taper pointed copper air terminal 1000 mm long 15 mm diameter with base and installed above the finish floor level. The air terminal shall be complete with single pointer rod of high tensile brass bar, it shall be reinforced so as to withstand the excessive pressure of air during storms. Use all accessories for fixing as recommended by the manufacturer. All accessories shall be made of copper. Bare copper tape shall be of copper, minimum 25 x 3 mm size similar to Furse TC-030 or equal.

b) Down Conductors

70sqmm PVC Copper conductor in surface GI pipe connected to tape protective conductors on roof down to the test link for earthing as indicated on the drawings. Each down conductor shall be equipped with independent testing points, earth termination lead & earth. The earth termination lead shall be of copper strip as per drawing.

The whole of the earth termination network should have a combined resistance to earth not exceeding 10 Ohms without taking into account any bonding to other services.

Provide horizontal bonding tape around the building at every 10 meter as per BS Standard.

5. INSTALLATION

Install lightning protection as indicated, according to manufacturer's written instructions.
Comply BS-6651.
Install conductors with direct paths from air terminals to ground connections. Avoid sharp

bends and narrow loops.

Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing.

Bond extremities of vertical metal bodies exceeding 60 feet (18m) in length to lightning protection components.

6. CORROSION PROTECTION

Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials.

Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

7. FIELD QUALITY CONTROL

Periodic Inspections: Provide the services of a qualified person to perform periodic inspections during or after completion of building.

SECTION – J
POWER TRANSFORMERS

1. SCOPE

The scope of this section of specification is to supply install, test and commission the transformers. The transformers shall be installed at locations shown on the drawings. For installation details the manufacturer's recommendations is to be followed.

2. SPECIFICATIONS

Transformers shall be from manufacturer's standard range complying with the requirements of the IEC 726 standards and shall be capable of delivering full rated output under the Site climatic conditions.

Transformers shall be of the indoor, Dry type, naturally circulated, naturally cooled, hermetically-sealed type, manufactured by SIEMENS or approved equal.
The step down transformer shall meet the following specifications.

-	Type	:	ONAN
-	Voltage ratio at no-load	:	11000 / 3300 volts.
-	Frequency	:	50 Hz
-	Vector Group	:	Dy 11
-	HV connection	:	11000 V Delta
-	LV connection	:	3300 V with grounded star point.
-	Impedance voltage	:	4.5% to 6%
-	Voltage regulation for rated operating condition at O.85 P.F.	:	Not to exceed 2.5% of no-load secondary voltage.

The transformers shall be provided with the following accessories.

- Double float Bucholz relay for alarm and tripping with testing facility.
- Silica gel breather, with oil bath
- Lifting Jugs
- Bi-directional rollers.
- Pressure release safety valve.
- Temperature protection system with thermostat & protection relay.
- Anti Vibration Pad
- Earth terminal
- Dial level gauge
- Dial type thermometer with maximum temperature indicator pointer.
- Diagram and name plate
- Pressure Release safety valve
- Off-load tap changer fitted with position indicator and pad-locking arrangement.
- HT porcelain bushings with protective spark gaps.
- LT and neutral porcelain bushings.
- Cable Termination Box on LT and HT side

Maximum winding temp rise shall be 40 degrees centigrade and top oil temperature rise shall be 60 degrees centigrade over ambient temperature.

Neutral (star point) of the secondary windings shall be brought out and earthed directly to the sub-station earthing system.

(i) Tapings

Transformers shall be provided with tapings on the HV windings, at plus/minus 2.5% ,5% & 7% of nominal and shall give their full rated output on any tapping. The tap changer shall be an

externally operated off-load device of robust construction, especially designed against risk of damage from short circuits and having all contact surfaces of ample area for satisfactory operation during overloads.

The mechanism shall be manually operated and shall come to rest only when the switch is making full contact. At all times, clear indication shall be given of the ratio at which the transformer is operating. Means shall be provided for locking the tapping switch mechanism in the position corresponding to each voltage ratio.

(ii) Construction

The transformer tank shall be of sheet steel construction suitably stiffened so that the transformer may be lifted and transported without permanent deformation. The transformer shall be fitted with lugs suitable for lifting and jacking the complete unit. The tank shall be provided with a skid under-base with removable wheels to allow the transformer to be moved in any direction.

Tanks and covers shall be designed such that there are no external pockets in which water can collect.

Tank and terminal box joints shall be fitted with gaskets to prevent entry of water. Gaskets shall be of a suitable non-absorbent material. Joint faces shall fit properly and no additional thickness or jointing shall be used to make good irregularities.

The top cover shall have a substantial flange and adequate number of bolts fixing the cover to a similar substantial flange on the transformer tank. The gasket provided at this joint shall be of synthetic rubber bonded cork. Conservator tank shall be provided with Silica gel breather to allow for expansion of oil.

The initial filling of oil shall be carried out at such a temperature that the pressure in the tank is at a minimum. The space above the oil shall be evacuated and filled with dry clean nitrogen. The pressure of nitrogen inside the top cover shall not exceed 0.35 kg/sq.cm. A pressure relief diaphragm device shall be incorporated in the top cover having a bursting pressure of 0.56 kg/sq.cm.

(iii) Instrumentation

Fluid filled transformer shall be provided with:

a thermometer having a re-settable pointer for registering the maximum oil temperature
Bucholz relay with alarm & tripping features.

(iv) Rating Plate

The transformer shall be provided with a rating and diagram plate made from stainless steel.

(v) Earthing

Transformers shall be earthed by means of substantial connections to the tank or case and terminals for this purpose shall be provided at the base of each unit.

(vi) Cable Boxes

Cable boxes shall be provided for the cable connections to the primary and cable/bus duct to the secondary windings. The cable boxes shall be suitable for use outdoors and for bottom/top entry cabling. The boxes shall be air-insulated type, suitable for XLPE/PVC cable/copper bus duct. The cables shall be terminated using the heat shrink termination method.

SECTION – K
UNDERGROUND TRENCH & PIPES

1. UNDERGROUND TRENCH

i. The underground trench for installation of underground cables and wires through pipes, etc. shall be provided internally and externally as shown on the drawings. While the routes for external runs are to be followed taking into account clearance from underground sanitary and water supply pipe lines, etc., those required internally are dependent upon the type and size of equipment being installed in the substation and equipment rooms, etc., and hence this shall have to be specially modified on the basis of the requirements of the equipment manufactures or suppliers.

ii. The layout and the design of the duct shall be approved by the CONSULTANTS before actually commencing the work on it. All other trades shall have to be coordinated while deciding the alignment of underground trenches. The construction of the trench shall be totally water proof such that no seepage or leakage of water takes place either from top, bottom, or sides.

iii. The cables/pipes shall be supported to two horizontally placed metal supports of 37mm x 6mm angle iron and duly clamped at interval not exceeding 750mm. A covering of 3.8mm thick of soft but indestructible by heat material shall be applied to un-served cables. The supports shall be staggered as detailed in Drawings.

iv. The angle iron shall be buried in the trench masonry at the time of construction.

v. The trench shall be absolutely clean when the cable is laid.

vi. Suitable slope shall be provided in the floor of the trench and the lowest point shall be connected to the drainage system so as to ensure self-drainage of water, if any.

vii. Trench inside the building shall be covered with 5.5mm, M.S. checkered plates.

viii. The trench outside the building shall be RCC/UPVC pipe of required diameter with watertight joints, and shall be laid at least 2 below grade.

ix. The main holes of the trench shall be left open till cable is pulled in and positioned. Thereafter the trench shall be covered with RCC slabs and mortar.

x. The main hole covers outside the building shall be of cast iron water proof type of the size of openings indicated on the drawings. The covers for the inside trench however, shall be of 5.5mm thick checkered plates.

xi. The CONTRACTOR shall arrange to provide for a water tight entry of cables where these enter in the building. This shall be done by the use of UPVC/CC pipes provided one for each cable in a reverse slope and with bitumen filling of the end.

xii. Where trenches are left open overnight and where roads are being cut in the day or night; the CONTRACTOR shall exhibit suitable danger signals such as banners, red flags and red lamps at his own cost.

xiii. If any damage is done, to the existing cables, etc., the cost of making goods such damages or entire replacement shall be recovered from the CONTRACTOR.

xiv. The road cuts and filling shall be filled up and suitably watered and cement shall not be laid until all subsidence stops and no time shall be lost in putting the cement concrete. Wet gunny bags shall be spared over it for a period of not less than three days in order to allow full setting of the cement concrete.

xv. All the trenches shall be watered and rammed properly before final dressing. The same applies to lawns public or private but here in place of cement filling some manure of good quality shall be utilized. The turf shall be carefully rammed and preserved in a convenient place before excavation and shall be re-laid after filling up, watering and maturing is completed.

xvi. The road cuts shall be filled up first with mud concrete in the proportion of 1:2 up to 150mm below the road level and after consolidating it properly 150mm of concrete in cement shall be laid over it, but in the case of bitumen surface of road the top dressing are to be adjusted.

xvii. The trenches shall be dug until the CONTRACTOR is certain that the cable is available for laying in it.

xviii. Wherever cables are required to be installed inside a Building or in any other masonry or channel work, it shall be done neatly by use of cleats or any other device as directed by the CONSULTANTS.

xix. Cement concrete pipes or G.I. pipe whichever is required shall be provided for all road crossings and nothing extra will be paid for these. The size of the pipe will be decided by the CONSULTANTS. These pipes will be laid direct in the grounds without any bed without pacca joint. No sand cushioning or tiles used in such situations.

xx. Cables shall always be laid out or laid into the ground through 200mm long C.C. pipe of suitable size. Nothing extra will be paid for this pipe. A reasonable length of cable in the form of coil shall be left at ends of the underground run of the cable for subsequent use.

xxi. Where road berms have been cut or curb stones displaced, the CONTRACTOR shall repair all damages to the satisfaction of the CONSULTANTS and all surplus earth or rock removed to a suitable dumping place which will be indicated by the CONSULTANTS. Where in the course of excavation lawns or roads have to be cut it shall be done in such a way that the turf removed can be re-laid. If this condition is not fulfilled the OWNER shall get the work done by other agency and recover the cost from the CONTRACTOR.

If any damage is done to any other service during the execution of the work, the whole cost of making good such damage shall be recovered from him and where such damage is excessive or deliberate, it shall amount to breach of the terms of this CONTRACT, the CONSULTANT may at his discretion take appropriate action at the cost of the CONTRACTOR.

Section - L

Cable Tray System:

i. The cable trays shall be fabricated by prime quality 1.6mm MS sheet steel or GI sheet, solid or perforated and painted powder coated RAIL- 7032. Supply and install all accessories like tees, bands, elbows, risers, etc. to complete the cable tray system.

ii. The length should be standard of 2.44 meters.

iii. All fixing or supporting accessories shall also be provided & installed like hangers, brackets, clamps etc.

iv. The cable trays shall be capable to support all type of wiring like high voltage, medium voltage, low voltage etc. it should be fabricated with the standards laid down by NEMA.
For internal areas, it should be mill galvanized.

For external areas, the cable trays and accessories should be hot dip galvanized after fabrication.
After fabrication process, all trays, ladders and accessories (bands, elbows, risers etc like nut, bolts, washers, tees) shall be dipped into liquid zinc bath, the surface including all cut edges being coated with a homogenous zinc layer to provide better protection against low chemical stress, marine air, urban air & other low atmospheric influences which activate

corrosion.

SECTION – M
VOICE & DATA COMMUNICATION SYSTEM

1. GENERAL

The proposed cabling system for the UTP and Fiber network cabling and Fiber Links shall be an open system and application and vendor independent and shall be warranted by an International Vendor for a minimum of 20 years. The contractor Installers (labor) and engineers must be trained and certified by this vendor to design and install cabling system.

A Main Patch Panel (MPP) shall be provided at the server room of the Building. The Patch panels are located as marked in drawings. The cable run from the Patch Panel to the associated outlet is limited to 90m. The cable run must be free of bridges, taps and splices.

Wiring system used shall be star topology i.e. each data/voice outlet is connected directly to Patch Panel. Both ends of the cables shall be labeled to EIA/TIA 606 administration standards.

Transmission Media:

For Data:
Vertical runs between floors extending from the MDF to each Patch Panel in a star topology using fiber optic cables installed in cable trays.

Horizontal runs from a patch panel to the data outlets using CAT-6, 4 Pairs UTP twisted pair cables.

For Voice:

1. Vertical runs between floors extending from the MDF to each JTB using multi pair CAT 5 cables installed in cable tray.

2. Horizontal runs from a TJB to the telephone outlet using 2 Pair telephone cables.

Data & voice processing system shall be supplied installed and tested complete in place including but not in a way of limitation, cables, socket outlets, adapters, connectors, patch panels, 110 wiring blocks, patch cords, cable management, floor distributors (racks/cabinets).

The Cabling System shall be designed using standard, proven equipment and materials with the latest technology version or model. If there is any problem during warranty period related to the shortage of Materials, the Contractor shall supply them with no extra cost.

The design shall fully comply with EIA/TIA 568B & ISO 11801 in a full star topology configuration collapsing in the MDF.

The network data cabling systems support at least 1000 Base-T (Gigabit) Ethernet or faster protocol.

The UTP (unshielded twisted pair) Category 6 cable's technical specifications shall be up to the highest industry standards and should have performance specifications better than 250 MHz and should exceed all proposed requirements for data, video & Gigabit applications.

The UTP Category 6 cable's technical specifications shall be up to the TIA/EIA-568B.2-1 industry standards and should have performance specifications better than 250 MHz and ample margin compared to the Category 6 Standard for performance in factors such as NEXT.

Data & Voice cables may be drawn through the same conduits and raceways & terminated in separate face plates.

2. SCOPE

The contractor shall carefully examine the specifications to ensure that he is fully conversant therewith and has included for everything necessary therein, either expressly provided for or as

would normally be expected to be provided for by a reputable contractor specializing in the type and nature of the Services described in the Contract.

The Contractor is advised that items or matters not specifically provided for, or partially described or otherwise missing from the specifications, but which are nevertheless necessary for the execution and completion of the Services, shall be deemed to have been included by the Contractor.

The Contractor shall ensure that all selected manufacturers of equipment and materials provide with appropriate warranties and guarantees for their products.
Authorized and certified installers registered with their respective manufacturers shall execute the installation of the Cabling system.

The Contractor shall also be required to submit, in their bid, a list of personnel along with their CV, certifying that the installers it intends to employ on the services have the necessary training and experience.

The LAN cabling system shall meet the emerging EIA/TIA 568A/B and ISO 11801 Category 6, Class E specifications and shall support Gigabit Ethernet, Sonnet/asynchronous transfer mode (ATM) at rates (minimum of) 1 GB/seconds and analog broadband video in addition to existing telecommunication and multimedia technologies.

The voice backbone cabling system shall meet the EIA/TIA 568A/B-5 and ISO 11801 Category 5E, Class D specifications.

The Contractor shall carry out all the necessary surveys, design and engineering so as to provide for the Services, a whole and complete system to ensure full compatibility of the Services with any of the existing facilities pertinent to Cabling System applications & operations.

The scope of the Services include the provision of all material, labor, supervision, construction, equipment, tools, temporary, test equipment, spares, consumable and all other things and services required to engineer, design, supply, install, test and commission the Cabling System.

It is the responsibility of the Contractor to make sure that the system works at the company environment.

The Vendor must provide a list of project Reference within the last three years.

The Vendor must have completed a project with a minimum of 1000 points or higher of Category 6
The Vendor must have experience with minimum 500 points of fiber installed and terminated.

3. SUBMITTALS

Product Data: Submit manufacturer's data on signal transmission media and components.

Shop Drawings: Submit layout drawings of computer cable distribution system and accessories.

Wiring Diagrams: Submit data transmission wiring diagrams for computer system, including rack and terminal connections.

4. QUALITY ASSURANCE:

For Manufacturer:
Firms regularly engaged in manufacture of signal transmission media and accessories of types required, whose products have been in satisfactory use in similar service for not less than 5 years.

For Installer:
Firms with at least 5 years of successful installation experience with projects utilizing systems and equipment similar to that required for this project.

Coordinate with other electrical work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of data system with other work.

Sequence installation of data system with other work to minimize possibility of damage and soiling during remainder of construction.

5. COPPER & FIBRE OPTIC CABLE AND CONNECTORS

UTP Copper & fiber optic cables shall be approved & recommended by component manufacturer. This is to enable the component manufacturer to give the necessary product and application warranties for the system.

Provide UTP copper cable, fiber optic cable and connectors, in sizes and types as recommended by the active equipment manufacturer for indicated applications. Mate and match connector materials to factory installed equipment.

Cabling Accessories:
Provide computer accessories, including modular wall and floor jacks, junction boxes, connecting blocks and pre-wired boxes.

The selection and type of material required for the Services shall conform to the specifications given herein and items or matters not specified herein shall conform to ISO/IEC 11801, EN 50173 and EIA/TIA 568B Category 6 Standards as applicable. The Contractor shall also ensure that the materials utilized to complete the Cabling System installation are capable of supporting the minimum expected performance requirements for emerging applications such as ATM services (1.2 GPS), including 10 GB Ethernet. The complete system shall guarantee a minimum of 250 MHz & 100 MHz bandwidth performance and the products shall be from an internationally reputable manufacturer. The selection of materials shall be subject to approval by The Company.

The cables that are used to complete the installation shall be Category 6 UTP, capable of carrying high bit rate signals for extended distances in building distribution systems over frequency ranges up to and potentially beyond 250 or 100 MHz, designed to work on an ISO 11801 Class "E" link.

The cable shall be composed of 23 or 24 AWG bare, solid-copper conductors. The insulated conductors shall be twisted into individual pairs and four such pairs twisted together.

The cables shall be fully color coded as provided hereunder, color contrast being such that each pair in the cable is easily distinguishable from every other pair.

Conductor Identificatio	**Colored Code**	**Abbreviation**
Pair 1	White – Blue Blue – (White)	WT – BL BL
Pair 2	White – Orange Orange – (White)	WT – OR OR
Pair 3	White – Green Green – (White)	WT – GN GN
Pair 4	White – Brown Brown – (White)	WT – BR BR

6. TELEPHONE SYSTEM

6.1 General

The work included under this section consists of furnishing of all labor, services and skilled supervision necessary for the construction, erection, installation and connection of all facilities specified herein and as shown on the drawings and/or normally required for the complete telephone system and its delivery to the owner on completion in all respects ready for use, except the main telephone exchange equipment (PABX) and telephone instruments which will be supplied and installed by the relevant authority in

accordance with the requirements of the PTCL.

6.2 Telephone Services

The telephone service entrance location shall be coordinated with PTCL. For bringing in the service connection and underground UPVC pipe 75mm diameter shall be installed, a minimum 500mm below ground level and as shown on drawings. Pull wire shall be furnished and installed in the pipe line as recommended by PTCL.

6.3 Telephone Conduit System

The telephone conduit system, including telephone outlet boxes, rosettes, junction boxes, etc. shall be generally in conformity with the specifications of similar items given in BOQ and shall be in accordance with the recommendation of PTCL.

6.4 Telephone Junction Boxes

The telephone junction/terminal boxes shall be cubical design of 1.6mm sheet steel fabricated with a hinged door fixed flush with the wall and having built in concealed lock. The color of the box shall be powder coated RAIL 7032, and it shall be installed in such a manner so as to have easy access for service and repair. The TJB shall be vermin proof. It shall be made to accommodate tag blocks with indicating and marking arrangements.

6.5 Telephone Wiring

Wiring of telephone system will be done by multi-core PVC insulated and sheathed cables complying with BSS 2746. The conductor shall be of high conductivity tinned copper diameter 0.6mm. PVC insulated and PVC sheathed. All telephone cables shall be continuous between telephone outlets and junction boxes. All connections shall be made, marked and identified on tag blocks and socket outlets.

7. SPECIFICATIONS OF UTP CABLES:

Cable Type	Category 6 UTP
Conductor Size(mm)	23 or 24 AWG
Number of Pairs	4
Nominal Outer Diameter (mm)	6.0
Impedance(Ohm)	100+/-15
Velocity of propagation (% speed of li	69
Frequency (MHz)	250
Max. Attenuation @ 250 MHz (dB	32.1
Worst case NEXT @ 250 MHz (dB	38.3

8. FIBRE OPTIC & UTP CABLING

The backbone cabling interconnecting distribution cabinets to the main Central distribution cabinet shall be of multimode fiber cable 50/125 microns; 12-core cable with color-coded fibers. All fiber optic cables shall be laid in straight run without intermediate splices and all fibers shall be terminated at either end using suitable fiber cable patch panels mounted on the wiring closets.

All fiber optic backbone links between the main cross connect and the Telecommunication rooms have a backup link using a different route from the main fiber optic link. Each of these links shall be 12-core fiber optic cable as described in this document.

The Contractor shall be responsible for the supply, installation, testing and commissioning of the complete fiber cable backbone interconnection/cross connection requirements of the "building/complex" LAN Cabling System.

The Contractor shall install suitable fiber optic pigtails/connectors needed to complete the entire fiber cable installation as per the manufacturer's recommendation and shall ensure that the backbone is capable to handle the traffic and provide error- free universal data transport for the foreseeable future.
The backbone Fiber optic cable shall be run either vertically between floors or horizontally to connect wiring closets to the MDF.

The 12 core fiber optic cables shall be installed from the Main Cross-Connect to each Telecommunication rooms. The cable shall be tied down to the designated area at the rear side using cable ties around the outer jacket, leaving 2 to 3 meters of excess length of the cables, in addition to the length required to facilitate the termination process.

All of the fibers in the backbone shall be terminated with LC type connectors at the time of the installation. The Contractor shall ensure proper testing of the fibers and make them available whenever they are needed. No fibers shall leave un-terminated, all fibers must be terminated. A document with fiber cable test results for every fiber cable link shall be provided by the Contractor.
The Contractor shall observe the manufacturer's specifications for maximum tension and minimum bend radius for each fiber optic cable. The contractor shall provide a copy of the manufacturer's specifications to the owner prior to the commencement of the work.

Care must be taken when mechanical pulling devices are used, that maximum tension limits are not exceeded. Minimum bend radius specification shall not be violated when the cables are routed through walls or around corners. The contractor shall ensure that all installation personnel are aware of these limitations.

The Contractor shall follow an intelligent numbering system based upon the destination and channel number. The numbering system shall have a prefix 'F' to indicate it is a fiber optic

cable, followed by the destination IDF, then a hyphen and the channel within the cable.

100 pairs UTP shall be installed between the Telephone MDF and the Voice/Data MDF. This cable shall be of category 5, 100 MHz and shall be terminated in a rack mounted patch panels installed in the telecommunication closet at the MDF.

Multi-pair, CAT 5, 100 MHz UTP cable shall be installed as backbone between the voice MDF to the IDF in each floor/location as indicated in the drawings.

Logical labeling should be as per ANSI/TIA/EIA-606. Labels should be ring and printed type. No labels should be written by hand.

9. OPTICAL FIBRE CABLE TECHNICAL SPECIFICATION

Fiber optic cables within the premises shall use multimode, graded-index.

Fibers must comply with EIA/TIA 492 specifications and OM3 fiber specification as in IS 11801 standard.
Fibers will have dual wavelength capability; transmitting at 850 and 1300nm ranges.
All fibers shall be color coded to facilitate individual fiber identification. The coating shall be mechanically strippable.

Core	50 μm ± 3 μm
Core Non-Circularity:	<6%
Core/Cladding Con Error:	<3.0 μm
Numerical Aperture:	0.200 ± 0.015
Cladding diameter:	125 μm ± 1 μm
Cladding Non-Circularit	<2.0%
Colored Fiber Diameter:	250 μm ± 15 μm
Buffering Diameter:	890 mm ± 50 mm
Minimum Tensile Streng	100,000 psi
Fiber Minimum Bending	.75 in. (1.91 cm)
Cable Minimum Bendin During Installation: After Installation:	 20 times cable diameter 10 times cable diameter

Operating Temp. Range	32°F to 122°F (0°C to 50°C)
Storage Temp. Range:	-40°F to 149°F (-40°C to 65°C)
Maximum Fiber Loss:	3.5 dB/km at 850 NM

	1.5 dB/km at 1300 NM
Minimum Bandwidth:	1500 MHz km at 850 nm (OFL) 500 MHz .km at 1300 nm (OFL) 2000 MHz km at 850 nm (DMD, laser) 500 MHz km at 1300 nm (DMD, laser)

10. DATA & VOICE OUTLETS

The Contractor shall provide the identification labels at each and every information outlet with clear information of its connection. (TR, cabinet number, patch panel number and port number). The labeling shall be on the faceplate of the information outlet according to EIA/TIA 606 Administration Standard.
The contractor has to provide clear identification labels for data & voice.

In the process of installing the information outlets, if the Contractor envisages difficulty in mounting the outlet at planned location in the drawings. The contractor shall notify the Engineer/Owner, the contractor shall not make his own discretion in modifying or changing any information provided in the drawings.

The type of information outlets shall be of modular RJ45 of Matt Chrome/ metallic or any other approved finish, 8 position, 8 conductor designed for high speed networking applications that use data transmission rates over frequency ranges up to and potentially beyond 250 MHz & 100MHz. The outlets shall be of insulation displacement connectors type (IDC).

The 8 position/8 conductor outlet shall meet the category 6 transmission requirements for connecting hardware specified in ISO/IEC 11801 and EIA/TIA-568A/B and Class E design guidelines.

The modular outlet shall provide maximum versatility in designing a premise distribution system. It shall be designed to snap into modular faceplate. When the outlet is inserted into the faceplate or frame, it shall lock into place and shall only be released using the dual-purpose wire insertion tool. The mounting and removal system shall allow easy installation and modification. The faceplate jacks must be shutter protected and shall include a label window required to write circuit identification number. Each port must support a color icon to identify the port function.
The plastic used to construct the modular data outlet shall be of high impact, flame-retardant, made of poly(phenylene oxide) with flammability rating meeting UL 94V-0UL, the jack wires shall be at least 50 micro-inch lubricated gold plating over 100 micro-inch nickel under plate. The connector shall be of copper alloy, at least 100 micro-inch bright solder over 100 micro-inch nickel under plate.

The insulation displacement connector shall accept 24/23 AWG solid copper wire conductors.

The connector shall have multicolor labels marking wire terminals with numbers, assuring fast, accurate installation. The outlet must support wiring configuration as per T568A and T568B on the same RJ-45 jack

The connector shall be wired using the wire insertion tool (impact tool). The module shall be wired from the centre to the outside and shall not untwist paired conductors more than 12.7 mm. In the process of terminating the cables in patch panels/outlets the Contractor shall ensure ISO/IEC and TIA/EIA category 5E/6 transmission performance requirements.

11. PATCH CORDS

The contractor shall supply patch cords for all the installed points on the network switch side as well on the workstation side. The cord length shall be of two different sizes, 1m on the network switches side and 3m on the workstation side.

The patch cable shall meet the requirements warranted to meet ISO/IEC 11801, EN 50173 and EIA/TIA 568A/B category 6 wiring standards capable of connecting high speed information terminal devices to information outlets, to interconnect information terminal devices and 8-position modular jack panel applications. The patch cord shall be designed to provide support for extended multimedia transmission distance over frequency ranges up to and potentially beyond 100/250MHz.

The patch cord shall support the computer networking applications over frequency ranges up to and potentially beyond 250 MHz and shall be compatible with voice and information applications.

The construction of the cord shall be of stranded type cordage tightly twisted, 24 AWG, 8 conductor. The cord shall be terminated to an 8-position RJ-45 modular plug on both ends. The cords shall support the transmission requirements warranted to meet ISO/IEC 11801 Class E, EN 50173 or TIA/EIA 568B Category 6, Class E component specifications and standards.

The Contractor supplied cord shall be of factory crimped modular plug at both ends.

Pre-wired patch cords,110 to 8 position(RJ45), constructed of 24 gauge, stranded wire in PVC jacket shall be used to add modularity to 110 system.

12. PATCH CORD ORGANIZER

The Contractor shall supply and install sufficient patch cord organizers/inter-bay patch cord organizers that are used for routing patch cords in 19-inch (48.3-cm) frames. The patch cord organizers shall support the requirements of routing patch cords both at the equipment side as

well as the Category 6-patch panel cabling side at the wiring closets. These organizers shall be located in the 19-inch frame inside the wiring closet.

The Contractor supplied patch cord organizers/inter-bay patch cord organizers shall support the requirements of routing cords in both horizontal and vertical pathways.

13. PATCH PANELS (JACK PANELS)

The Contractor shall supply and install the modular patch panels to meet the full cabling system requirement of the "building/complex". Every category 6 cables serving the information outlets at work areas shall be terminated at the patch panels. The Contractor shall ensure that the supplied patch panels meet the ISO/IEC 11801, EN 50173 and TIA/EIA 568 warranted component specifications and standards.

The patch panels shall be of 19-inch rack-mounted panels. The rear of the panel shall feature connecting blocks mounted on a printed wiring board. These connecting blocks shall be capable for use in terminating category 6 station wires, equipment, or tie cables. The modular patch panel shall be capable of supporting up to 24 jack positions (ports) as required by the design drawings of the voice and data system and shall have the facility to write the circuit designation details at the front side of each jack. The contractor shall provide 20% spare capacity for both voice and data.

The insulating displacement connector field in the patch panel shall be made continuous to the 8-pin modular jack field on front of the panel through printed wiring board connections to enhance the features to confirm to EIA/TIA 568A/B cabling recommendations.

The construction of the modular jack panel shall be of category 6 – compliant and shall have the stringent requirements of connecting hardware as specified in EIA/TIA 568A/B commercial/ residential building Cabling System standards.

When the patch panels are tested in accordance with the appropriate test methods described in EIA/TIA 568 A/B and ISO/IEC 11801, EN 50173 Category 6 specifications. The modular patch panels shall meet the worst-pair near-end cross talk (NEXT) requirements over the entire frequency ranges up to and potentially beyond 100/250 MHz on all pair combinations.

Care must be taken to ensure that the cables are terminated correctly at category 6 cross connect hardware (patch panels).

The pair twist of the cables must be maintained as close to the termination at the patch panel IDC Modular outlet as possible. Cables shall not be untwisted for more than 12.7 mm. The cable conductor's entry shall be at the center of the IDC module and the module shall be wired from the center to the outside.

The cable conductors shall be terminated as described in EIA/TIA 568A/B and ISO/IEC 11801, EN 50173 Category 6, Class E wiring sequence by using the proper insertion tool (impact tool).

When terminating the cables in the insulating displacement connector field, care must be taken to ensure that the strip – back is limited only as much cable jacket as is required to perform connecting hardware terminations. The cables shall be properly secure terminations. The cables shall be properly secured to the 19 – inch rack with cable ties as well as at the patch panels.

The IDC connectors must be color coded to meet both T568A and T568B wiring Configuration.

Each port of the patch panel must support color Icon to identify the port function.

Each port must be numbered in sequence with white printing on black background or other high contrast colors.

Each port on the patch panel must have a label place holder and for the patch panel number.

The IDC connector on the back of the patch panel shall support 22 to 25 AWG solid conductors cables.

The package must include frame mounting screws, labels, cable ties and instruction sheet.

14. IDC WIRING SYSTEM

The IDC blocks shall be used for the voice cross connect and should be 19" rack mountable type.
The IDC blocks shall be capable of terminating up to 336 pairs.

Shall be capable to terminate 22-26 AWG solid conductors or 22-26 AWG stranded conductors.

Shall be made of high-impact UL 94V-0 rated thermoplastic.

Maximum insulated conductor outside diameter 0.05"

Complete kit include connecting blocks, labels and label holders shall be used.

Jumper troughs shall be used to route cable horizontally and vertically.

15. CABLING CABINET (Racks)

The Contractor shall supply and install cabling System Cabinets to house the passive and active network equipment. The cabinets shall be free/standing or wall mounting types.

The Cabling System cabinets shall meet the requirements of accommodating the high volume of cabling 19" 24-port patch panels & LAN Equipment fully assembled with the following items.(Cabinet dimension 42U 600 mm x 800 mm nominal width & depth). The cabinets must meet the following specifications:
42U 800 x 800 Ready Rack
500 KG load rating
42U 600 4mm Safety Glass Door (On the front).
42U 600 1.6 mm steel Door (On the rear).
600 x 800 side vented top cover.
Castors heavy duty braked.
42U Panel mounting angle kit.
800 X 800 thermostat controlled Low Noise Fan Tray.

A power outlet strip shall have a 2 meter flying lead, (3-wire extension cord) with a 3 prong British plug with fuse and shall have 13 amp. 250 volt 3 prong British outlets with individual on/off switch and indicator light with mounting brackets. The AC Mains distribution integral at the rear pillar of the cabinet should have at least 10 of 13 amp. Power Outlets. Cable management panel inclusive of other accessories such as earthling kits, screws, washers, grip-nuts and a removable shelf, able to resist a weight of 50 to 60 kgs. The cabinets shall be rugged and strong and all steel shall be finished scratch proof in a durable enamel Grey paint on both sides.

The cabinets must include Low Noise Thermostat controlled fans and shall automatically switch on and off according to the temperature inside the cabinets, the temperature range shall be from to 10 to 60 degrees centigrade. The dimensions of the tray shall be of 600 mm x 800 mm. The fan tray shall have minimum of four fans 250 Volts AC + 6% 50 Hz. The low noise top mounted fan tray shall aid the cooling requirement of the LAN equipment installed inside the cabinets, and in the process of installing the fan tray on top of the cabinet it shall not occupy any of the usable U height in the cabinet.

The front glass door shall have at least 4 mm toughened & 50 percent light transmission smoked safety glass able to resist a weight of 80 to 100 Kgs. Placed within 200 mm of the door center. The door shall be lockable and shall have a swing handle supplied with 2 keys.

The rear door shall be the same as the front except the construction of the door shall be of rugged and strong 1.6mm steel finished in a durable enamel Grey paint on both sides, and without glass.

The internal panel mounting angles shall be supplied in pairs to provide 19" mounting positions with hole patterns to accept captive nuts on universal centers. In the design of the panel mounts

the centers of each U height shall be notched, to make the positioning of cage nuts much simpler. The panel mounting shall be fitted onto panel mount angle supports to allow infinite adjustment throughout the depth of the track.

The cabinets shall be supplied at least with one shelf kit. The shelf should carry a load rating of 50 Kgs. And shall be manufactured with holes/slots providing sufficient airflow to LAN equipment when installed inside the cabinets.

Four steel castors with rubber wheels at least 40 mm high. These castors shall be mounted at the corners of the cabinet and be able to support the total weight of the cabinet and all options.

The cabinets must support the installation of fire protection units and all 19" equipment including frames for 110-punch block.

The supplied cabinets must meet the following standards:
IEC 297-2
D/N 4/494 Part 7
D/N 4/491 Part 1
Load rating 500 Kg
Rust proof coating
EN 60950
VDE 0100
Material 1.6mm steel
Paint finish according to RAL 7035

For the 25U freestanding cabinets the specifications is as follows:

The 19" 6U, 350 x 600, rack mounted type. Tempered glass front & rear door with key lock for maximum protection.

A power outlet strip shall have a 2 meter flying lead, (3-wire extension cord) with a 3 prong British plug with fuse and shall have 13 amp. 250 volt 3 prong British outlets with individual on/off switch and indicator light. The AC Mains distribution Integral at the rear pillar of the cabinet should have at least 6 of 13 amp. Power Outlets.

The cabinet shall be fitted with at least a 2 way low Noise Fan Tray and medium duty castors.

The supplied cabinets must meet the following standards:
IEC 297-2
D/N 4/494 Part 7
D/N 4/491 Part 1
Load rating 500 Kg
Rust proof coating

EN 60950
VDE 0100
Material 1.6mm steel
Paint finish according to RAL 7035
18 42 U free standing open frame
Integrated cable and cord management
allows for more efficient and effective cable management
Focused on accessibility
Extruded aluminum construction
Modular open frame design (no doors and side panels to remove)
Pre-threaded mounting holes
42U with 270 holes per vertical channel meets EIA/TIA RMU rack mounting unit dimension
Mounting screws with pilot point
Cable guides provide an effortless solution to transitioning cables
Flexible cable guides allow cable to snap-in easily for quick cable routing
Spacing of cable guides aligns exactly with the standard ISO 1101 rack
Unique switch gate Door / Cover provides easy access to the door
Edge protected pass through holes for transition of cables to rear side

SECTION - N
ADDRESSABLE FIRE ALARM SYSTEM

1. SCOPE

The work consists of supply, installation and commissioning of all material and services of the complete Addressable Fire Alarm system as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

2. STANDARDS

Following standards/codes shall be applicable:

BS 5839
NFPA 72

Any other international standard

3. OPERATION

The Fire Alarm System shall be pre-signal non-coded type complete with battery backup.

As per drawings the break glass type fire alarm stations and automatic detectors shall be installed at site. In case of any Fire, the manual station shall be operated by pulling down the handle or breaking the glass. The actuation of this station shall cause an audio as well as visual alarm at the fire alarm control and indication unit, duly indicating the location of the respective station/zone.

An authorized person shall immediately visit the affected area and if after investigating, it is deemed necessary, alarm in the whole building shall be initiated from either the alarm switch located beside the fire alarm control panel by inserting a special key or the actuation of any indication at the Main Fire Alarm Control Panel. The general alarm shall be initiated by an authorized person after inspecting the affected location.

Circuit shall be so arranged that an open circuit in an initiating or indicating loop shall cause the individual zone and common trouble indication at the fire alarm control panel.

4.0 MATERIAL

4.1 Wiring

Fire Alarm Cable shall be 2 core shielded twisted pair, fire resistant, PVC insulated, 250/440 volts grade cable to be laid in concealed PVC conduit.

4.2 Power Supply

The supply and operating voltages shall be 220 volts, 50 c/s and 24 volts D.C. respectively. The control stations shall be provided with sufficient capacity nickel cadmium battery with charger to operate the complete system for the least 15 hours in case of mains failure. A 20 Amp SPN switch socket shall be provided near the central fire alarm panel to feed the mains supply.

4.3 Fire Alarm Control and Indication Unit

The fire alarm control and indication unit shall be a Solid State Modular Unit consisting of the following Modules; suitable number of modules shall be used to provide facility for 6 loops. It shall not be possible to remove the key without turning the key to its normal position, thus resetting the alarm contacts.

i. Loop Module

loop Module shall have multiple of supervised initiating circuit with a trouble and an Alarm Lamp for each loop. Detection circuit wiring shall be two wire Class `A' and shall power all Detectors (Relay outputs and) voltage output for each zone alarm and voltage output for each zone trouble shall be provided.

ii. Audible Expander Modules

Audible Expander Modules shall provide for supervised control circuit for polarized alarm signaling devices. Loop activated lamp shall be provided for each loop to aid on system testing and trouble- shooting provide (1) (2) (3) indicating circuits.

iii. Power Module

Power Module shall supply the necessary power for the loop module and all Detectors (and shall contain a Battery Charger to charge the batteries) An AC power to Lamp shall be provided to indicate the normal condition of the panel. Individual supervisory lamps shall be provided for AC power failure indication, ground fault detection, and low battery. All controls shall be behind a key locked door to prevent unauthorized operation. Two supervised control circuits for audible signaling shall be provided as part of this module. Common trouble and common alarm relay and logic outputs shall be provided. The panel cover shall be key locked to prevent unauthorized access.

4.4 Manual Call Point

It shall be re-settable (non-breaking) glass type, electronically addressed and suitable for semi finish and surface amount installation as per drawing. The break-glass manual station shall be operated by pulling down the handle. When operated, the handle shall remain down with the pre-signal alarm contacts closed until the station is reset. The general alarm contacts shall remain open until after investigation. The general alarm switch shall be operated by an authorized person with a special key.

4.5 Fire Alarm Bell

Fire alarm (bell) shall be of red color surface mounted installed where indicated on the drawings. Sound intensity shall be such that an audible signal will be heard clearly throughout the structure when all the bell ring. The bell shall be connected in multiple cross loop conductors.

4.6 Smoke Detector

The detector shall use the light scattering principal to measure smoke density & shall send data to FACP indicating analog level of smoke density. It should be low profile design, electronically addressed, twin LED's for 360 degree vision and removable optical chamber for cleaning & maintenance. The operating voltage shall be 24V DC and surface mounted ceiling and shall include a separate twist-lock base that includes a temper proof feature.

4.7 Heat Detector

It should be low profile design with fixed temperature and rate of rise heat detection type. The heat detector shall be intelligent addressable device rated for 135 degrees. Electronically addressed and twin LED's for 360 degree vision. The operating voltage shall be 24V DC and surface mounted as per drawing.

4.8 Fire Alarm Sounder

It shall be of red color surface mounted installed as per drawing. It should be electronically addressed and strobe provided by high intensity LED cluster. The operating voltage shall be 24V DC.

4.9 Annunciator

The remote visual annunciator shall have the capacity for indicating 6 distinct alarm loop and one common trouble condition. The annunciator shall be back lighted type to increase visibility and to deter tampering with the lamps. The descriptions of each zone shall be approved by the Engineer In-charge. In the normal condition the annunciator shall have a blank appearance. Alarm and trouble condition shall be annunciated both visually and audibly. Lamp shall be 24 V DC, and replacement shall be readily available. Lamp replacements shall be accomplished without tools.

A test switch shall be provided for periodic testing of all lamps in the annunciator. To reduce tampering the annunciator shall have a key operated silence switch and a key locked cover. For aesthetic reasons the unit shall be compact, have a brushed metallic

trim ring and be surface mounted.

4.10 Function of Addressable Fire Alarm Control Panel (FACP)

i. Design

The FACP shall be solid state, modular design with integral static protection. All indicating lamps shall be long life, low maintenance solid state light emitting diodes (LED). It shall have graphically LCD display, programmable from PC built-in gas extinguishing control and integrated security alarm facilities. It should be designed to receive signals emitted by manual call points & fire detectors, producing sound & light indications. It should provide options for integration of external sound units & executive devices.

ii. Enclosure

The FACP enclosure shall be semi flush mounted. The enclosure shall be hinged from the left and the cover shall have clear windows and locking mechanism to keep the system operating and status switches from being tampered keys shall be made available to fire department and other authorized operating personnel. Finish shall be "FIRE ALARM RED" and "BLACK".

iii. Loops & Identification

All controls shall be labeled, all loop locations shall be identified, and the FACP shall be provided with a set of permanently mounted operating instructions, to avoid confusion. Loop location identification shall be as approved by the Engineer In-charge and contain up to three lines of text with 1/8" minimum character heights.

iv. Components of Fire Alarm Control Panel

a. All hardware and software to allow the panel configuration and operation to be changed at the panel. System that require off-site programming are not acceptable.

   The memory data for panel configuration and operation shall reside in non-volatile, memory provided by battery backed RAM. Removal of the board shall not cause loss of memory contents.

   Switches for panel setup, set reset, manual, evacuation alarm, silence and acknowledge. Individual supervisory LEDs shall be provided for power, run, alarm, trouble, disconnect, low battery and ground fault.

b. Indicating zones: As indicated on the drawings, each zone containing smoke detectors shall provide power and monitoring for up to only 50%

detectors. (All hardware and software shall be provided to facilitate selection of circuit performance to provide alarm verification for smoke detector circuits with field false alarms. When a detector signals an alarm, the panel shall automatically reset the detector, wait and their double checks to verify the alarm. Each zone shall have a red LED to indicate alarm and yellow or amber LED to indicate a trouble condition.

c. Indicating Loops: 1 or 2 indicating circuits shall be provided. Each circuit shall provide power for polarized alarm signaling devices. A red LED to indicate the energized state of the circuit and a yellow LED to indicate a trouble condition shall be provided for each circuit. A disconnect switch for each circuit shall be provided to allow the FACP to be tested with sounding alarm signals. When disconnected, the FACP shall indicate both trouble condition and disconnect.

v. Manual Functions

At any time, even without an alarm condition on an indicating circuit, the operator shall provide the following manual capabilities in the FACP by means of switches located behind a key locked cover:

a. In case of fire if a general evacuation is needed all bells shall sound. These signals can be initiated from the main panel and secondary switch at manual fire alarm initiating device (break glass unit).

b. Silence the local audible signal. This shall also cause the LED(s) to cease flashing and to be continuously `ON'.

c. Silence the alarm signals.

d. Reset the FACP, after all initiating devices have been restored to normal.

e. Disconnect any individual initiating or indicating circuit from the alarm sequence. This action shall light a disconnect LED and cause a trouble condition.

f. Perform a complete operational test of the system microprocessor with a visual indication of satisfactory communication with each board.

g. Test all panel LEDs for proper operation without causing a change in the condition on any zone.

vi. System Supervision

a. Upon application of primary power, or reapplication following power failure, the FACP shall automatically be in a normal supervisory condition.

b. In the normal supervisory condition, a green "POWER" LED shall be illuminated, indicating the presence of primary power.

c. A green "RUN" LED shall be illuminated indicating that the microprocessor is communicating with the system and the memory contents are satisfactory.

d. The following shall be electrically supervised:

All initiating and indicating device circuits.

All plug-in circuit board shall have proper board type in the position. System that use electrical continuity to supervise the presence of plug boards, but that do not assure that board position have been exchanged, shall provide equivalent means for specified supervision, beyond that provided by the locked cover.

4.11 Test

Upon completion, the Contractor shall conduct a total system test where line supervision and each device shall be tested. All the tests shall demonstrate that the system meets the tests shall operating requirements of this specification, that individual conductors of all circuits are free of grounds, shorts and breaks, and that no grounds exist between any piece of equipment in the control unit and the cabinet. All final connections, testing, adjusting and calibrating shall be made under the direct supervision of a factory trained technician of the system supplier.

4.12 Installation

The Fire alarm system shall be installed as mentioned in the drawings. The system shall be connected, tested and commissioned as per manufacturer's instructions and in the presence of Engineer In-charge. The wall recessed mounting Fire alarm manual stations shall be installed at a height of 4.5' feet above finished floor level. The connections of the appropriate Contactors of the Fire alarm system shall be made as per manufacturer's instructions.

The Fire alarm system conduit shall be laid 15cms (6") from the electrical conduits and cross the electrical conduit at 90 degree only. The Fire alarm system conduit shall be marked with red color at terminations in order to distinguish it from other conduit system.

SECTION - O
CONVENTIONAL FIRE ALARM SYSTEM

1. SCOPE

The work consists of supply, installation and commissioning of all material and services of the

complete Addressable Fire Alarm system as specified herein and / or shown on the Drawings and given in the Bill of Quantities.

2. STANDARDS

Following standards/codes shall be applicable:

BS 5839
NFPA 72

Any other international standard

3. OPERATION

The Fire Alarm System shall be pre-signal non-coded type complete with battery backup.

As per drawings the break glass type fire alarm stations and automatic detectors shall be installed at site. In case of any Fire, the manual station shall be operated by pulling down the handle or breaking the glass. The actuation of this station shall cause an audio as well as visual alarm at the fire alarm control and indication unit, duly indicating the location of the respective station/zone.

An authorized person shall immediately visit the affected area and if after investigating, it is deemed necessary, alarm in the whole building shall be initiated from either the alarm switch located beside the fire alarm control panel by inserting a special key or the actuation of any indication at the Main Fire Alarm Control Panel. The general alarm shall be initiated by an authorized person after inspecting the affected location.

4. MATERIAL

4.1 Wiring

Fire Alarm Cable shall be 2core, fire resistant, PVC/PVC insulated, 250/440 volts grade cable to be laid in concealed PVC conduit.

4.2 Power Supply

The supply and operating voltages shall be 220 volts, 50 c/s and 24 volts D.C. respectively. The control stations shall be provided with sufficient capacity nickel cadmium battery with charger to operate the complete system for the least 15 hours in case of mains failure. A 20 Amp SPN switch socket shall be provided near the central fire alarm panel to feed the mains supply.

4.4 Manual Call Point

It shall be re-settable (non-breaking) glass type, electronically addressed and suitable for semi finish and surface amount installation as per drawing. The break-glass manual station shall be operated by pulling down the handle. When operated, the handle shall remain down with the pre-signal alarm contacts closed until the station is reset. The general alarm contacts shall remain open until after investigation. The general alarm switch shall be operated by an authorized person with a special key.

4.5 Fire Alarm Bell

Fire alarm (bell) shall be of red color surface mounted installed where indicated on the drawings. Sound intensity shall be such that an audible signal will be heard clearly throughout the structure when all the bell ring. The bell shall be connected in multiple cross loop conductors.

4.6 Smoke Detector

The detector shall use the light scattering principal to measure smoke density & shall send data to FACP indicating analog level of smoke density. It should be low profile design, electronically addressed, twin LED's for 360 degree vision and removable optical chamber for cleaning & maintenance. The operating voltage shall be 24V DC and surface mounted ceiling and shall include a separate twist-lock base that includes a temper proof feature.

4.7 Heat Detector

It should be low profile design with fixed temperature and rate of rise heat detection type. Electronically addressed and twin LED's for 360 degree vision. The operating voltage shall be 24V DC and surface mounted as per drawing.

4.8 Fire Alarm Sounder

It shall be of red color surface mounted installed as per drawing. It should be electronically addressed and strobe provided by high intensity LED cluster. The operating voltage shall be 24V DC.

4.9 Function of Conventional Fire Alarm Control Panel (FACP)

i. Design

The FACP shall be solid state, modular design highly reliable & functional type with integral static protection. All indicating lamps shall be long life, low maintenance solid state light emitting diodes (LED). It shall have graphically LCD display, programmable from PC built-in gas extinguishing control and integrated security alarm facilities. It should be designed to receive signals emitted by manual call points & fire detectors, producing sound & light indications. It should provide options for integration of external sound units & executive devices.

ii. Enclosure

The FACP enclosure shall be semi flush mounted. The enclosure shall be hinged from the left and the cover shall have clear windows and locking mechanism to keep the system operating and status switches from being tampered keys shall be made available to fire department and other authorized operating personnel. Finish shall be "FIRE ALARM RED" and "BLACK".

iii. Functions

The functions of conventional fire alarm systems shall be as follows:

a. Control over fire alarm lines & controllable output for fault conditions (short circuit & interruption) and automatic reset.
b. Detection of removed fire detector and automatic reset.
c. Ability to identify automatic fire detectors and manual call points.
d. LED indication for fire & fault conditions.
e. Built-in sound signalization for fire condition (one-tonal continuous) that can be switched off.
f. Built-in sound signalization for fault condition (one-tonal continuous) that can be switched off.
g. Test mode of fire alarm lines.
h. Disable of fire alarm lines.
i. Disable of output for fire condition.

iv. Components of Fire Alarm Control Panel

a. All hardware and software to allow the panel configuration and operation to be changed at the panel. System that require off-site programming are not acceptable.

   The memory data for panel configuration and operation shall reside in non-volatile, memory provided by battery backed RAM. Removal of the board shall not cause loss of memory contents.

   Switches for panel setup, set reset, manual, evacuation alarm, silence and acknowledge. Individual supervisory LEDs shall be provided for power, run, alarm, trouble, disconnect, low battery and ground fault.

b. Indicating zones: As indicated on the drawings, each zone containing smoke detectors shall provide power and monitoring for up to only 50% detectors. (All hardware and software shall be provided to facilitate selection of circuit performance to provide alarm verification for smoke detector circuits with field false alarms. When a detector signals an alarm, the panel shall automatically reset the detector, wait and their double checks to verify the alarm. Each zone shall have a red LED to

indicate alarm and yellow or amber LED to indicate a trouble condition.

v. Manual Functions

At any time, even without an alarm condition on an indicating circuit, the operator shall provide the following manual capabilities in the FACP by means of switches located behind a key locked cover:

a. In case of fire if a general evacuation is needed all bells shall sound. These signals can be initiated from the main panel and secondary switch at manual fire alarm initiating device (break glass unit).

b. Silence the local audible signal. This shall also cause the LED(s) to cease flashing and to be continuously `ON'.

c. Silence the alarm signals.

d. Reset the FACP, after all initiating devices have been restored to normal.

e. Disconnect any individual initiating or indicating circuit from the alarm sequence. This action shall light a disconnect LED and cause a trouble condition.

f. Perform a complete operational test of the system microprocessor with a visual indication of satisfactory communication with each board.

g. Test all panel LEDs for proper operation without causing a change in the condition on any zone.

vi. System Supervision

a. Upon application of primary power, or reapplication following power failure, the FACP shall automatically be in a normal supervisory condition.

b. In the normal supervisory condition, a green "POWER" LED shall be illuminated, indicating the presence of primary power.

c. A green "RUN" LED shall be illuminated indicating that the microprocessor is communicating with the system and the memory contents are satisfactory.

d. The following shall be electrically supervised:

All initiating and indicating device circuits.

All plug-in circuit board shall have proper board type in the position. System that use electrical continuity to supervise the presence of plug boards, but that do not assure that board position have been exchanged, shall provide equivalent means for specified supervision, beyond that provided by the locked cover.

4.11 Test

Upon completion, the Contractor shall conduct a total system test where line supervision and each device shall be tested. All the tests shall demonstrate that the system meets the tests shall operating requirements of this specification, that individual conductors of all circuits are free of grounds, shorts and breaks, and that no grounds exist between any piece of equipment in the control unit and the cabinet. All final connections, testing, adjusting and calibrating shall be made under the direct supervision of a factory trained technician of the system supplier.

4.12 Installation

The Fire alarm system shall be installed as mentioned in the drawings. The system shall be connected, tested and commissioned as per manufacturer's instructions and in the presence of Engineer In-charge. The wall recessed mounting Fire alarm manual stations shall be installed at a height of 4.5' feet above finished floor level. The connections of the appropriate Contactors of the Fire alarm system shall be made as per manufacturer's instructions.

The Fire alarm system conduit shall be laid 15cms (6") from the electrical conduits and cross the electrical conduit at 90 degree only. The Fire alarm system conduit shall be marked with red color at terminations in order to distinguish it from other conduit system.

SECTION – P

CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM

1. GENERAL

A. All equipment and materials used shall be standard components that are regularly manufactured and used in the manufacturer’s system.

B. All systems and components shall have been thoroughly tested and proven in actual use.

C. All systems and components shall be provided with the availability of a toll-free, 24-hour technical assistance program (TAP) from the manufacturer. The TAP shall allow

for immediate technical assistance for either the dealer/installer or the end user at no charge for as long as the product is installed.

D. All systems and components shall be provided with a one-day turnaround repair express and 24-hour parts replacement. The repair and parts express shall be guaranteed by the manufacturer on warranty and non warranty items.

2. GENERAL SPECIFICATIONS

Indoor/Outdoor CCTV Camera Dome System

A. The indoor/outdoor CCTV camera dome system shall be a discreet, miniature camera dome system consisting of a dome drive with a variable speed/high speed pan and tilt drive unit with continuous 360° rotation, 1/4-inch high resolution color (or monochrome or color/black-white) CCD camera, motorized zoom lens with optical and digital zoom and auto focus; and an enclosure consisting of a back box, lower dome, and a quick-install mounting.

B. The indoor/outdoor CCTV camera dome system shall meet or exceed the following design and performance specifications:

3. DOME DRIVE

A. The variable speed/high speed pan and tilt drive unit shall meet or exceed the following design and performance specifications:

1.	Pan Speed	Variable between 360° per second continuous pan to 0.1° per second
2.	Vertical Tilt	Unobstructed tilt of +2° to -92°
3.	Manual Control Speed	0.1° to 80° per second, and pan at 150° per second in turbo mode. Tilt operation shall range from 0.1° to 40° per second
4.	Automatic Preset Speed	Pan speed of 360° and a tilt speed of 200° per second
5.	Presets	Eighty preset positions with a 20-character label available for each position; programmable camera settings, including selectable autofocus modes, iris level, LowLight™ limit, and backlight compensation, for each preset;

		command to copy camera settings from one preset to another; preset programming through control keyboard or through dome system on-screen menu
6.	Preset Accuracy	+/- 0.1°
7.	Proportional Pan / Tilt Speed	Speed decreases in proportion to the increasing depth of zoom
8.	Automatic Power-Up	User-selectable to the mode of operation the dome will assume when power is cycled, including automatically returning to position or function occurring before power outage
9.	Zones	Eight zones with up to 20-character labeling for each, with ability to blank the video in the zone
10.	Motor Drive	Cogged belt with 0.9° stepper motor
11.	Motor Operating Mode	Micro step to 0.015° steps
12.	Motor	Continuous duty, variable speed, operating at 18 to 30 VAC, 24 VAC nominal
13.	Limit Stops	Programmable for manual panning, auto/random scanning, and frame scanning
14.	Inner Liner	Rotating black ABS liner inside sealed lower dome
15.	Alarm Inputs	Seven N.O./N.C. dry contacts
16.	Alarm Outputs	One auxiliary Form C relay output and one open collector auxiliary output
17.	Alarm Output Programming	Auxiliary outputs can be alternately programmed to operate on alarm
18.	Alarm Action	Individually programmed for three priority levels, initiating a stored pattern or going to a

		pre-assigned preset position
19.	Resume after Alarm	After completion of alarm, dome returns to previous programmed state or its previous position
20.	Window Blanking	Eight four-sided, user-defined shapes, with each side being of different lengths; window blanking setting to turn off at user-defined zoom ratio; window blanking set to opaque gray or translucent smear; blank all video above user-defined tilt angle; blank all video below user-defined tilt angle
21.	Patterns	Four user-defined programmable patterns including pan, tilt, zoom, and preset functions; pattern programming through control keyboard or through dome system on-screen menu
22.	Pattern Length	Four patterns of user-defined length, based on dome memory
23.	Autosensing	Automatically sense and respond to protocol utilized for controlling unit whether Coaxitron® or RS-422 P or D protocols; accept competitors' control protocols with the use of optional translator cards
24.	Menu System	Built-in for setup of programmable functions; multilingual, including English, French, Italian, Spanish, Portuguese, and German, and alternative languages in Russian, Turkish, Polish, and Czechoslovakian
25.	Auto Flip	Rotates dome 180° at bottom of tilt travel
26.	Password Protection	Programmable settings with optional password protection
27.	Clear	Clear individual, grouped, or all programmed settings
28.	Diagnostics	On-screen diagnostic system information

29.	Freeze Frame	Freeze current scene of video during preset movement
30.	Display Setup	User-definable locations of all labels and displays; user-selectable time duration of each display
31.	Azimuth/Elevation / Zoom	On-screen display of pan and tilt locations and zoom ratio
32.	Compass Display	On-screen display of compass heading; user-definable compass setup
33.	Video Output Level	User-selectable: normal, or high to compensate for long video wire runs
34.	Dome Drive Compatibility	All dome drives are compatible with all back box configurations
35.	RJ-45 Jack	Plug-in jack on dome drive for control and setup of unit and for uploading new operating code and language file updates. Compatible with personal computers and PDAs such as Palm and iPAQ
36.	Remote Data Port Compatibility	Ability to control and setup unit and to upload new operating code and language file updates through optional remote data port that is located in area with easy access. Compatible with personal computers and PDAs such as Palm and iPAQ
37.	UTP Compatibility	Ability to plug into back box an optional board that converts video output to passive, unshielded twisted pair transmission
38.	Fiber Optic Compatibility	Ability to plug into back box an optional third-party board that converts video output and control input to fiber optic transmission
39.	Third-Party Control Systems	Ability to plug in optional board that converts

		control signals from selected third-party controllers
40.	Power Consumption	Maximum 70 VA

4. BACK BOX AND LOWER DOME

The back box and lower dome shall meet or exceed the following design and performance specifications:

A. In-Ceiling Environmental

1.	Connection to Dome Drive	Quick, positive mechanical and electrical disconnect without the use of any tools
2.	Trap Door	Easy-access trap door that allows complete access to the installation wiring and, when closed, provides compete separation of the wiring from the dome drive mechanics

3.	Terminal Strips	Removable terminal strips with screw-type terminals for use with a wide range of wire gauge sizes
4.	Auxiliary Connections	One Form-C relay output at <40 V, 2 A maximum, and a second open collector output at 32 VDC maximum at 150 mA
5.	Alarm Inputs	Seven alarm inputs
6.	Installation	Quick-mount spring clips
7.	Cable Entry	Through a 0.75-inch conduit hole
8.	Environmental Features	Factory-installed heaters and blowers
9.	Operating Temperatures	Maximum temperature range of -60° to 140°F (-51.1° to 60°C) for two hours, and a continuous operating range of -50° to 122°F (-51.1° to 50°C) continuous operation
10.	Memory	Built-in memory storage of camera and location-specific dome settings such as presets and patterns. If new dome drive is installed in back box, all settings to download automatically into new dome drive
11.	Color	Black, baked-on enamel powder coat
12.	Construction	Aluminum
13.	Lower Dome Material	Acrylic, optically clear, with no distortion in any portion of the dome up to +2° above the horizontal
14.	Dome Color	Clear and smoked versions
15.	Trim Ring Connection	Two captivated screws

B. In-Ceiling Interior

1.	Connection to Dome Drive	Quick, positive mechanical and electrical disconnect without the use of any tools
2.	Trap Door	Easy-access trap door that allows complete access to the installation wiring and, when closed, provides compete separation of the wiring from the dome drive mechanics
3.	Terminal Strips	Removable terminal strips with screw-type terminals for use with a wide range of wire gauge sizes
4.	Auxiliary Connections	One Form-C relay output at <40 V, 2 A maximum, and a second open collector output at 32 VDC maximum at 150 mA
5.	Alarm Inputs	Seven alarm inputs
6.	Installation	Quick-mount spring clips
7.	Cable Entry	Through a 0.75-inch conduit hole
8.	Operating Temperatures	Maximum temperature range of 32° to 122°F (0° to 50°C)
9.	Memory	Built-in memory storage of camera and location-specific dome settings such as presets and patterns. If new dome drive is installed in back box, all settings to download automatically into new dome drive
10.	Color	Black back box, baked-on enamel powder coat; white trim ring
11.	Construction	Aluminum
12.	Lower Dome Material	Acrylic, optically clear, with no distortion in any portion of the dome up to +2° above the horizontal
13.	Dome Color	Clear, smoked, chrome, and gold versions

14. Trim Ring Connection — Snaps in place

15. Safety Cable — Plastic tether

5. DIGITAL VIDEO RECORDER

A. The digital video recorder (DVR) shall provide a high-quality recorder capable of storage and playback of images from 1 to 16 camera inputs at a simultaneous refreshing recording rate of up to 480 images per second (NTSC) at CIF resolution with a CD-RW as standard equipment. Refer to paragraph B.8. for total frame rates at 2 CIF and 4 CIF resolutions. The DVR shall possess a watchdog system, triplex operation, Windows® 2000 operating system with Service Pack 4 with the latest security updates from Microsoft, watermarking of each frame, inputs for external alarms, video motion detection, and scheduled event recording. Remote software shall be provided for operation via PC, web, and Pocket PC handheld devices.

B. The DVR shall meet or exceed the following design and performance specifications:

PROCESSOR:

1. Processing Unit: Pentium® 4, 2.8 GHz processor with 256 MB of RAM

2. Recording Modes: Continuous, motion detection, alarm activation, or scheduled recording

3. Storage: Hard drive with 80, 250, 500, 750, or 1,000 GB of storage

4. Operating Software: Windows 2000, Service Pack 4

5. Signal Format: NTSC/PAL

6. Resolution:
   NTSC: 320 x 240, 640 x 240, 640 x 480, 720 x 240, or 720 x 480 pixels, depending on model

   PAL: 352 x 288, 704 x 288, 704 x 576, 720 x 288, or 720 x 576 pixels, depending on model

7. Compression: Pelco proprietary

Frame Rate:	NTSC	PAL
CIF	480 ips	400 ips

2CIF	112 ips	96 ips
4CIF	80 ips	64 ips

8. Functions: Operate as a recorder and a full-duplex multiplexer

9. PTZ Control: Pan, tilt, and zoom functions via RS-422 communications (D, P, and Coaxitron® protocols)

10. Viewing / Recording: Configurations of full screen, 4, 9, 12, or 16 cameras, or custom-designed display views

11. Full-Triplex Operation: Simultaneous playback and live viewing while recording live images

12. Programmable Schedules: 24 individual schedules

13. Program Modes: Motion event, alarm input, or continuous recording

14. Hardware Watchdog System: A hardware device to monitor the system clock for Windows lockup; upon lockup of the system the recorder shall automatically reboot without losing any of the programmed settings

15. Password Protection: Four user levels of protection for setup functions, operation, and system exiting

16. Motion Detection: Built-in motion detection for each camera to start recording or to increase the recording rate of the system

17. Motion Areas: Selectable detection area and sensitivity for each camera

18. Alarm/Motion Activation: Alarm input will start the unit recording, or if already recording, increase the recording rate and image quality

19. Pre-Alarm or Pre-Motion Recording: Record images for up to 60 seconds before the alarm sensor has been activated

20. Bandwidth Throttling: Network throttling of transmitted video

21. Alarm History Log: Available through a query

22. Alarm Outputs: Sixteen dry contact alarm outputs to activate external devices

23. Motion Activation: When a unit is in scheduled time recording and a camera detects motion or an alarm is activated, the system shall begin recording the event

24. Remote Control: Full remote control operation of pan, tilt, and zoom functions via TCP/IP protocol and RS-422 interface

25. LAN/WAN Connection: Software and hardware provided for viewing and controlling DVR over the network

26. Video Quality: High-quality video recording of at least VHS grade compared to the original video; supports NTSC or PAL video

27. Color Palettes: Minimum of 16 million color palettes

28. Gray Scale: 256 shades

29. Backup: A backup management system is to be provided to back up data to external devices (CD or other storage devices) without interrupting hard disk recording

30. Hard Disk Drives: From 80 GB up to 1TB

31. Programming: On-screen programming and operation through a PC keyboard or PS/2 mouse.

32. Digital Zoom: Digital zoom of the image on the screen during playback modes

33. Authentication: Software provided for image verification of each image recorded

MECHANICAL:

Mounting: Capable of being mounted in an EIA-standard 19-inch rack or placed on a shelf or desktop Connectors:

a. Depending on model, eight or sixteen BNC video inputs plus eight or sixteen looping video outputs with automatic termination

b. Two 9-pin, D-type connectors for COM 1 and COM 2 ports (disabled)

c. Two 6-pin, mini-DIN connectors for a PS/2 mouse and keyboard

d. One 15-pin, D-type port for a PC monitor connection

e. One 25-pin D-type port for Printer connection

f. One S-video jack for analog monitor output (disabled)

g. Two multiplexed analog video outputs (optional)

h. One RJ-45 connector for network connection

i. Four RJ-45 ports for RS485/RS422 support

j. Depending on model, eight or sixteen push-in connectors for alarm inputs and eight or sixteen push-in connectors for relay outputs

k. Six high-speed USB 2.0 ports

Dimensions:

a. Desk Mount

7.0 (H) x 17 (W) x 19.9 (D) inches
(17.78 x 43.18 x 50.55 cm)

b. Rack Mount

7.0 (H) x 19.0 (W) x 22.0 (D) inches
(17.78 x 48.26 x 55.88 cm)

Operating Temperature: 50°F to 95°F (10° to 35°C)

Relative Humidity: Maximum 80% non condensing

Optical Drive: CD-RW

ELECTRICAL:

Input Voltage 100-240 VAC, 50/60Hz, auto ranging

7. GENERAL SPECIFICATIONS

A. The DSP color CCTV camera shall consist of a 1/3-inch format CCD imaging chip.

B. The DSP color CCTV camera shall meet or exceed the following design and performance specifications:

8. VARI-FOCAL LENGTH, DC-DRIVE, AUTO IRIS LENS

The lens shall be a 1/3" format, variable focal length, auto iris lens, along with any accessories that may be required for a complete lens system.

The lens shall meet or exceed the following design and performance specifications:

The lens shall be a “CS” mount.

The lens shall be used with 1/3” or smaller format cameras.

The lens shall provide DC-drive auto iris, manual zoom and manual focus adjustments.

The lens shall provide high resolution optics in a compact body.

The lens shall automatically compensate for changing light conditions utilizing DC-drive voltages from the amplifier circuitry resident in the camera.

The lens shall be equipped with a 4-pin “square” connector for auto iris functions.

SECTION – Q
PUBLIC ADDRESS/SOUND SYSTEM

1. SUMMARY

This section includes supply and installation of equipments for amplifying, distributing, and reproducing sound signals.

2. GENERAL

A complete sound system is required for project and shall consists of an amplifiers, loud speakers, microphone, outlets on walls and the necessary wiring etc. The Contractor is required to supply and install complete sound system equipment, surface/concealed P.V.C conduit wiring etc. as specified herein or otherwise required for proper functioning and on drawings, the Contractor shall submit detailed shop drawings of the sound system offered by them, for final approval and acceptance of the consultants.

3. AMPLIFIER

The amplifier shall consist of a preamplifier unit and 25 watts power amplifier. The unit shall be fully transistorized and modular type so that by sliding different components and clip-on connections are made it forms one compact unit.

The preamplifier shall have two microphones inputs and shall be suitable to drive at least two amplifiers in parallel or to feed one or more remotely located power amplifier. The preamplifiers should have besides microphone channels at least one music channel for use with record player. The preamplifier shall be completed with master tune control and volume controls as required. The external connections shall be by plugs. The hum and noise level shall be between 44 dB to 62 dB and distortion shall be less than 2% at maximum output.

It shall be suitable to operate on 220 volts 50 c/s single phase circuit. The output voltage made be of manufacturer standard (48-70V). There shall be two loudspeaker output and switching arrangement. The input and output impedance, sensitivity, distortion, hum and noise levels etc. shall be as per manufacturer's standards keeping in view the best performance of the sound system.

4. MICROPHONE

The microphone shall be unidirectional moving coil type with frequency response range of 40 c/s to 18Kc/s. The impedance shall be 500 Ohms. The microphone shall be provided with metal stand of pleasing appearance having anti-vibration base, adopter, swivel holder, and about 3 meters of microphone cable, built-in plug and switch.

5. LOUD SPEAKERS

The loudspeakers shall be recessed mounting type, 5 watts output having impedance of about 8 Ohms. Frequency range shall be 60-15Kc/s. The loudspeaker shall be of pleasing appearance and it shall be suitable to install on the false ceiling or on the walls as required.

All accessories required for complete sound system and to suit the type of equipment offered shall be supplied and installed by the Contractor. Such accessories shall include switching device, socket outlets for microphone on wall, matching transformer, line transformer, adopter and other installation materials etc. The Contractor shall submit a complete list of accessories for the entire sound system offered by him. The price of such accessories shall be included in the BOQ.

6. WIRING

The wires for loudspeakers outlets wiring shall be twin core P.V.C insulated and screened. The size of wire shall be 2.5mm^2 minimum.

7. FUNCTIONAL DESCRIPTION OF SYSTEM

Delete functions in subparagraphs below that are not required and edit remaining descriptions to suit Project; add other functions as required.
Selectively connecting separate zones to different signal channels.
Selectively amplifying sound among various microphone outlets and other inputs.
Communicating simultaneously to all zones regardless of zone or channel switch settings.
Paging, by dialing an extension from any local telephone instrument and speaking into the telephone.

Producing a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed. Reproducing high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; and output free of non uniform coverage of amplified sound.

8. EQUIPMENT AND MATERIALS

Coordinate features to form an integrated system. Match components and interconnections for

optimum performance of specified functions.
Modular equipment type using solid-state components, fully rated for continuous duty, unless otherwise indicated. Select equipment for normal operation on input power usually supplied at 110 to 130 V, 60 Hz.

9. PREAMPLIFIERS

It should be either separately mounted or as an integral part of power amplifier.
Output Power: Plus 4 dB above 1 mW at matched power-amplifier load.
Total Harmonic Distortion: Less than 1 percent.
Frequency Response: Within plus or minus 2 dB from 20 to 20,000 Hz.
Input Jacks: Minimum of two. One matched for low-impedance microphone; the other match able to cassette deck, CD player, or radio tuner signals without external adapters.
Minimum Noise Level: Minus 55 dB below rated output.
Controls: On/off, input levels, and master gain.

10. POWER AMPLIFIERS

Mounting: Rack mounted.
Output Power: 70-W balanced line.
Frequency Response: Within plus or minus 2 dB from 50 to 12,000 Hz.
Minimum Signal-to-Noise Ratio: 60 dB, at rated output.
Total Harmonic Distortion: Less than 3 percent at rated power output from 50 to 12,000 Hz.
Output Regulation: Less than 2 dB from full to no load.
Controls: On/off, input levels, and low-cut filter.
Input Sensitivity: Matched to preamplifier and providing full-rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on speaker microphone or handset transmitter.

11. COMPONENTS

Parameters listed in this Article are typical values. Performance and product characteristics vary among manufacturers. Revise to suit Project.
Microphone:
Type: Dynamic, with cardioids polar or unidirectional characteristic.
Impedance: 150 ohms.
Frequency Response: Uniform, 50 to 14,000 Hz.
Output Level: Minus 58 dB minimum.
Finish: Satin chrome.
Cable: C25J.
Mounting: Desk stand with integral-locking, press-to-talk switch.
Quantity of Microphones: [Four] <Insert number>.
Quantity of Desk Stands: [Three] <Insert number>.
Equipment Rack: For house amplifiers and auxiliary equipment racks should be 19 inches.
Group items of same function together, either vertically or side by side, and arrange controls symmetrically.

Power-Supply Connections: Approved plugs and receptacles.
Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.
Enclosure Panels: Ventilated rear and sides and solid top. Use louvers in panels to ensure adequate ventilation.
Finish: Uniform, baked-enamel factory finish over rust-inhibiting primer.
Power-Control Panel: On front of equipment housing, with master power on/off switch and pilot light; and with socket for 5-A cartridge fuse for rack equipment power.
Service Light: At top rear of rack with an adjacent control switch.
Vertical Plug Strip: Grounded receptacles, 12 inches (300 mm) o.c. the full height of rack, to supply rack-mounted equipment.
Maintenance Receptacles: Duplex convenience outlets supplied independent of vertical plug strip and located in front and bottom rear of rack.
Spare Capacity: [20] <Insert value> percent spare space capacity in rack for future equipment.
Coordinate paragraph and subparagraphs below with Drawings.
Cone-Type Loudspeakers: Comply with TIA/EIA SE-103.
Minimum Axial Sensitivity: Pressure rating of 45 dB.
Frequency Response: Within plus or minus 3 dB from 50 to 15,000 Hz.
Size: 8-inches (200 mm) with 1-inch voice coil and minimum 140grams ceramic magnet.
Minimum Dispersion Angle: 100 degrees.
Rated Output Level: 10 W.
Matching Transformer: Full-power rated with four standard taps. Maximum insertion loss of 0.5 dB.
Surface-Mounting Units: Ceiling, wall, or pendant mounting, as indicated, in steel back boxes, acoustically dampened. Front face of at least 1.2mm steel and whole assembly rust proofed and shop primed for field painting.
Revise finish description below to suit aesthetic requirements.
Flush-Ceiling-Mounting Units: In steel back boxes, acoustically dampened. Metal ceiling grille with white baked enamel.
Microphone Outlet: Three-pole, polarized, locking-type, microphone receptacles in single-gang boxes. Equip wall outlets with brushed stainless-steel device plates. Equip floor outlets with gray tapered rubber or plastic cable nozzles and fixed outlet covers.
Conductors and Cables: Jacketed, twisted pair and twisted multi-pair, un-tinned solid copper.
Insulation for Wire in Conduit: Thermoplastic, not less than 0.8mm thick.
Microphone Cables: Neoprene jacketed, not less than 0.8mm thick, over shield with filled interstices. Shield No. 34 AWG tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on conductors is not less than 60 percent.
Plenum Cable: Listed and labeled for plenum installation.

12. EXECUTION INSTALLATION

Wiring Method

Install wiring in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum-board partitions where cable wiring method may be used. Use plenum cable in environmental air spaces including plenum ceilings. Conceal cables and raceways except in unfinished spaces.

Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed to avoid damage to cables. Secure cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, or fittings.

Wiring within Enclosures

Bundle, lace, and train conductors to terminal points with no excess use lacing bars in cabinets.

Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.

Separation of Wires

Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

Splices, Taps, and Terminations

Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

Identification of Conductors and Cables

Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

Wall-Mounting Outlets: Flush mounted.

Floor-Mounting Outlets: Conceal in floor and install cable nozzles through outlet covers. Secure outlet covers in place. Trim with carpet in carpeted areas.

Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG and conductors from microphone receptacles to amplifiers not smaller than No. 22 AWG.

Speaker-Line Matching Transformer Connections: Make initial connections using tap settings indicated on Drawings.

13. EARTHING

Revise this Article to suit system requirements. Include earthing electrodes for special

applications only.
Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment earthing.

14. FIELD QUALITY CONTROL

Perform the following field tests and inspections and prepare test reports:
Schedule tests with at least seven days' advance notice of test performance.
After installing public address and music equipment and after electrical circuitry has been energized, test for compliance with requirements.

Operational Test

Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.
Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.
Repeat test for each separately controlled zone of loudspeakers.
Minimum acceptance ratio is 50 dB.
Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.
Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in the same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.
Power Output Test: Measure electrical power output of each power amplifier at normal gain settings of 50, 1000, and 12,000 Hz. Maximum variation in power output at these frequencies must not exceed plus or minus 1 dB.
Signal Ground Test: Measure and report ground resistance at pubic address equipment signal ground. Retesting: Correct deficiencies, revising tap settings of speaker-line matching transformers where necessary to optimize volume and uniformity of sound levels, and retest. Prepare a written record of tests.
Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

15. ADJUSTING

On-Site engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

16. DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain public address and music equipment.

SECTION – R
NURSE CALL SYSTEM

1. SUMMARY

This Section includes visual nurse call equipment using lamp and electronic tone annunciation at a central annunciator station to register calls from patient and other call-in stations.
Paragraph below specifies microprocessor-based audiovisual/voice equipment.
This Section includes audiovisual equipment using voice communications and microprocessor control. All stations in an area are connected to a master station. Master stations are capable of communicating selectively with each other and with connected patient and other stations.

2. SUBMITTALS

Delete items in this Article not required for Project.
Product Data: For each type of product indicated.
Shop Drawings: Detail the system including the following:
Delete inapplicable subparagraphs below.
Cabling Diagrams: Single-line block diagrams showing cabling interconnection of all components for this specific equipment. Include cable type for each interconnection.
Wiring Diagrams: Power, signal, and control wiring.
Station Installation Details: For built-in equipment; dimensioned and to scale.
Equipment Cabinet Drawings: Dimensioned and to scale.
Delete first paragraph below unless Project includes special patient equipment listed.
Coordination Drawings: Detail system components that fit, match, and line up with provisions made in equipment specified in other Sections or in separate contracts:
Delete equipment below not in Project or not applicable to Coordination Drawings.
Patient head-wall units.
Patient consoles.
Patient beds with built-in nurse call features.
Manufacturer Certificates: Signed by manufacturers certifying that nurse call equipment complies with requirements.
Field Tests Reports and Observations: Include record of final adjustments certified by Installer.
Operation and Maintenance Data: For nurse call equipment to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 "[Closeout Procedures] [Operation and Maintenance Data]," include the following:
Operating instructions.
Troubleshooting guide.
Wiring diagrams and terminal identification.
Equipment parts list.
Product data for types and sizes of wires and cables used.

Warranty: Special warranty specified in this Section.

3. QUALITY ASSURANCE

Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
Manufacturer Qualifications: A firm experienced in manufacturing equipment similar to that indicated for this Project and that maintains technical support services capable of providing user with training, parts, and emergency maintenance and repair with a 24-hour-maximum response time.
Source Limitations: Obtain nurse call equipment components through one source from a single manufacturer.
Electrical Components, Devices, and Accessories: Listed and labeled according to UL 1069 as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

4. COORDINATION

Retain paragraph below if patient control units operate items not part of nurse call equipment. Coordinate patient control units with items controlled that are not part of nurse call equipment. Delete inapplicable subparagraphs below.
TV: Channel selection and volume.
Lights: Up light and down light at patient location.
Delete paragraph and subparagraphs below if nurse call equipment is not built into equipment or cabinets.
Coordinate wiring paths and maintenance access at locations listed below. Coordinate trim features and finishes at these locations to present a unified design appearance.
Delete equipment below not in Project. Add others to suit Project.
Patient head-wall units.
Patient consoles.
Patient beds with built-in nurse call features.
Nurse station.

5. WARRANTY

When warranties are required, verify with Owner's counsel that special warranties stated in this Article are not less than remedies available to Owner under prevailing local laws. Coordinate with Division 1 Section "Product Requirements."
Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace batteries that fail in materials or workmanship within specified warranty period. Special warranty, applying to batteries only, applies to materials only, on a prorated basis, for

period specified.
Warranty Period: Include the following warranty periods, from date of Substantial Completion: Retain subparagraph and associated subparagraphs below to match battery type specified in Part 2. Verify availability of warranties with manufacturer.
Nickel-Cadmium, Wet-Cell Batteries:
Full Warranty: [Five] <Insert number> years.
Pro Rata: [15] <Insert number> years.

6. EXTRA MATERIALS

Extra materials may not be allowed for publicly funded projects.
Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
Revise subparagraph below to suit Project.
Lamps: For corridor dome lights and zone lights equal to [20] <Insert number> percent of amount installed.
Fuses: One for every 10 of each type and rating, but no fewer than <Insert quantity> of each.
Printed Circuit Boards: Each kind, equal to [10] <Insert number> percent of amount installed, but no fewer than one unit.
Retain subparagraph below for audio/visual system only.
Master Station Privacy Handset: [One] <Insert number>.

7. SYSTEM REQUIREMENTS

Coordinate the features of materials and equipment to form an integrated system. Match components and interconnections for optimum performance of specified functions.
Revise percentage in paragraph below to suit Project.
Expansion Capability: Equipment ratings, housing volume, spare keys, switches, relays, annunciator modules, terminals, and cable conductor quantities adequate to increase the number of stations in the future by 25 percent above those indicated without adding internal or external components or main trunk cable conductors.
Delete first paragraph below if equipment does not connect with an existing system. Add descriptions of specific operational sequences that must be achieved.
Existing System Compatibility: Functionally and electrically compatible with existing system so components and wiring operate as an extension of the existing system and all functional performance of the existing system applies to the final system. Colors, tones, types, and durations of signal manifestation are common between new and existing systems.
Resistance to Electrostatic Discharge: System, components, and cabling, and the selection, arrangement, and connection of materials and circuits, shall be protected against damage or diminished performance when subjected to electrostatic discharges of up to 25,000 V in an environment with a relative humidity of 20 percent or less.

Equipment: Solid state, modular.
Connection method in paragraph below is optional for some manufacturers.
Wall-Mounted Component Connection Method: Components connect to system wiring in back boxes with factory-wired plug connectors.

8. FUNCTIONAL PERFORMANCE

Retain and edit this Article for visual/tone equipment.
Patient Station Call: Lights a steady call-placed lamp on the station, steady lamps in the zone light and corridor dome light associated with the patient's room, and steady lamps at the central annunciator and master, staff, and duty stations. At the same time, it sounds a distinctive tone at intervals, at the central annunciator and master, staff, and duty stations. Legends at the central annunciator and master station identify the calling station.
Pull-Cord Station Call: Flashes a call-placed lamp on the station and distinctive-color lamps in the zone light and corridor dome light and at the central annunciator and staff and duty stations. At the same time, it sounds a distinctive tone at intervals, at the central annunciator and master, staff, and duty stations. A legend at the master station identifies the calling station.
Emergency-Call Station Call: Produces the same responses as pull-cord station calls, except flashing and tone repetition rates are more frequent, tone frequency is higher, and lamps in the zone light and corridor dome light are a different color. Indicator lamps may be extinguished and the system reset only at the calling station.
System Reset: Operating reset button at the originating station cancels signals associated with the call.
Cord-Set Removal: A patient station call is initiated when the cord set is removed from the jack in the patient station faceplate. Inserting a cord-set plug or a dummy plug into the jack and operating the station reset button reset the call.
Patient Control Unit: Controls entertainment volume and channel selection. Nurse button on the unit initiates a patient station call. Integral speaker reproduces entertainment sound.

9. FUNCTIONAL PERFORMANCE

Retain and edit this Article for basic audiovisual/voice equipment.
Station Selection: Master station is capable of selectively communicating with other stations or groups of stations on its system by operating selector switches.
Master Station Privacy: Capable of conversing with individual stations in complete privacy.
Hands Free: Called station is capable of conversing hands free.
Annunciation: At the master station, a tone announces an incoming call and an annunciator light or liquid-crystal display identifies the calling station and indicates the priority of the call. Memory lamps or lighted displays identify stations selected for outgoing calls.
System Reset at Master Station: A normal incoming call is canceled, associated lights and audible tones are extinguished, and the system is reset when the station switch is returned to the normal position after responding to a call.

Patient Station Call: Lights the call-placed lamp at patient station, zone, and corridor dome lights. It sounds a tone and lights the call lights at staff/duty stations and actuates annunciation at the master station. When the calling station is selected at the master station, the patient can converse with the master station without moving and without raising or directing the voice. During voice communications, entertainment audio at the calling station is automatically muted.

Pull-Cord Call Station and Emergency-Call Station Call: Lights call-placed lamp and corridor dome light, and flashes zone light. Master station tone pulses and annunciator light for that room flashes. When master station acknowledges the call by operating a switch, the tone stops but lights continue to flash until the call is canceled at the point of origin.

Code Blue, Staff, and Duty Station Call: Lights the call-placed lamp at the station and actuates annunciation at the master station. When the called station is selected at the master station, the caller and the master station operator can converse.

Code Blue: Unique sound and light pattern, indicating the highest priority emergency.

Staff Station: Unique sound and light pattern, indicating an emergency.

Duty Station: Sound and light pattern, indicating a call to the nurse station.

Handset Operation: Lifting handset on master station disconnects speaker microphone and transfers conversation to the handset.

Station Privacy: No patient, staff, or duty station can be remotely monitored without the lighting of a warning lamp at the monitored station.

Patient Station Cord Set: When a patient station cord-set plug is removed from the jack in the station faceplate, a patient station call is initiated as described above. When the master station call button for the station is pressed, the tone stops but lights continue to flash until the call is canceled at the point of origin or the plug is reinserted or replaced with a dummy plug.

Patient Control Unit: Controls entertainment volume and channel selection. Speaker is used for both nurse communication and entertainment sound. Entertainment sound is automatically muted when station is communicating with master station. Nurse button on the unit initiates a patient station call.

Three paragraphs below specify optional functions provided in some higher-budget audiovisual/voice equipment. Some functions may be proprietary. Coordinate with Drawings.

Selective Paging: Master station is capable of initiating a message to selected groups of stations or speakers simultaneously by using station group switches.

Staff Reminder: Master station can initiate a staff reminder that a patient requires direct staff response by operating a reminder control while in contact with the patient station. This will light a distinctive-color lamp in the corridor dome light at the patient's room and in the appropriate zone lights. Reminder calls are canceled by operating a staff reminder cancel switch in the patient's room.

Edit paragraph and subparagraphs below if one method of initiating priority signal is preferred over another.

Call Priority Indication: Call priority switch near each patient station, or integral with the master station, controls the priority status of the call transmitted by individual stations. The switch selects one of the following status levels:

Normal: No change to the normal call initiation and canceling sequence.
Emergency: Call initiation produces signals and indications identical to those of emergency-call stations. Indicator lamps are extinguished and the system is reset only at the originating station.
Priority: System response is the same for emergency status, except voice communication between the master station and the calling station is locked in from the time of call initiation until the system is reset at the originating station.
Two equipment articles below specify products specific to each of the two alternative equipment types. Retain one to select equipment type. "Miscellaneous Equipment Component Descriptions" Article that follows equipment articles includes products common to both equipment types.

10. EQUIPMENT DESCRIPTIONS

Retain and edit this Article for audiovisual/voice equipment.
Master Station: Speaker-microphone unit with operating controls.
Indicator lamps with legends or by liquid-crystal displays designate identification and priority of calling stations and called stations.
Delete first subparagraph below if call priority option is specified.
Pulse rate of incoming-call lights denotes priority of calls awaiting response.
Station Selection Controls: Switches select stations for two-way voice communications.
Signal Tones: Announce incoming calls.
Delete first subparagraph below if call priority option is specified.
Pulse rate and frequency of tone identify the highest priority call awaiting response at one time.
Volume Control: Regulates incoming-call volume.
Privacy Handset with Hook Switch: Of the type that does not require push-to-talk switch, attached to each station, unless otherwise indicated.
Delete subparagraph below if optional reminder function is not specified.
Staff Reminder Control: Initiates flashing of corresponding corridor dome lights for patients requiring service. Permits scanning equipment to indicate which patients are currently in reminder status.
Delete subparagraph below if individual select ability of patient-call priority indication is not specified or if selection of patient-call priority indication is at room station.
Call Priority Selection: Controls associated with patient station selection switches determine the priority indication displayed when a call is initiated at a patient station.
Central Equipment Cabinet: Lockable metal. Houses amplifiers, tone generators, power supplies, controls, terminal strips, and other components.
Amplifier: With fidelity and overall gain necessary to achieve the sound transmission and reproduction characteristics specified, considering interoperability with the installed speakers/microphones and wiring.
Power Output: Not less than 3 W at a total harmonic distortion not exceeding 5 percent.
Hum and Noise: 60 dB below full output with normal input open.
Volume Control: Concealed within the amplifier unit to control the volume of sound

reproduced at all stations.
Protection: Circuit to prevent damage to the amplifier in case shorted or open output.
Selective Paging Amplifiers: Plug-in card mounted in central equipment cabinet; rated 15 W.
System Power Supply: For 24-V dc for operation of the call system.
Equipment Rating: Suitable for continuous operation between 32 and 120 deg F (0 and 49 deg C), from a primary line voltage between 105- to 125-V ac, 60 Hz.
Output: Regulated 24-V dc with protection against overloads. Line-to-load regulation shall not exceed 2-1/2 percent with ripple and noise remaining below the 10 mV, RMS level.
Overload Protection: Electronic fold-back circuit set to limit the volt-ampere output to less than 100 VA during overloaded or shorted output. Restore power output automatically on removal of overload without resetting circuit breakers or replacing fuses.
Power-on indicator lamp.
Surge Protective Device: Comply with Division 16 Section "Transient Voltage Suppression" for auxiliary panel suppressors, with [LED indicator lights for power and protection status] <Insert accessories>.
Subparagraph and associated subparagraphs below are optional depending on applicable codes and regulations. See Evaluations in Division 16 Section "Central Battery Inverters" for discussion of battery types.
Battery Backup Unit: Sealed [nickel-cadmium, wet-cell] <Insert type> battery supplies power through an automatic switch when normal power fails, for a period of not less than [six] <Insert number> minutes at rated output.
Automatic retransfer to normal power, after a [15] <Insert number>-minute time delay.
Two-rate battery charger with an automatic trickle rate and a recharge rate.
Speaker/Microphones:
Type: Permanent-magnet, dynamic or ceramic, protected against dust and humidity.
Sound Reproduction: Sound level of 90 dB plus or minus 3 dB at a distance of 48 inches (1220 mm) on the axis without overdriving or distorting any frequencies between 300 and 3000 Hz when installed in an enclosure or in the pillow speaker.
Power Handling Capacity: Not susceptible to damage from overdriving within the range of power available from the amplifier.
Impedance Matching: Coordinated and matched to the input and output circuits of the amplifier, both for single connection and for group monitoring, to provide the sound reproduction specified. Subsystems or components shall not be combined, which could cause unacceptable distortion such as feedback between pillow speakers and un-muted room speaker/microphone combinations. This protection shall extend throughout the entire range of operation (volume control) of all components.
Single-Patient Station: Speaker microphone with 2-inch (50-mm) dynamic cone, a polarized receptacle to match the cord-set plug, monitor lamp, reset switch, and call-placed lamp; assembled under a single faceplate.
Dual-Patient Station: Speaker microphone with 2-inch (50-mm) dynamic cone, two polarized receptacles to match cord-set plugs, monitor lamp, and reset switch; assembled under a single faceplate.
Retain one of two subparagraphs below.

Single call-placed lamp serves both beds.
Dual call-placed lamps, one for each bed.
Staff and Duty Stations: Audible call-tone signal device, speaker microphone with 2-inch (50-mm) dynamic cone, monitor lamp, reset switch, routine-call lamp, emergency-call lamp, and call push button; assembled under a single faceplate.
Code Blue Station: Audible call-tone signal device, speaker microphone with 2-inch (50-mm) dynamic cone, monitor lamp, reset switch, Code Blue emergency-call lamp, and call push button; assembled under a single faceplate.
Ambulatory-Patient Station: Speaker microphone with 2-inch (50-mm) dynamic cone, monitor lamp, reset switch, call-placed lamp, and call push button; assembled under a single faceplate.
Verify adequacy of standard amplifier capacity for Project applications.
Selective Paging Speakers: 8-inch (200-mm) cone type with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet, multi-tap matching transformer, flush-mounting steel back-box, and white enamel-finished metal ceiling grille.
Delete paragraph below if optional call priority indication is not specified.
Call Priority Switch Station: Three-position, tamper-resistant priority selection switch. Positions designated by labeling "Normal," "Emergency," and "Priority."
Delete paragraph below if optional staff reminder function is not specified.
Staff Reminder Cancel Switch Station: Momentary contact.

11. MISCELLANEOUS EQUIPMENT COMPONENT DESCRIPTIONS

Retain and edit this Article for either visual or voice equipment.
Emergency-Call Station: Locking-type push button, labeled "Push to Call Help"; reset trigger to release push button and cancel call; and call-placed lamp; mounted in a single faceplate.
Pull-Cord Call Station: Water-resistant construction. Includes the following, mounted under a single faceplate:
Pull-Down Switch: Lever-locking type, labeled "Pull Down to Call Help."
Reset trigger.
Call-placed lamp.
First six paragraphs and associated subparagraphs below specify plug-in components. Coordinate types and quantities furnished with Owner. Quantities stated are examples only.
Verify Owner's sterilization procedures and adjust requirements to suit Project. UL 1069 does not address sterilization.
Patient Control Unit: Equipped with plug and 96-inch- (2400-mm-) long white cord.
Ethylene oxide, sterilize-able.
Delete first subparagraph below if control of room lights is not in patient control units.
Light-Control Switch: Arranged for independent on-off control of patient's up and down light.
Integral Speaker: 2 inches (50 mm), with 0.35-oz. (9.9-g) magnet, rated 0.2 W.
Controls: Speaker volume, TV control, and nurse call.
Housing: High-impact white plastic.
Attachment: Stainless-steel bed clamp with permanently attached Mylar strap.

Quantity: 12 units for every 10 patient beds.
Call-Button Cord Set: Plug and 72-inch (1800-mm) white cord; equipped with momentary-action, call-button switch.
Ethylene oxide, sterilize-able.
Washable cord.
Palladium switch contacts in high-impact white housing with cord-set strain relief.
Attachment: Stainless-steel bed clamp with permanently attached Mylar strap.
Quantity: 3 cord sets for every 10 patient beds.
Geriatric Call-Button Cord Set: Plug and 72-inch (1800-mm) white cord; equipped with momentary-action, light-pressure switch in soft outer jacket.
Ethylene oxide, sterilize-able.
Washable cord.
Palladium switch contacts in high-impact white housing with cord-set strain relief.
Attachment: Stainless-steel bed clamp with permanently attached Mylar strap.
Quantity: 2 cord sets for every 10 patient beds.
Squeeze-Bulb Switch Cord Set: Plug and 72-inch (1800-mm) washable tube with white, washable, neoprene squeeze-bulb activator, plug-mounted, momentary contact switch.
Ethylene oxide, sterilize-able.
Attachment: Stainless-steel bed clamp with permanently attached Mylar strap.
Quantity: 2 cord sets for every 10 patient beds.
Call-Button Plug: Designed to plug into patient station cord-set receptacle. Button switches call circuit. Furnish 2 plugs for every 10 patient beds.
Dummy Plugs: Designed to plug into patient station cord-set receptacle when call-button plug or patient cord set is not used. Furnish 3 plugs for every 10 patient beds.
Indicator Lamps: Light-emitting-diode type with 20-year rated life, unless otherwise indicated.
Retain one of two paragraphs below to select material and finish for faceplate.
Station Faceplates: Type 302 stainless steel, 0.0375-inch (0.95-mm) minimum, on brushed finish. Maghine-engraved labeling identifies indicator lamps and controls.
Station Faceplates: High-impact plastic, [beige] <Insert color> color. Molded or maghine-engraved labeling identifies indicator lamps and controls.
In first paragraph below, coordinate number of lamps with functional requirements.
Corridor Dome Lights and Zone Lights: Three-lamp signal lights.
Lamps: Front replaceable without tools, low voltage with rated life of 7500 hours. Barriers are such that only one color is displayed at a time.
Lenses: Heat-resistant, shatterproof, translucent polymer that will not deform, discolor, or craze when exposed to hospital cleaning agents.
Revise colors in subparagraph below to suit Owner's preference.
Filters: Two per unit, amber and red.
Cable: Features include the following, unless otherwise indicated:
Conductors: Jacketed single and multiple twisted-pair, copper cables. Sizes and types as recommended by equipment manufacturer.
Cable for Use in Plenums: Listed and labeled for plenum installation.
Earthing Components: As specified in Division 16 Section "Earthing."

12. EXECUTION INSTALLATION

To select system wiring method, retain one of first two paragraphs below and revise to suit Project. Coordinate with Drawings.

Wiring Method: Install wiring in raceway except within consoles, desks, and counters. Conceal raceway and wiring except in unfinished spaces.

Wiring Method: Install wiring in raceway except within consoles, desks, and counters; and except in accessible ceiling spaces and in gypsum board partitions, where cable wiring method may be used. Use UL-listed plenum cable in environmental air spaces including plenum ceilings. Conceal cable and raceway wiring except in unfinished spaces.

Install cables without damaging conductors, shield, or jacket.

Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

Pull cables without exceeding cable manufacturer's recommended pulling tensions.

Pull cables simultaneously if more than one is being installed in same raceway.

Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.

Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.

Install exposed raceways and cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings designed and installed so as not to damage cables. Secure cable at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, or fittings.

Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train conductors to terminal points with no excess. Provide and use lacing bars in cabinets.

Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power-wiring runs. Run in separate raceways or, if exposed or in same enclosure, provide 12-inch (300-mm) minimum separation between conductors to speaker microphones and adjacent parallel power and telephone wiring. Provide separation as recommended by equipment manufacturer for other conductors.

Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes, terminal cabinets, and equipment enclosures. Install terminal cabinets where there are splices, taps, or terminations for eight or more conductors.

Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks if required.

Identification of Conductors and Cables: Retain color-coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams. Label stations, controls, and indications using approved consistent nomenclature.

Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in

a cabinet or junction or outlet box, and elsewhere as indicated.
Label exposed cables at intervals not exceeding 15 feet (4.5 m).
Prepare cable administration drawings to show building floor plans with cable administration point labeling. Identify labeling convention and show labels for terminal hardware and positions, cables, stations and devices and equipment earthing conductors.

13. EXISTING SYSTEMS

Retain this Article if equipment being specified is to connect with existing sound, intercommunication, or nurse call equipment.
Examine existing systems for proper operation, compatibility with new equipment, and deficiencies. If discrepancies or impairments to successful connection and operation of interconnected equipment are found, report them and do not proceed with installation until directed. Schedule existing systems' examination so there is reasonable time to resolve problems without delaying construction.

14. EARTHING

Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other signal impairments.
Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment earthing except at connection to main building ground bus.

15. FIELD QUALITY CONTROL

Retain first paragraph below to require a factory-authorized service representative to perform, or assist Contractor with, field inspections, tests, and adjustments. Retain one of two options to suit Project; delete both to require only an inspection before field testing.
Manufacturer's Field Service: Engage a factory-authorized service representative to inspect[, test, and adjust] field-assembled components and equipment installation, including connections[, and to assist in field testing]. Report results in writing.
Test Procedure: Comply with the following:
Schedule tests a minimum of seven days in advance of performance of tests.
Report: Submit a written record of test results.
Operational Test: Perform an operational system test, and demonstrate proper operations, adjustment, and sensitivity of each station. Perform tests that include originating station-to-station and all-call messages and pages at each nurse call station. Verify proper routing, volume levels, and freedom from noise and distortion. Test each available message path from each station on the system. Meet the following criteria:
Speaker Output: 90 dB plus or minus 3 dB, 300 to 3000 Hz, reference level threshold of

audibility 0 dB at 0.02 milli Pascal of sound pressure.
Gain from patient's bedside station to nurse station, with distortion less than 65 dB (plus or minus 3 dB, 300 to 3000 Hz).
Signal-to-Noise Ratio: Hum and noise level at least 45 dB below full output.
Test Procedure:
Frequency Response: Determine frequency response of two transmission paths by transmitting and recording audio tones.
Signal-to-Noise Ratio: Measure the ratio of signal to noise of the complete system at normal gain settings, using the following procedure: Disconnect a speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure the ratio of signal to noise and repeat the test for four speaker microphones.
Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 300, 400, 1000, and 3000 Hz into each nurse call equipment amplifier, and measure the distortion in the amplifier output.
Retesting: Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets these Specifications and complies with applicable standards. Report results in writing.
Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

16. ADJUSTING

Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sound levels and controls to suit actual occupied conditions. Provide up to [three] <Insert number> visits to Project during other-than-normal operating hours for this purpose.

17. DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel and caregiver staff to adjust, operate, and maintain nurse call equipment.

SECURITY ACCESS SYSTEM - VELOCITY SYSTEM

1. GENERAL

1.1 **Section includes**

Security access system, Velocity by Hirsh Electronics, including the following:

1. Server hardware and software.
2. Application software.
3. Intrusion detection devices.

4. Security access devices.
5. Access control, relay control, and alarm monitoring controllers.

1.2 RELATED SECTIONS

A. Section 16050 - Basic Electrical Materials and Methods.

1.3 REFERENCES

A. NFPA 70 – National Electrical Code.

B. UL294 – Standard for Access Control Systems.

C. NFPA 72 – National Fire Alarm Code.

D. NFPA 101 - Life Safety Code.

1.4 REGULATORY REQUIREMENTS

A. System shall be UL-Listed.

1.5 EXISTING SYSTEM DESCRIPTION

A.

1.6 NEW SYSTEM DESCRIPTION

A. The Hirsch Electronics "VELOCITY Version 3.1 Security Management System shall be a modular and network capable access control and intrusion detection system. The Security Management System shall have the ability of handling corporations with multiple remote sites, controlled access with various reader technologies supported simultaneously, alarm monitoring with text and graphics based annunciation, Photo Call-Up, Photo ID Budging, DVR and CCTV switcher control that allows for easy expansion or modification of readers, inputs, and outputs. The system control at the central computer location shall be under a single software program control, shall provide full integration of all components, and shall be alterable at any time, depending upon the facility requirements. Reconfiguration shall be accomplished on-line through system programming, without hardware changes.

B. The system shall support both manual and automatic responses to alarms entering the system. Each alarm shall be capable of initiating a number of different actions, such as camera switching, activation of remote devices, email of alarm/event, text page of alarm/event, Threat Level change, and door control.

C. Access control functions shall include, validation based on time of day, day of week, holiday scheduling, automatic or manual retrieval of cardholder photographs, and access validation based on positive verification of card, card/PIN, and PIN.

D. The VELOCITY System shall interface to the CCTV matrix control system through a serial software interface, simulating alarm inputs. The CCTV system shall be programmed to respond to the alarm input, switching the appropriate camera(s) to the appropriate monitor/s and/or recording devices. All control of camera selection, position, zoom, focus, iris, pre-position, etc. shall be controlled by the CCTV system's keyboard/joystick controls or the Velocity computer keyboard and mouse. Advanced switcher programming shall be performed through the switcher and associated keyboard or software programming interface.

E. The VELOCITY System shall interface to the DVR system through an API software interface. The DVR system shall be programmed to respond to the alarm inputs through Velocity's Triggers/Actions Manager. In response to an alarm, the DVR shall record video as programmed, including: Pre-Alarm, Alarm Duration, Post Alarm, and Frames per second as defined for that camera. All control of position, zoom, focus, and iris shall be controlled by the DVR system's keyboard/joystick controls or the Velocity on-screen PTZ controls. Initial DVR setup and Advanced programming shall be

performed through the DVR's configuration software programming interface.

F. Utilizing assigned passwords, it shall be possible to define the levels of system operation for each individual Operator. Operator Actions range from basic monitoring to full control of the system databases.

G. The system programming shall be user-friendly Windows environment (use conventional "Title Bar", "Menu Bar", "Tool Bar" and "Status Bar") and allow mouse control of key functions. The programming shall be MENU driven and include on-line "Documentation", "Help" or "Tutorial" information. The software shall utilize combo boxes for previously entered system-required data where applicable.

H. The system shall provide supervised alarm point monitoring. Upon recognition of an alarm, the system shall be capable of displaying alarm information in text format in a dedicated Alarm Viewer, real-time status in a Status Viewer, on a graphic floor plan, initiate alarm recording on a DVR, switching CCTV cameras, email an alarm notification to one or more people, and send a text page to a cell phone or display pager that are associated with the alarm point. The system shall be capable of arming or disarming alarm points both manually and automatically, by time of day, and day of week.

I. The method of communication from remote locations to the central components shall be transparent to the user.

J. After installation, the OWNER shall be able to perform hardware configuration changes as desired without the services of the MANUFACTURER.

K. Equipment repair shall be able to be accomplished on site, by module replacement, utilizing spare components.

L. All controller components shall utilize "Distributed-Processing" concepts. The distributed processing shall include the ability to down-load operating parameters to any field panel, thus allowing the field panel to provide full operating functions independent of any other system component.

M. The system shall be capable of utilizing the existing LAN / WAN connecting the buildings or a dedicated security Ethernet network for Hirsch DIGI*TRAC Controller and Velocity Client communications. Install Hirsch SNIB2 communications interface in each controller to communicate to the controllers via 10/100 Mbps, 128 bit AES encrypted Ethernet.

N. The Controllers shall utilize Version 7.4 or later Flash downloadable CCM (Command and Control Modules) firmware.

O. Upgrade CCM Firmware in existing controllers as required.

1.7 ALTERNATES:

A. Alternate Item #1: Provide a complete photo ID Budging system, including: Pan/Tilt/Zoom camera with Synchronized Flash, Tripod, and backdrop (Hirsch Model IDCAMKIT; Ultra Magic Card RIO Printer (Hirsch IDP-MLR); Printer Rolls (Hirsch Model IDP-ML5-PR).

B. Alternate Item #2: Provide a Dual Monitor PC Card (Hirsch Model DMC) and an additional 17 inches (423 mm) Flat Panel Monitor (Hirsch Model HMS-M17FP).

C. Alternate Item #3: Provide as an option a Fault-Tolerant Server Computer, Windows Server 2003 R2 operating system, SQL Server 2005 database, 17" Flat Panel Monitor (Hirsch Model HMS-L2D-3-17FP).

1.8 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Manufacturer's Data:
   1. Submit three (3) copies of:
      a. Product Data Sheets.
      b. Installation Instructions.
   2. Authorized Dealer Certificate and Certified Training Certificates of installers who will be working on this project.

C. Shop Drawings:
   1. Submit three (3) copies and digitally in AutoCAD 14 or later format on a CD (3 copies), shop drawings, including:
      a. Layout of equipment on supplied AutoCAD drawings.
      b. Security Console elevation drawings.
      c. Field Controller equipment location wall layouts, including size requirements.
      d. Detailed wiring diagrams of Field Controllers, Door Details, and head-end devices.
      e. Load calculations of all security equipment for proper sizing of electrical provided by the customer and standby emergency generator circuits.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F. As-Built Drawings:
   1. Update Shop Drawings to create final As-Built Drawings. Submit 3 copies and digitally in AutoCAD 14 or later format on a CD (3 copies).

G. Operation Data: Include three (3) copies of the software Administrator and Operator Manuals.

H. Maintenance Data: Include maintenance and repair procedures.

1.9 QUALITY ASSURANCE

A. Manufacturer: The access control system shall be from a single-source manufacturer that specializes in intrusion detection and access control systems with a minimum of 5 years experience.

B. Installer: Company specializing in intrusion detection and access control systems with a minimum of three years experience on systems of similar size and scope. Technicians working on project must have been certified on the hardware and software used for this project.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.
   4.

1.10DELIVERY, STORAGE, AND HANDLING

A. Owner will provide, on-site, a secure, dry, locked storage area for all equipment delivered under this scope of work.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.11PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.12WARRANTY AND SERVICE AGREEMENT

A. All equipment, materials, and labor shall be guaranteed for a period of 24 months from the date of final acceptance by the Owner.

B. Provide any software maintenance updates or upgrades at no additional cost to the Owner for this period.

C. Perform two (2) scheduled preventative maintenance site visits per year during the warranty period.

D. Response Times – Normal business hours shall be 7 AM to 5 PM Monday through Friday. Calls for service before noon shall be responded to on-site before the end of the day. Calls after noon shall be responded to on-site by noon the following business day.

E. Provide extra costs for time outside of normal business hours if the Owner requires emergency service.

F. Submit an all-inclusive Annual Maintenance Agreement cost for years 3 and 4, including two (2) preventative maintenance sites visits per year.

G. Submit normal and after hours labor costs and typical costs for equipment for items not covered under the Warranty, like: Acts of God, vandalism, misuse.

1.13EXTRA MATERIALS

A. Provide one (1) each of the following Hirsch Electronics components to serve as system spares:
   1. SNIB2 – Secure Network Interface Board (as required).
   2. MRIB – MATCH Reader Interface Board (as required).
   3. DS47L (as required)
   4. DS47L-SPX (as required)
   5. Card Reader (as required)

PRODUCTS

1.14MANUFACTURERS

A. Acceptable Manufacturer: Hirsch Electronics; 1900-B Carnegie Ave., Santa Ana, CA 92705. ASD. Toll Free Tel: (888) 809-8880. Tel: (949) 250-8888. Fax: (949) 250-7372. Email: info@hirschelectronics.com. Web: http://www.hirschelectronics.com.

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

1.15BASIC CENTRAL SYSTEM COMPONENTS

A. Security Management System: Hirsch Electronics Corporation, Velocity Security Management System, model VEL (Velocity Server plus unlimited remote clients).

B. Central Processing Unit Computer Specifications:

1. The software shall operate on a Dell or equal personal computer. The requirements for the computer, rated to the size of the system, are as follows:

C. Central Processing Unit (CPU):

1. The computer CPU shall be type Pentium 4, 2GHz/533MHz or greater.

D. Random Access Memory (RAM):

1. The computer shall have a minimum of 1GB RAM for the Server (plus 40MB per active client) and 512 MB RAM for Clients and Single User Workstation running on Windows XP Professional SP2 or Windows Vista (1GB recommended).

E. Disk Drives:

1. The computer shall have a 40 GB IDE, SATA or SCSI hard disk drive minimum, a 3.5" floppy disk drive, and CD-ROM (CD-R on the Server recommended).

F. Monitor:

1. The computer shall have a 17” Flat Panel Monitor, XGA color.

G. Mouse:

1. 2 button bus type

H. Keyboard:

1. The computer shall have a standard 101-keyboard layout and IBM-compatible.

I. Modem:

1. The modem shall be a 56K internal modem with PC Anywhere 12 Remote Control Software for the server computer. The owner will provide a dedicated voice-grade phone line at the Head-End Server location.

J. Serial Ports:
1. Provide 2 serial ports.

K. Parallel Ports:
1. Provide 1 parallel port.

L. Ethernet Port:
1. Provide 1 10/100/1000 Cat5 Ethernet port (onboard or separate card)

M. Sound Card and Speakers:
1. 1. Provide audio output (onboard or separate sound card) and speakers.

N. Operating System:
1. The VELOCITY Server computer shall operate under Windows Server 2003 SP1 or R2 and the Single User Server or Client shall operate under Windows XP Professional SP2 or Windows Vista. 32 and 64 bit versions shall be supported.

O. Database:
1. The VELOCITY Server shall have Microsoft SQL Server 2005 Express Database included and loaded with the application. The system shall optionally run on MS SQL Server 2005. 32 and 64 Bit versions shall be supported.

P. Printers: (as required for each workstation)
1. Report Printer - The computer shall have one parallel or USB printer port, and corresponding printer, Hirsch Model HMS-PLBW Laser Printer, and printer drivers for Windows XP Pro SP2.
2. Budging Printer - The computer shall have one parallel or USB printer port, and corresponding printer Hirsch ID Badge Printer, Hirsch Model IDP-MLR, and printer drivers for Windows XP Pro SP2.
3. Alarm and Event Printer - The computer shall have one parallel or USB printer port, and corresponding printer, Hirsch Model PR-1 Dot Matrix Printer, and printer drivers for Windows XP Pro SP2.

Q. UPS:
1. The UPS (Uninterruptible Power Supply) for the Server, Hirsch Model UPS-HMS, and Client, Hirsch Model UPS-

HMS, shall provide for 20 minutes of continued operation in the event of an AC Power Failure.

R. Tape Drive – Internal on Server:

1. The tape drive shall be a 20/40 GB Travan, Model Hirsch HMS-TBI. Provide 12 Blank Tapes.

S. Tape Drive Software

1. The tape drive software shall be Symantec Backup Executive.

T. Communications Interface To Field Controllers Supported:

1. RS-232.
2. RS-485.
3. TCP/IP.
4. Dial Up.

U. Control Panel Specifications:

1. The control panel shall incorporate microprocessor-based, digital technology, using high speed processing for maximum reliability.

V. Distributed Intelligence:

1. The system shall use distributed intelligence architecture, with controllers operating independently of one another.
2. Regionalized functions for all controllers connected to an Xbox communications loop shall include: Use Count, Absentee Limit, Temporary Days, Pass back, and Input/output linking and shall not require the host to be online for processing and control.

W.Stand Alone Operation:

1. All database information required for stand-alone operation shall be stored at the control panel level. All decision-making shall be performed at the control panel, eliminating the need for degraded mode operation.
2. Proprietary software programs and control logic information used to coordinate and drive system hardware shall be stored in Flash Downloadable Read Only Memory.

X. XML Writer Application:

1. The system shall support as standard sending any or all event and alarm transaction events out of a selected port in a standard XML format.
2. A Time Zone may be defined to limit when this data is exported.
3. Multiple XML Writers may be defined and run concurrently for different applications.

Y. MS Message Queue Application:

1. The system shall support as standard sending any or all event and alarm transaction events in a standard XML format to a Microsoft Message Queue.
2. A Time Zone may be defined to limit when this data is sent to the queue.
3. Multiple MS Message Queues may be defined and run concurrently for different applications.

1.16SYSTEM CONFIGURATION

A. The head-end shall support one (1) Server Computer that may optionally be used as a full functioning Client. The system shall support unlimited remote Client computers will full system functionality. The unlimited client capability will be inherent to the software and will not require additional licensing by the manufacturer.

B. The server software shall support Cold Redundant, Warm Redundant, Hot Redundant, and
Clustered server environments.

C. During installation, support for a split SQL Server Database server and Application/Communications server shall be available.

D. Host Computer to Controller Communication Protocols:
1. Communications between the computer and the controller shall be accomplished by Scramble*Net Communications and shall be encrypted using a 64-bit cipher feedback method (HES - Hirsch Encryption Standard). The encryption shall be full time and not require any programming or key setting to operate.
2. The system shall utilize RS232 up to 50' for hardwired applications.
3. The system shall utilize RS485 up to 4000' (4-wire hardwired). Longer distances are allowed with a communications multiplexer / amplifier (Hirsch Model NET*MUX4), if applicable.
4. The system shall utilize TCP/IP for communicating over dedicated or shared Ethernet networks. For 10/100 Ethernet communications to the controller, install SNIB2 128 Bit AES Encrypted communications interface board in each controller.
5. All of the communications protocols shall be supported simultaneously on the system.

E.

F. Host Computer to Controller Communication Transmission Methods/Hardware:
1. Communications between the computer and the controller shall be able to use any or all of the following methods:

a. Hardwired.
b. Leased line modem.
c. Fiber Optic.
d. Microwave.
e. RF.
f. Ethernet 10/100.
g. Dial-Up modem.

G. Proprietary Network Interface Hardware:

1. The controller shall be interfaced to an industry standard personal computer running proprietary software with the addition of an opto-isolated network communications interface board (Hirsch Model: SNIB). The Scramble Net Interface Board will accept RS232 or RS485 communications interface. Each board is uniquely addressable through on-board dipswitch settings and has an adjustable baud rate from 1200 – 19,200. The board shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable.
2. Optionally, the enhanced SNIB2 communications interface board may be installed for 10/100 Ethernet, 128 Bit AES encrypted communications input to the controller. Downstream RS485 hardwired communications to controllers daisy chained off the "master" controller on any communications port can communicate up to 115 K Baud.

The SNIB2 board firmware will be Flash Downloadable to accommodate any future communication enhancements.

H. Maximum System Wide Capacities:

1. The following shall be the maximum system wide capacities. These capacities will be inherent to the software and do not require additional licensing by the manufacturer. The actual number shall be dependent upon the mix of controllers that make up the system:
   a. Doors: Unlimited.
   b. Supervised Alarm Inputs: Unlimited.
   c. Control Relays: Unlimited.
   d. Controllers: Unlimited.
   e. Users: Unlimited.

1.17SYSTEM SOFTWARE

A. General layout of the software "Windows" will include but not be limited to:

1. Main Menu Bar shall be used to access all Velocity Functions from a standard pull down menu method.
2. Tool Bar ICONS shall be used to access all common Velocity Functions with a single mouse click.
3. Customizable Graphical User Interface shall allow for configuring the screens in a variety of layouts. Layouts for

each window include: Docked to the Top, Bottom, Left, and Right; Floating; Child – Minimized, Maximized, Restored. Each Operator shall have their own unique layout for available options. If dual-monitors are used, the Customizable GUI shall apply to both monitors. It shall be possible to restore factory defaults for each user with a single action.

4. Tool Tips describing the feature(s) that the selected item represent, will be displayed in small "bubbles" underneath the selected item, field caption or other component. These tool tips shall be user definable.
5. The Administration Console shall use the familiar Microsoft Explorer metaphor with a tree of folders in the left pane and details of selected folders in the right pane. The left pane shall include the following main components: Main Administration Console, Velocity Configuration, DIGI*TRAC Configuration, and Interface Configuration.
    a. The Main Administration Console shall include:
        1) Alarm Viewer.
        2) Badge and Graphics Designer.
        3) Customization Manager.
        4) Enrollment Manager.
        5) Event Viewer.
        6) Graphics.
        7) Report Manager.
        8) Status Viewer.
        9) SQL Manager.
        10) Velocity Scheduling Agent
        11) Video Explorer.
        12) Who's Inside
        13) CCTV Camera Viewer.
    b. The Velocity Configuration Module shall include:
        1) Person Templates
        2) Credential Templates.
        3) Time Zones.
        4) Holidays.
        5) Door Groups.
        6) Function Groups.
        7) Operators.
        8) Roles
        9) Command Sets.
        10) Workstations.
        11) Alarm Responses
    c. The DIGI*TRAC Configuration Module shall contain:
        1) Add either an S*NET, X*NET, or Dial-Up communications port, either serial or TCP/IP.
        2) Add XBOX

3) Add DIGI*TRAC Controller.
4) Import New Controller
5) Add Dial-Up Location and Modem Pool Settings.
6) Doors, Readers, Inputs, Outputs, Expansion Inputs, Expansion Outputs.

d. The Interface Configuration Module shall define the parameters for communicating to a CCTV switcher, Serial Port Redirector, Email Notification of Alarms, Message Queue writers, Central Station Interfaces (optional and sold separately) and DVR integration.

6. Dialog Boxes will provide a means for entering information into fields and displaying information from the System Software database.

B. Workstation Customization:

1. Each Operator may customize the Graphical User Interface display location and size of the software components. After Logging Off and then Logging In again, the User Interface will display the software components exactly as the Operator left them when they Logged Off.
2. Alarm Viewer will bring the "Alarm Viewer Window" forward on new alarm(s) while you are in other Velocity windows.

C.

D. Time Zones:

1. Time Zones define periods during which readers, cards, codes, alarm inputs, doors or other system features are active or inactive. Basic configuration parameters shall "ask" the Operator to define "when" the user is enabling (or disabling) a specific feature. In addition to Monday-Sunday, there shall be one day of the week called Holiday. When selected, there will be 4 Holiday Schedules that determine if the Holiday is to be followed for this Time Zone. There shall be 64 Standard Time Zones, 64 Master Time Zones, and 20 Grand Master Time Zones.

E. Holidays:

1. Holidays are used within the system for the purpose of defining if a Time Zone is to be followed on a defined Holiday. Each Time Zone has up to 4 Holiday schedules. There are 366 user definable Holidays this year and 366 days next year. It shall be possible for the Operator to "Make the rest of Today a Holiday". Holidays shall be selected from a calendar, including the ability to select multiple days.

F. Door Groups:

1. Door Groups shall allow the user to establish groups of readers, each with its own unique Time Zone, at a facility for the purpose of granting or denying access to Credentials. Door Groups are assigned to Credential Templates, and people being added to the system take on the Door Group of the Credential Template selected during the enrollment process. A new Door Group may be defined when adding a Credential or Credential Template without having to exit and re-enter the Credential function for that Person.
2. The Door Group application shall allow the user to view any existing Door Group listed in the dialog box. A user, with proper authority, shall be able to modify, add, or delete a Door Group from the System Software.
3. More than one Door Group may be added to a Credential as long as there is no overlap of a controller in a door group already added to the Credential.
4. Door Groups may be combined into Master Door Groups, which can then be added to a Credential.

G. Function Groups:

1. Credentials can be assigned to perform a single User Function, like Momentary Access, or multiple functions like Momentary Access in one controller and Control Trigger Function in a relay controller for Elevator Access. When multiple User Functions are required by a Person, a Function Group may be defined and associated with one or more credentials. The Function Group requires a Scramble Pad keypad to be used, where the Person's base Credential PIN number is entered, followed by an * (Asterisk), followed by a one or two digit Extension digit, which defines which User Function will be issued for which Control Zone. This allows for a single person to perform multiple User Functions like: Unlock Door, Relock Door, Change Threat Level, Mask Alarm Inputs, Lock Down Doors.

H. Credential Templates:

1. A Credential Template can be used when adding Credentials to people. The Credential will take on the properties of the Credential Template selected. This will minimize the number of keystrokes and time required to add a Credential to a person. The Credential Template properties include: Credential Name; Badge Template; Activation and Expiration Date and Time; ID Format; Card Type; Code Length; Duress Digit; Credential Function and Category; Door Group, Multiple Door Groups, or Function Group; Threat Authority; 2 Person Rule options; Use Count, Day Limit, and Absentee Limits; Apply Credential Management Globally; Tag, Alert, Disable Credential;

Issue Number; Status; Executive Override for Pass back; Special Needs Access Extension.

Credential Templates may be linked, whereby any User Credentials that are added with a Linked Credential Template can be group edited by editing the definition of the Linked Credential Template. A User's credential may be unlinked and customized or it can be linked to another Credential Template.

I. Command Sets:
   1. A Command Set defines an action or actions to be sent to a controller or controllers. Command Sets can include: Unlock and Relock a Door; Lock Down and Release a Lock Down on one or more doors; make the rest of today a Holiday; Mask all Interior Alarm Points; change the facility Threat Level; Forgive All Pass back. Once defined, a Command Set can be executed from the Command Set Window, or from a Graphic Floor plan ICON, if defined. There shall be an unlimited number of Command Sets available to be defined. Command sets shall be defined with pick lists and shall be restrict able by Operator Group and Workstation.

J. Roles

1. Each Operator is assigned one or more Roles that defines at each authorized workstation, what that Operator is allowed to see and do, including:
   a. Add-Ins
   b. Application Permissions
   c. Cameras
   d. Command Sets
   e. Credential Templates
   f. DIGI*TRAC Hardware
   g. Door Groups
   h. Event Viewer Filters
   i. Function Groups
   j. Graphics
   k. Person Groups
   l. Person Templates
   m. Reports
   n. Status Viewer Groups
   o. Video Explorer Groups

2. Alarm and Event Routing can be defined by Operator Role. Specific alarms and events can be routed by Time Zone to Operators to allow for only those Operators needing to see certain alarms and events can see them.

K. Operator:

1. Operators entered into the system shall take on the properties of the Role/s to which they are assigned. If the Operator is already defined in the Operating System, the "Find" feature can be used to select this Operator for use in Velocity.

L. Velocity Scheduling Agent

1. There shall be a Velocity Scheduling Agent that allows functions to be performed on an as needed basis, like activating and deactivating credentials. It can also schedule Tasks like: Synchronize Controller Clocks; Run Historical Log Archiver; Print Reports; Email Reports; Import/Export User Data; Execute third party applications; Dial-Up remote sites; Perform Database Maintenance (backups), and Run Command Sets on a Daily, Weekly, Monthly basis.

M. SQL Database Manager:

1. The SQL Database Manager shall launch SQL Server Management Studio Express for manual backups and restoration of backups when running SQL Server 2005 Express.

N. Diagnostic Window:

1. There shall be a Diagnostic Window available to aid in system diagnostics / troubleshooting. Once a Controller is selected, the Standard Setup and Status diagnostic commands may be selected from a drop down list and sent to the selected controller. The response from the controller is displayed in the Diagnostic Window, and may be viewed, copied to the clipboard, a Report created and printed or saved to a file.
2. In addition, any supported DIGI*TRAC Command can be sent to the selected controller.

O. Status Viewer:

1. There shall be a Status Viewer which displays in a spreadsheets type format, the real-time status of all or selected Doors, Readers, Inputs, Relays, Expansion Inputs, Expansion Relays, and Controllers. Devices may be grouped in to "Status Groups", which are selectable from a drop down list. Devices may have selected information displayed. The available list includes the following:
   a. Name and Address.
   b. Status.
   c. Alarm and Acknowledged Status.
   d. Masking Status.
   e. Line Module Input Status and Type.
   f. Relay Status.
   g. Detailed relay status
   h. Controller Threat Level status
   i. Revision Number.
   j. Enabled Status.
   k. Controller Alarm Relay, Tamper, and Battery Status.

P. Alarm Viewer:

1. The Alarm Viewer shall have 4 panes: Alarm, Acknowledged Alarms, Instructions, and Comments. At the bottom of the Main Console display are counters to indicate Active Alarms, Acknowledged Alarms, and Off Normal Conditions. Double clicking the Counter will launch the Alarm Viewer. The Alarm Viewer may also be manually launched, or automatically in the event of a new alarm occurrence. Alarm Viewer properties that may be configured include:
   a. Require Acknowledgement Before Clearing.
   b. Auto Acknowledge on RTN (Return to Normal).
   c. Require Entry of Note on Acknowledgement.
   d. Force New Note on Multiple Acknowledgements.
   e. Require Entry of Note on Clear.
   f. Force New Note on Multiple Clear.
   g. Restore Alarm Viewer on New Alarm.
   h. Specify the number of Cached Alarms to Load at Launch of Alarm Viewer.

2. Foreground, Background, Alarm, and Secure colors may be changed. In addition, the Columns of data viewed in the Alarm and Acknowledged windows may be selected and the sequence in which they will appear. The available columns include:
    a. ICON.
    b. DVR Video.
    c. Count.
    d. Controller Time.
    e. Host Time.
    f. Description.
    g. Address.
    h. Level.
    i. Alarm ID.
    j. Acknowledge Time and Acknowledged By (available for the Acknowledged Pane).
3. Tool bar ICONS shall include:
    a. Acknowledge Selected.
    b. Clear Selected.
    c. Acknowledge All.
    d. Clear All.
    e. Add Note.
4. Right Clicking an Alarm Event shall display a list of available options, including:
    a. Acknowledge.
    b. Clear.
    c. Acknowledge All.
    d. Clear All.
    e. Record Note.
    f. Go To Graphic.
    g. Display User Photo.
    h. Replay WAV file.
    i. DVR Alarm Video: Show Viewer and Get Recorded Alarm Video.

Q. Event Viewer:

1. The Event Viewer can display all or Filtered Transactions. Custom filers may be defined and selected, or Standard selections can be made for main categories of Event types. Column width, order, selection, and scrolling direction are user definable, as well as text and background color.
2. The number of cached events to load when launched, up to 10,000, may be defined. The Operator shall be able to scroll back in time to view events no longer seen on the screen, without the need for running a report.

R. Velocity Learning Center - An Internet Explorer like “Velocity Learning Center” page shall be available for accessing on-line help, tutorials, manuals, Known Issues, and Product Registration information.

S. Create Defect Report

1. There shall be a wizard to create a system defect report to aid in reporting issues to factory technical services personnel.

T. Customization Manager:

1. There shall be a Customization Manager that allows the Operator to define an alternate language or change the English name or label for each element of the software.
2. Audio WAV files may be defined for playback when a particular Alarm Type is active.
3. Priority Levels may be defined (1-99) for each Alarm Type.
4. Operator Instructions per Alarm Type shall be user definable.
5. Individual Alarm Points may be customized on an individual point level, where each alarm point can have a unique priority, wav file, and operator response instructions.
6. Alarm points that are customized can have an assigned "escalation" where if an operator doesn't respond in a user defined period of time, the alarm event can be escalated to another Operator with the selected Role.

U. Report Manager:

1. The Report Manager shall allow the Operator to select from a number of pre-defined Reports. Custom Reports can be created outside the software, and added to a Custom folder, making the Custom Reports available from within the Report Manager application.
2. Once a Report is selected, the default Criteria and Sorting options may be used, or custom Criteria and Sorting options may be selected. The report criteria can be optionally displayed on the top of the report.
3. Once the report is run, it may be viewed, printed, or saved in various standard file formats.

4. Standard Reports included as standard shall include:
    a. Customization Reports:
        1) Component Resources.
        2) Customizations Report.
    b. DIGI*TRAC Configuration
        1) Controllers.
        2) Doors.
        3) Expansion Inputs.
        4) Expansion Relays.
        5) Inputs.
        6) Network Layout.
        7) Printers.
        8) Readers.
        9) Relays.
    c. History Logs:
        1) Active Alarms by Date.
        2) Alarm Log by Date.
        3) Alarm Log by Date with Comments.
        4) All Events Log.
        5) External Events Log.
        6) Internal Events Log.
        7) Operator Log.
        8) User Activity Log.
    d. Person Information:
        1) Credential Status.
        2) Door Access by Person.
        3) Dossier Style by Person.
        4) Expired and To-Be-Expired Person Access.
        5) Expired Credentials.
        6) Last Access by Person.
        7) Person Access and Function Group Summary.
        8) Person Access and Function Group Summary with Codes and Cards.
        9) Person Access by Door.
        10) Person Access Summary.
        11) Person Access Summary with Codes and Cards.
        12) Person FG Summary with Codes and Cards.
        13) Person Function Group Summary.
        14) Who Is Inside Where.
    e. Velocity Configuration:
        1) Command Sets.
        2) Door Groups.
        3) Function Group Extensions.
        4) Functions Groups with Users.
        5) Functions with Users.
        6) Holiday Schedules.
        7) Holidays.
        8) Master Door Groups.
        9) Master Door Groups with Persons.

10) Operator Groups.
11) Operators.
12) Time Zones – Grand Master Time Zone.
13) Time Zones – Master Time Zone.
14) Time Zones – Standard Time Zone.
15) Time Zones – Standard Time Zones in Use.

V. CCTV Interface:

1. System Software shall allow the ability to define, view, monitor, and control the CCTV Matrix Control System. Simulated Alarms can be sent to the switcher, as well as Tours, Presets, select a specific camera, Grab and Store a CCTV image, and pan/tilt/zoom/iris controls for the selected camera. In addition, one or more Triggers and Actions can be defined for each camera.

W.DVR Interface:

1. The DVR interface configuration allows a qualified Operator to add a new DVR to Velocity. Properties defined when adding a DVR include:
   a. DVR Name.
   b. DVR Description.
   c. DVR Vendor (American Dynamics: DV8000, DV16000, Intellex IP, and Ultra; and Integral Technologies DVX series currently supported).
   d. DVR I.P.
   e. I.P Port (Control).
   f. I.P. Port (Live Video).
   g. DVR Server Name.
   h. Port (Listen).
   i. Time Zone.
   j. DVR Enabled.
2. From the DVR Interface Configuration, the Operator shall be able to Search and Retrieve video from one or more cameras for a specified period of time. In addition, the Event Viewer History enables a qualified Operator to track and report events that are specific to the DVR subsystem history logs. These logs include:
   a. Active Alarms by Date.
   b. Active Alarms by Date with Comments.
   c. Alarm Log by Date.
   d. Alarm Log by Date with Comments.
   e. All Events Log by Category.
   f. All Events Log by Date.
3. The DVR interface shall allow a qualified Operator to:
   a. View Cameras.
   b. Generate a Host Alarm.
   c. Stop a Host Alarm.
   d. Get Alarm List from DVR.
   e. Search and Retrieve Recorded Video.

f. Play Local Video.
g. Time Synchronization.
h. Diagnostics.
i. View DVR Properties.

4. When Viewing cameras, the Operator may select Small, Medium, or Large display size, and select for viewing 1, 4, 9, or 16 cameras to display in the View Window. Cameras may be selected then dragged to the window the Operator wishes to view the camera in. If the camera has Pan/Tilt/Zoom/Focus/Iris control, the Operator can open the control functions and operate the on-screen controls for the selected camera.
5. An Operator shall be able to define Triggers and Actions that allows Alarms and Events in Velocity to cause Alarm recording in the DVR through an API interface. A camera preset can be defined as well as a View Group to automatically display on alarm.
6. In Graphics, DVR Cameras and DVR recorder ICONS can be placed on floor plans and used to view the associated video from the selected camera.
7. Video can be exported from a DVR and store it on the Velocity PC, then transfer the video to other media like CD-R and CD-RW.
8. There shall be a Velocity Video Explorer application that lets a qualified Operator to view multiple cameras from multiple DVRs in a single window. Cameras can be displayed in 1, 4, 9, or 16 display views and these views can be saved as View Groups for fast and easy selection by the Operator.
9. Alarms can be sent from the DVR to Velocity. Alarms include: Motion and Video Loss. When used with MATE Behavior Watch advanced analytics, these alarms can be displayed in Velocity

X. Console Preferences:

1. The Console Preferences shall define specific settings or devices for use with Velocity. These shall include: Show Splash Screen on Startup; Access and Enable Customized Values for Components in Customization Manager; Use 24-Hour Time Format; Automatically start Velocity when computer starts; PIN and Code reuse options; Display Credential template and time to display; SQL Server and Network Connections settings; Alarm Options for Stacking, Make Note requirements, repeat Multimedia until Acknowledged, and Alarm Queuing options; Report, Budging, and Alarm/Event Printer properties; CCTV Properties.

Y. DIGI*TRAC Configuration:

1. This function shall contain the required definition of the hardware components of the system. The database files shall be based on the hierarchy of the system hardware as it is physically installed in the field.
    a. The system shall have the ability to export controller configurations in an XML format for later use on this or other systems.
    b. The system shall have the ability to import a previously exported controller configuration for ease of adding a new system.
    c. The system shall have the ability to drag and drop and duplicate controllers in the hardware tree. No reprogramming of Door Groups shall be required when dragging and dropping one or more controllers in the hardware tree.

Z. Controller Properties:
1. Controller Properties shall define all General settings for the Controller. These setting will include: Name, Type, Address, Local Time Zone, Enabled Status, Firmware Revision Number and Date, Expansion Option Boards Installed and available Hardware. All additional Controller Setup Options can be defined here and are detailed in the Firmware Features section below.

AA. Controller Device Properties:
1. The Controller Device Properties shall define all connected field devices, including: Doors, Readers, Inputs, Relays, Expansion Inputs, and Expansion Relays. Device names and all operating parameters shall be definable if operation other than the included defaults is required.

BB. Graphics:
1. The Graphics application shall allow the Operator to add, delete or modify graphic floor plans and add indicator ICONs to graphic floor plans that represent Controllers, input/output points, readers, or cameras located in the facility. Formats for Graphics supported include: jpg; bmp; dxf; wmf; emf.
2. There shall be two Modes, Live and Design. The Live mode shall be used for real time monitoring. In addition, right clicking an ICON presents the Operator with a list of available Access or Control Functions that can be issued to the device. The Design mode allows the Operator to Define which Graphics are to be used, place ICONs on the Graphics, and define properties for each ICON.
3. There shall be a Pan and Zoom Viewer that provides a key plan that can be panned and scrolled by moving the red box, which indicates the current viewing area.

4. There shall be a Directory of available Graphics to easily select the desired Graphic to display.
5. The Graphics application shall display the real-time state and condition of Alarm Points and Doors. The Door ICONs shall change from a closed door ICON to an Open door ICON, representing that the door is open. When the door is closed, a closed ICON will appear again. The Alarm ICONs shall change from a closed contact ICON to an Open contact ICON, representing that the alarm device is active. When the Alarm Device is restored to its normal condition, a closed contact ICON will appear again. The ICON will also display the Device Name and Alarm Condition that caused it to go into an Alarm condition. The Color of the ICON will also change based on whether it is in alarm or secure.
6. User definable ICONs can be created and used. Link ICONs can added to quickly link to other graphics. Command Set ICONs can be used to issue a Command Set with a single mouse click.
7. Custom Links shall be available to provide additional functionality. These links include:
    a. AXIS Camera Link – This link shall enable the Operator to launch an AXIS IP camera from any graphics page. A dedicated viewer window will open for each camera link by double clicking the link.
    b. Quick Link – This link shall enable an Operator to launch an HTML page from any graphics page. A dedicated window will display the defined HTML page when the link is double clicked.

CC. Badge and Graphics Designer:
1. The Badge and Graphics Designer shall allow the Operator to create and customize an unlimited number of Badge Templates that may be assigned to a Person in the Enrollment Manager and create Backdrops to be used in the Graphics module.
2. An Object Toolbar shall be available for selecting Objects to appear on the Badge Template or Backdrop, including: Bit Map Logos, Photos, Fixed Text, and Database Fields. Each Object shall have a Properties box where the specific Properties of that Object are defined, including: File, database field, Font Color, Font Style, Font Size.

DD. Enrollment Manager:
1. The Enrollment Manager application shall maintain information related to a Person, and Credentials assigned to that person. Multiple Credentials per person shall be supported. New people can be added with the assistance of

a Person Template to automatically enter User Defined field data and select Person Groups for this person.

2. The Personal Information pane shall include the General, 10 Additional Tabs, and a Person Group tab. The system shall be capable of defining 999 user definable fields and place them on any of the 10 Tabs. The captions of the Tabs are customizable and can be restricted by Operator. There shall be an "Additional Images" tab that can be used to store additional photos of the person, photos of relatives, and/or photos of Assets assigned to the person. These field names can be either a "Text Box", "Dropdown" where the Operator can enter text, or select from a Dropdown List, a "Dropdown List" where selecting from the List is required, Date, Number, Unique number, Auto-unique, Auto-sequential, unique text, and the Dropdown and Dropdown Lists can sort in Ascending or Descending order. Fields can be made "Required", where the Person's record cannot be saved unless data is entered in that field. Field captions can have their color changed. A Photo field shall be available for acquiring a live video image, acquire an image from a TWAIN device, or acquiring a photo from an existing file. A Record Last Updated field shall be available, as well as Preview and Print a Badge. A signature field shall also be available.

3. A Person can be placed in one or more Person Groups. An Operator's Role/s determines which Users an Operator can view.
4. Once a person is added, one or more Credentials may be added to that Person. Credentials may be added using a Credential Template, or directly without a Credential Template. The Credential will take on the properties of the Credential Template if used. There shall be a Card Enrollment Station used for entering card data into the system. PIN Numbers can either be randomly selected, or Operator/User selected. Multiple card formats shall be supported, including: multiple bit length Wiegand, ABA (magnetic stripe), and custom. Each credential can have assigned one or multiple Door Groups, Master Door Groups, or Function Groups for access and control authorization. If a new Door Group is required and not currently defined, the Operator can create a new one from within the credential management application. Additional credential properties that may be assigned include:
   a. Badge Template.
   b. Card Data.
   c. Hot Stamp Card Number.
   d. Activation Date/Time.
   e. Expiration Date/Time.

f. PIN Length.
g. PIN Number.
h. Duress Digit.
i. Day/Use/Absentee Limits.
j. 2 Person Rule.
k. Threat Authority.
l. Tag.
m. Alert.
n. Disable.
o. Pass back Executive Override.
p. Special Needs Access.
q. Issue Number.

Devices may be configured to allow for scanning and automatic field data entry from a Business Card scanner, Drivers License Scanner, Passport Scanner, and PIV Smart Card Reader. Fields can be mapped to allow for proper placement of the scanned data in the correct field.

There shall be the ability in the credential management program to provide Print and Issue control for budging, where the maximum number of times a badge can be issued and printed can be set, as well the current count listed. The reason for a badge reissue shall be logged for auditing purposes.

5. Once a Person is selected from the List, the Credential Status and information is displayed for the assigned Credentials. The information includes: IDF, ID, Function, Description, Status, Expires On, Last Access, Last Door, Tag, and Alert. An Operator may right click on a Credential, and will be presented with the following options: Tag, Alert, Disable, Forgive Pass back, Override Code Tamper, Reset Limit Count, Force Download, Unassigned, Delete, and Properties.

6. The bottom of the Enrollment Manager window shall display counters for: People, Assigned Credentials, Unassigned Credentials, and Guest Credentials.

7. Multiple User search options shall be available, including: “Find Person” query search builder; form based quick search, and Quick Find.

8. There shall be the capability to group edit multiple User’s user defined fields and Person Groups.

EE. Download Monitor:
1. The system shall display the status of all data downloads to the field controllers.

FF. Switch Operator:

1. There shall be the capability to change Operators without the need for the current Operator to Log Off the computer. The new Operator's Velocity permissions are then used during the session to control access to Velocity functionality.

GG. Velocity Data Import/Export:

1. There shall be the capability to Import user related data into the database. This data can be in either a text file, Comma Separated Value format, or XML format. The imported data can be mapped to any of the user definable fields available within the Velocity Enrollment Manager. In addition, a User's photo, signature, and credential info, including PIN, card number, hot stamp card number, and the Credential and Person Templates to use when importing are available for importing.
2. There shall be the capability to Export user related data from the Velocity database. This exported data can be formatted in a text file, Comma Separated Value, or XML format. This data can be selected from any of the fields available in the Velocity Enrollment Manager.

HH. Add-Ins: The following "Add-Ins" are available to be added to Velocity by an authorized Operator.

1. Velocity Remote Desktop – The Operator shall be able to launch a terminal services session from within the Velocity shell.
2. Launch pad – The Operator shall be able to launch standard Windows applications within Velocity.

II. Software Developers Kit (SDK): The Security Management Application shall support an SDK to allow for external third party applications to interact with the Enrollment Manager Application. It shall also provide for external event and alarm monitoring and control back into the application in an XML format.

1. API – There shall be available as an option, an Application Programming Interface to allow third party applications to manage Users and Credentials in the Security Management application, including add, edit, and delete functions.
2. XML – There shall be available as an option, an XML interface to allow for the Security Management application to receive commands in an XML format, as defined by the SDK, to perform commands like: List Alarms, Acknowledge Alarms, Unlock Doors, issue Command Sets, and others, and to provide command responses in an XML format.
3. The Vendor shall have available a Professional Services Group to assist and/or provide solutions using the SDK.

1.18HARDWARE REQUIREMENTS

A. Controllers:

1. There shall be three primary types of controllers:
    a. Access control (1 Door [Hirsch Model M1N], 2 door [Hirsch Model M2N] and 8 door - [Hirsch Model M8N].
    b. Alarm monitoring (16 supervised inputs - [Hirsch Model M16N]), expandable to 32 inputs.
    c. Relay control (8-32 relay [Hirsch Model MSPN-8R] with the addition of REB8 relay expansion boards and (64 relay - [Hirsch Model M64N]).

B. Each controller shall have the following common features.

1. Controller Board: The controller board shall be microprocessor based, incorporating Flash ROM (firmware) downloadable from the Host Computer, RAM (User Information, System Setups, Event Transaction Buffer) and a Clock/Calendar. The ROM shall be modularly upgradeable in the field for enhancements to system features. All powered connections to the controller board shall be protected by fuses. All wiring connections to the controller board shall be to "Phoenix" type screw terminals. Each door connection shall consist of terminals for two readers, one 10 Amp rated Form C dry output relay for lock control, and one input for monitoring a status switch, a request-to-exit device, and a tamper switch. There shall be status indicator lights for active relays, as well as diagnostic indicator lights to aid in system troubleshooting. There shall be dedicated alarm output relay/s for external reporting of the following conditions: Alarm; Duress; Tamper; and Trouble.
2. Enclosure: The controller enclosure shall be a NEMA style metal cabinet designed for surface mounting. It shall have a tampered, removable hinged door with a high security key lock. It shall have conduit knockouts to allow from 1/2" to 1" EMT conduit to be used for wire entry into the cabinet.
3. Internal Power Supply: The controller shall have an internal power supply that will accept 50 Hz/ 200 - 240 VAC, or 60 Hz/100 - 120 VAC. The primary side of the power supply shall be protected with a fuse. The power supply shall provide 28 VDC power to the controller board, internal battery charger, selected card readers, and reader interface boards.
4. Standby Battery: The controller shall have an internal standby battery that is capable of running the system during AC power interruptions. It shall be recharged by a charging circuit incorporated into the controller board.
5. Expansion Options: A maximum of five (5) expansion boards can be installed in each controller, with the

exception of four (4) in the Model M64N and none in the Model 1N. A SNIB (SCRAMBLE*NET Interface Board) is included with each controller with the “N” designation in the part number and takes up one of the available expansion slots. A SNIB2 is included with each controller with the “N2” designation in the part number.

6. Alarm Inputs: The controller shall be capable of accepting up to 32 additional supervised alarm inputs, in increments of eight (8). The sensitivity of the line supervision shall be 2% AA Standard. The alarm expansion boards shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable. This option shall be limited to 16 additional supervised alarm inputs for the 16 zone alarm input controller (Model M16N) and none for the Model M1N. The alarm expansion board shall be Hirsch Model AEB8.
7. Relay Output: The two (2) access control (Model M2N and Model M8N) and one (1) alarm monitoring (Model M16N) controllers shall be capable of accepting up to 32 additional Form C, 2 Amp rated relay outputs in increments of 8. The 1 - 32 relay controller (Model MSPN-8R) shall accept up to a maximum of 24 additional Form C, 2 Amp rated relay outputs in increments of 8. The 1 - 64 relay controller (Model M64N) and the Model M1N shall not accept any additional relay outputs. These outputs shall be used for control applications other than standard door access, such as elevator floor control, local door annunciators, HVAC interface, etc. The relay expansion boards shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable. The relay expansion board shall be Hirsch Model REB8.

8. CODE/Buffer: The controller shall be capable of expanding the CODE database up to a maximum of 132,000 Users with the addition of a memory expansion board. The board shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable. The CODE/Buffer expansion board shall be Hirsch Model MEB\CB64 (64,000 Users) or the MEB\CB128 (128,000 Users). Both Expansion Boards shall expand the Buffer capacity as well as the Code record capacity. The Model M1N shall not accept any CODE/Buffer Expansion board.
9. Event Transaction Buffer: The controller shall be capable of expanding the event transaction buffer up to a maximum of 20,000 events and 2,000 alarms with the addition of a memory expansion board. The board shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable. The event transaction buffer expansion board shall be Hirsch Model MEB\BE. The Model M1N shall not accept a Buffer Expansion board.
10. Intelligent Reader Interface: The control panels shall utilize an intelligent reader interface (Hirsch MRIA or MRIB) to communicate with card readers of various types. The interface shall be microprocessor based and allow data formats including ABA magnetic stripe, Wiegand (26 to 55 bit), Proximity, Bar Code, Touch Memory, RF and Biometric. The interface shall utilize a digitizing algorithm, which will convert the card data to a unique number, thus, eliminating the need for facility codes. A single interface shall support both entrance and exit readers with keypads associated with each door. The interface shall be U.L. Listed to U.L.294. The reader interface shall be included as standard in all Scramble Pads.

1.19CONTROLLER FIRMWARE

A. General Features:

1. The software for the controller shall reside in Flash ROM (firmware) and be located on a plug removable module on the controller board to facilitate easy field upgradeability of the features. All of the necessary software for a fully functional System is located in the controller. The controller firmware shall include the following general features at a minimum and be fully supported by the VELOCITY head-end.
   a. 3 - 15 digit keypad Code's.
   b. Duress digit for keypad Code's.
   c. 150 Time Zones for access restriction and automatic event control.
   d. 128 Access Zones for access management.
   e. 256 Control Zones for alarm and relay management.

f. 366 programmable holidays this year, 366 days next year. Each Holiday may be assigned to 1 – 4 Holiday Schedules.
g. Automatic daylight savings time clock adjustment.
h. 27 different functions for Code's and cards, e.g. access, unlock, re-lock, alarm mask, relay control.
i. Add user records.
j. Tag users for annunciation at host computer.
k. 4,000 Users.
l. 1500 event, 1500 alarm transaction buffer.

B. Access Control Features;

1. The controller shall include the following access control features at a minimum:
   a. Restrict access by: time of day; day of week; door; holiday.
   b. Momentary Access of door up to 8100 seconds.
   c. Extended Access for User Definable Momentary Access duration (requires Scramble Pad). Scramble Pad will display time remaining on the minute, and annunciate at the defined "Warning Time".
   d. Special Needs Time Extension to provide additional time for Momentary Access and Door Open Too Long for selected people.
   e. Unlock/Re-lock of door by CODE, card or Time Zone.
   f. Door status monitoring shall allow for: door forced monitoring; door-open-too-long monitoring; door-open-too-long while door is unlocked; auto-re-lock of door when opened or closed.
   g. Request-to-exit masks alarm and/or unlocks door.
   h. 2 person requirement by door. A user can be defined as Normal, A/B Rule A, A/B Rule B, Executive Override. Can be disabled by Time Zone.
   i. 63 Pass back Zones. Can be disabled by Time Zone. A User can designated with Pass back Executive Override.
   j. Use Count limits on users
   k. Absentee Rule limits on users.
   l. Temporary Day limits on users.
   m. Occupancy Counting / Minimum & Maximum limits per Pass back Zone.
   n. Dead man CODE / Timer.
   o. Threat Levels – 99 Levels may be defined. Based on the Level in effect for the facility, selected readers may be disabled, dual readers in Card/Code Only During Time Zone can require

dual, and selected User's Credentials can be disabled.

C. Alarm Management Features:

1. The controller shall include the following alarm management features at a minimum:
   a. Momentarily mask alarm by CODE and/or card.
   b. Mask/unmask alarm by CODE and/or card or by Time Zone.
   c. Alarm device supervised while masked.
   d. Tamper switch on alarm device monitored while masked.
   e. Tamper Input may be configured to operate as a "Latch Monitor" with the appropriate door lock hardware.
   f. Entry/Exit delay per alarm input.
   g. Alarm input triggers relays.

D. Relay Control Features:

1. The controller shall include the following relay control features at a minimum:
   a. CODE and/or card, input, or other relay triggers relays.
   b. Trigger relay/s by time zone.
   c. Relay may be normally de-energized or energized.
   d. Disable relay/s during time zone.
   e. Clear relay at end of time zone.

1.20 CARD READER/KEYPAD SPECIFICATIONS

A. Readers:

1. The controllers shall accept all of the following reader technologies concurrently: Scrambling Keypad; Mag Stripe; Wiegand; Proximity; Smart Card; Bar Code; Biometrics - Retinal Scan, Hand Geometry, Fingerprint; Radio Frequency. The readers can be used for access control, alarm management, and/or relay control and shall be capable of being used alone (keypad only, card only) or a scrambling keypad and any other reader technology may be combined to operate as a dual technology reader where two valid IDs (PIN and card) are required.

B. Scramble Pad:

1. The controller shall be capable of using scrambling keypad readers. The keypad shall incorporate the following features: Scrambling display of numbers 0 - 9 (numbers appear in different location every time it is used); +/- 4 degree horizontal and +/- 26 degree vertical viewing restriction; accept 3 - 15 digit CODEs simultaneously; be disabled for 1 minute and report CODE Tamper violation

(guessing CODEs); be disabled and report Physical Tamper violation (attempt to remove keypad from mounting box); silent CODE duress; status LEDs for reporting granted, denied, and overridden transactions, AC Fail, Programming Mode active, responses to Status Request of Alarm Inputs and Relay Outputs; weather resistant; supervised by controller; and built-in diagnostics. The Scramble Pad shall include the MATCH Reader Interface functionality for connection of up to two (2) card readers. The scrambling keypad shall be the Hirsch Scramble Pad Model DS47L.

2. A version of the scrambling keypad shall be available for use in high ambient lighting conditions or where the front is subject to direct sunlight. This version shall have a +/- 26 degree horizontal and +/- 4 degree vertical viewing restriction. The high intensity display scrambling keypad shall be the Hirsch Scramble Pad Model DS47L-HI.
3. A version of the scrambling keypad shall be available with an integrated proximity card reader. Presentation of the card shall automatically auto-start the scrambling display. The scrambling keypad with integrated proximity card reader shall be the Hirsch ScrambleProx Model DS47L-SPX.
4. A version of the scrambling keypad with high intensity display shall be available with an integrated proximity card reader. Presentation of the card shall automatically auto-start the scrambling display. The scrambling keypad with integrated proximity card reader shall be the Hirsch ScrambleProx Model DS47L-SPX-HI.
5. A version of the scrambling keypad shall be available with an integrated smart card reader. Presentation of the card shall automatically auto-start the scrambling display. The scrambling keypad with integrated smart card reader shall be the Hirsch ScrambleProx Model DS47L-SS-IE.
6. A version of the scrambling keypad with high intensity display shall be available with an integrated smart card reader. Presentation of the card shall automatically auto-start the scrambling display. The scrambling keypad with integrated smart card reader shall be the Hirsch ScrambleProx Model DS47L-SS-IE-HI.

C. Mag Stripe Card Readers:

1. The controller shall be capable of using standard ABA/ISO high and low energy track 2 cards and readers. The reader shall have a wide throat to accept laminated photo ID cards. For indoor and outdoor use, the mag stripe reader requires the addition of a MRIB (MATCH Reader Interface Board) or a MRIA (MATCH Reader Interface Assembly).

D. Wiegand Card Readers:
   1. The controller shall be capable of using standard Wiegand readers and cards with 26-55 Bit standard Wiegand data formats. The readers can be swipe, insert, turnstile, or key.

E. Proximity Card Readers:
   1. The controller shall be capable of using proximity readers that output a standard 26-55 Bit Wiegand data format. The readers can have a short or long read range and be unidirectional or bi-directional.

F. Bar Code Reader:
   1. The controller shall be capable of using Bar Code readers and cards with standard Wiegand data format output. The reader shall be swipe, black, weather resistant, and capable of reading multiple symbols, including concealed bar codes.

G. Miscellaneous Readers:
   1. The controller shall be capable of using any reader technology that outputs a standard ABA/ISO data format or a standard 26-55 Bit Wiegand data format. Readers that meet this requirement include: Radio Frequency; Biometrics - Hand Geometry, Retinal Scan, Finger Print, Voice Recognition; Smart Card, including Mifare, DESFire, and FIPS-201 compliant readers.

EXECUTION

1.21EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

1.22INSTALLATION

A. Install system in accordance with manufacturer's instructions.

B. Install wiring for detection and signal circuit conductors in conduit. Use 22 AWG minimum size conductors.

C. Make conduit and wiring connections to existing door hardware devices as required.

1.23FIELD QUALITY CONTROL

A. Test in accordance with NFPA 72 – National Fire Alarm Code

B. Test in accordance with Hirsch Electronics testing procedures for "Velocity Security Management System".

1.24TRAINING

A. The two designated System Administrators shall attend the 4 Day Factory Velocity Class.

B. The Dealer shall coordinate with the System Administrators for two 8 hour Operator training sessions on the Operational System to be conducted on-site on the actual running system.

1.25MANUFACTURER'S FIELD SERVICES

A. Provide manufacturer's field services for final system checkout and acceptance testing as required.

1.26PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

LIST OF APPROVED MANUFACTURER

Low Voltage Switchboards / Distribution Boards

a. Hussain & Company.
b. Zelon Engineering
c. Unique Engineering
d. YUWATECH Engineering

Circuit Breakers

a. M & G

b. TERASAKI
c. ABB

LV Cables and Wires
a. Pakistan Cables Ltd
b. AGE Cables
c. Pioneer Cables Ltd.

PVC Conduits and Accessories
a. Galco
b. Prince
c. Jeddah

Back Boxes
a. Hussain & CO.
b. Ezzi Engineering

Switch & Socket Outlets
a. Clipsal E-Series
b. M.K Slim Line

FAN & Accessories
a. Pak Fan
b. GFC Fan
c. Millat Fan

Lighting Fixtures
a. Philips
b. Zain light
c. Osram lights
d. Pierlite

Data Communication System
a. Siemens
b. Clipsal Datacom
c. 3M
d. Panduit

Telephone Cable
a. Pakistan Cables Ltd.
b. Pony Taiwan

Fire Alarm System
a. Gent (UK)
b. Zeton (UK)
c. Zeta (UK)
d. Simplex
e. Honey Well (USA)

Closed Circuit Television (CCTV) System

a. Pelco (USA)
b. Tyco
c. Samsung (Korea)

Nurse Call System
a. C - Tec UK
b. Rondish USA

Lightening Protection System
a. W.J. Furse – U.K
b. Erico – U.K

Queue Management System
a. Guardall-(Canada)

Public Address System
a. TOA
b. Bosh
c. Boss

Transformers
a. Siemens
b. PEL

Cable Tray System

a. Unique Engineering
b. Zelon Engineering
c. YUWATECH Engineer

PLUMBING SYSTEMS

1.0 GENERAL REQUIREMENTS

1.1 General

a) Scope:

The work included in this section consists of providing and installing a complete system of Potable Water Distribution System, Sanitary Sewerage System, Storm Water Drainage System, Plumbing Fixtures, Drainage Lift Pump, Pumping equipment, Sewer Appurtenances, Miscellaneous Items, Make-up Water filling System as per drawings and specifications including all labor, materials, equipments, tools and tackles and implements necessary for the execution and completion of the entire system.

b) General:

The work will be carried out to the strict requirements and directions of the Consultant and complete to his entire satisfaction and conform to the good sanitary practices.

The Contractor shall appoint and keep for all times during the currency of this contract qualified plumber holding – license from local bodies and fully competent technicians of the required trades.

The Contractor shall be deemed to have visited and/or inspected the site prior to tendering to apprise himself of the condition under which the work will be executed.

The Contractor will have to coordinate this work with other civil works in such a manner that all works are completed within the accepted time of completion of the civil works.

The Contractor shall be deemed to have thoroughly studied the specifications and drawings.

The Contractor shall allow in his price for all cutting charges and holes and subsequently repairing these in a workmanlike manner. No claim will be allowed on this account.

The Contractor shall include in his price for painting all pipes with one primer and two finishing coats of approved make and shade enamel paint.

The Contactor shall at his own expense, get the entire system tested or retested to the satisfaction of the Consultant.

c) Method of Testing:

Water system shall be tested in the following manner and cost of testing including all damaged pipes shall be deemed to be included in the price of water supply works:

Initial testing (individual testing).
Progressive testing.
Final testing.

d) Individual Testing:

In initial testing pipes shall be tested individually over a test bed consisting saddles, thrust plate and force pump with a pressure gauge. The thrust plate shall be strong enough to resist a pressure equivalent to double the test pressure i.e. 150 psi pipe shall be placed over test bed with one end inserted into thrust plate groove and the other plugged water-tight and to pump forcing water with pressure.

Pump shall be operated to buildup to required pressure in pipe i.e. 150 psi. After the test pressure is reached the pump shall be stopped and pipe shall be watched for 6

hours for any drop in pressure and any visible leaks. Any pipe showing leaks or pressure drop beyond 5 psi shall be rejected and removed from site.

e) Progressive Testing:

Test shall be made after roughing in and before walls ceiling and floors are finished. Water under pressure shall be used, all the openings in the installation shall closed and pressure of 15 psi shall be developed in the system with the help of a bond force pump. After the required pressure has been obtained and pumps have stopped, the pipes shall be inspected by eye or ear for any leak and also for any pressure drops in the gauge. The test shall be performed in convenient segments during the course of work and provision of sufficient plugging tees and valves in the pipe line shall be made available for the purpose at the cost of the Contractor. The Contractor shall submit a time schedule for such tests.

f) Final Test:

The test shall be made with the same pressure as given above after the fixture has been installed and the system is completed.

g) Sewerage:

Method of Testing

(i) Initial Testing

After the completion of lying and jointing of the plumbing system it shall be tested to locate leakage connections or faulty installation the following procedure:

(ii) Water Test

For this test all the openings in the drainage pipe shall be closed. The openings shall be closed by – test plug which shall be inserted in the open end of pipe or fitting so that the heavy rubber gasket fits tightly all around. When all openings have been closed water shall be run into the pipes and the test pressure at the lowered end shall be built up by operating force pump. The drop in pressure the water after pumping is stopped, indicates the leakage that shall be subjected to pressure of 4.2 meter of water in pipes. This test shall be performed in convenient segments and provision for plugging etc. shall be done by the Contractor for this purpose.

1.2 SPECIAL REQUIREMENTS

a) General:

It is the intent of the drawings and specifications that all works, machinery equipment and piping fixtures be provided complete, tested adjusted and made ready for operation. The drawings and specifications shall be taken as a whole and not separately since they are intended to explain and illustrate each other.

Any apparatus, appliances, materials or work not shown on drawings but mentioned in the specifications or vice versa and any incidental accessories necessary to make the work complete in all respects and ready for operation, even if not particularly specified, or shown in the drawings shall be provided without additional expenses.

Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work and in the Contractor offer, the same as if herein specified or shown.

b) Coordination:

The contact documents have been carefully coordinated to avoid overlapping or conflict, however, should any discrepancies by old between contract documents within a trade or between trades, they shall be immediately reported to the Consultant so that the required revision, or work directive may be issued to all parties concerned, at the earliest possible date.

c) Coordination With Other Traders:

The Contractor shall cooperate with other trades and furnish and/or exchange the information necessary to permit the work of all trades to be installed satisfactory and with the least possible interference or delay.

Contractor shall be responsible for all setting plans, templates, shop drawings, and layout diagrams to assure installation of equipment in proper space relationship to other equipment and Contractor so that the equipment shall be operate-able in accordance with completion schedule as set forth.

d) Standard Specification:

In all cases where standard specifications, such as BSS, ASTM and the like are referred to in these specifications, the latest revision in effect at the time of bidding, shall govern.

e) Materials & Equipment:

Unless otherwise specified, all materials and equipment provided shall be new and shall conform to the grade, quality and standards specified herein.

Materials and equipment provided under these Specifications shall be limited to products regularly produced and recommended by the manufacturer for the service intended. This material and equipment shall have capacities and ratings sufficient to amply meet the requirements of the project. The capacities and ratings shall not be in excess of those published by the manufacturers but must be in accordance with the engineering data or other comprehensive literature made available to the public by the manufacturer and in effect at the time of opening bids.

Sanitary fixtures shall be installed in strict accordance with manufacturer's instructions for type and functioning of each piece if fixture used.

These instructions from the manufacturer shall be considered part of these specifications. Type, capacity and functioning shall be guaranteed suitable and shall operate satisfactory in the system, for the purpose intended.

f) Drawings:

The drawings have been made to scale with the best knowledge of conditions, dimensions and space requirements available at the time of drafting. Any error, or discrepancies detected in the drawings shall be reported to the Consultant immediately upon discovery for the attention and instruction and as to further procedure.

The contactor shall follow drawings in laying out work and check drawings of other trade to verify space, in which the plant will be installed, Maintain maximum headroom and space condition at all points. Where headroom or space condition appear inadequate the drawings shall be modified and approved by the Consultant before proceeding with the installation and if directed by the Consultant before proceeding with the installation and if directed by the Consultant reasonable modifications made in the layout as needed without extra charges; to prevent conflict with the work of other trades or for prior execution of the work. Where variations occur between the drawings and the specifications or either documents itself the item or arrangement of better quality and/or greater quality, shall be included into the contract price. The Consultant will decide on the items and manner in which the work shall be installed.

g) Approval of Materials & Equipment:

The materials, workmanship, design and arrangement of all work installed under the contract shall be subject to the approval of the Consultant. Reference to model, type or figure number of particular manufacturer is done solely for the purpose of indicating the standard of quality, type character and finish desired. Equipment manufactured by other companies of comparable design and configuration, meeting all the specific requirements of the item number may be acceptable when approved by the Consultant.

The Contractor shall submit to the Consultant for approval within fifteen (15) days after the acceptance of the bid, a complete list of manufacturers of sanitary fixtures and materials, along with detailed catalogues. All other items shall be provided in accordance with the detailed specifications. The Contractor's intent to use the exact marks specified does not relieve him of the responsibility of submitting such a list. Where any equipment, materials process or method of construction of manufactured article is specified by name or by reference to the catalogue number of manufacturer, use the specifications as a guide and not to take precedence over the basic duty and performance specified, as noted on the drawings. In all cases verify the duty specified with the specific characteristics of the materials offered for approval, if materials is installed before it is approved, the Contractor shall be liable for its removal and replacement at no extra charges to the Client if in opinion of the Engineer the material or equipment does not comply with the drawings and specifications.

h) Samples:

The Contractor shall submit samples of any and all materials for approval at the instructions of the Consultant.

i) Accessibility:

The Contractor shall locate all equipment which must service operated or maintained in fully accessible positions, include, but do not limit access to valves, traps, clean out, drain points and controllers, if required for better accessibility, furnish access doors for the purpose.

j) Open Ends:

Plug or cap shall be provided at all open ends in the piping, conduit and duct work system as the work is erected, in the order to keep out all foreign objects and water.

Contractor shall be responsible for removing from the system any foreign materials which could adversely affect the operation of the system.

k) Record Drawings:

The contractor shall during the progress of work keep a careful record of all changes where actual installation differs from that shown on the drawings. Upon completion of work the contractor shall furnish at this cost a completion set of tracings on which the contractor shall in neat and accurate manner make at complete record of all changes and revisions of the original design and as installed in the completed work.

The completion drawings shall be scrutinized and finalized by the Consultant and two sets of prints handed over to Consultant.

l) Other Works:

Builder's Works

Builder's work including foundations, cutting, patching and redecorating of construction is included in this contract. This work will be carried by the contractor at his own cost and arrangement. All cutting in the construction shall subject to the approval of the Consultant and shall subject to the approval of the Consultant and shall make good after completion on work to the entire satisfaction of the Consultant.

2.0 POTABLE WATER DISTRIBUTION SYSTEM

2.1 GENERAL

a) Scope

The extent of the potable water distribution system is shown on the drawings and includes pipe work, valves, fittings and miscellaneous appurtenances, chambers, related structures and testing and disinfecting the entire system.

b) Quality Assurance

i. Quality Control

Establish and maintain quality control to assure compliance with the specified requirements for all work to the satisfaction of the Engineer.

ii. Codes and Standards

Comply with the applicable requirements of the following Codes and Standards:

- IPC – International Plumbing Codes.
- AWWA – American Water Works Association
- ASTM – American Society for Testing and Materials

c) Submittals

Manufacturer's Data: Submit manufacturer's data, test certificates, specification and installation instructions for pipe, pipe fittings, valves and other accessories.

d) Material Delivery, Storage and Materials

i. General

At every point of loading or unloading, provide suitable means for lifting and loading. Do not unload by means of rolling down plank or other form of inclined ramp. Ensure that pipes, fittings and other items are kept dry, clean and adequately stored. Perform work in accordance with manufacturer's instructions and to approval of the Engineer.

ii. Handling of PPR Pipes

- Store PPR pipes in covered areas and protect from direct sunlight.
- During storage, ensure that PPR pipes are not distorted. Stack pipes on a level surface off the ground or in suitable racks. Ensure that sockets are situated at alternate ends. Install bearing timber at appropriate spacing and to sufficient width to prevent denting of pipes. Stack pipes only to the extent recommend by manufacturer. Provide adequate protective measures for pipes and other items in transit.
- Distorted, buckled or defective pipes shall not be used in the work.

2.2 MATERIALS

a) Polypropylene Random (PPR) Pipes and Fittings

i. Pipes and Fittings

Provide PPR pipes and fittings that comply with DIN 8077-8078 PS45339-98 & 4534-99 Standard. Provide pipes that are suitable for installation depths, bedding and loading conditions and working pressure to which they will be subjected.

ii. Joints

For pipe jointing, comply with DIN 8077-78.

iii. Testing

Provide manufacturers certificate that testing of pipes and fittings complied with the specified requirements.

b) Gate Valves

Provide gate valves, conforming to BSS-1952 flanged or threaded ends and suitable for a working pressure of not less than 7 bar.

Provide valves designed to turn counter clockwise to open with indication arrows. Valves in chambers with hand-wheel or with operating nut and key as indicated and buried valves with operating nut and key. Provide not less than one (1) tee bar for every five (5) valves.

Carryout protection of surfaces of valves in chambers by the application of two (2) coats of approved oil paint to a total dry film thickness of not less than 0.15 mm.

c) Concrete Works

Concrete and all related works shall conform to Specification of Concrete. Provide anchor blocks, valve chambers, encasement concrete, etc. where required and indicated on drawings.

d) Pipe Embedment

Provide fine aggregate complying with ASTM C33 consisting of natural sand, manufactured sand or a combination thereof.

e) Equipment

All equipment necessary and required for the proper construction of water supply lines shall be on the project in first class working condition and shall have been approved by the Engineer before construction is permitted to start.

2.3 EXECUTION

a) Inspection

The Contractor shall examine the substrates and the conditions under which the potable water system shall be carried out and correct any unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

b) Excavation

i. The width of the pit or trench for the structure shall be sufficient to permit satisfactory jointing of the pipe and / or pouring of concrete and thorough tamping of the bedding material under and around the structure, but it shall not be less than the external diameter of the pipe.

ii. Where a firm foundation is not encountered at the design grade, due to unsuitable material, this soil shall be removed and replaced with approved fill material for the full trench width. The Engineer shall determine the depth of removal. The fill material shall be compacted to provide adequate support for the pipe.

iii. Excavate trenches to the depth indicated or required and carry the excavation to a depth below the bottom of pipes for pipe embedment, or concrete encasement as indicated or directed.

iv. Employ hand excavation methods when machine digging will cause damage to buildings or other structures, above or below ground. Wherever necessary to prevent caving, trench excavations in soils such as but not limited to sand, gravel and sandy soil shall be adequately sheeted and braced. Withdraw sheeting in increments of not more than 300 mm and fill and compact resulting void by the withdrawn sheeting. Pile all excavated material in a manner that will not endanger the work or obstruct walkways and roads.

v. Provide and maintain adequate barricades, construction signs, warning lights, and guards to protect persons from injury and to avoid property damage during the progress of the work until the site is safe for traffic use. Rules and regulations of the Government regarding safety provisions shall be observed.

c) Pipe Laying

i. General

Install the potable water system generally in compliance with the lines and grades indicated on drawings and as herein specified.

- *PPR Pipes*
  Install in accordance with the manufacturer's instructions.

- *Valves*
  Install in accordance with manufacturer's written instructions unless otherwise specified or directed.

ii. Alignment and Grade

Lay and maintain pipes to the required lines and grades. Provide fittings, valves, hydrants, etc. at the required locations with joints centered and all valve and hydrant stems plumb. No deviations shall be made from the required lines for grade except with written consent of the Engineer.

d) Maintenance

Restoration and Cleanup: Restore and replace any removed or damaged paving, curbs, etc. or other disturbed surfaces and structures, to the satisfaction of the Engineer.

Removal all surplus pipe material, tools, temporary structures etc. Dispose of all dirt, rubbish, excess excavated material to approved dumping area, and leave construction site clean to the satisfaction of the Engineer.

e) Disinfection

Before the Engineer places in service and before certification of completion the pipeline, flush and disinfect the potable water system in accordance with AWWA C601, “Disinfection Water Mains”.

2.4 CONNECTION FROM THE EXISTING SWEET WATER MAINS

The Contractor is required to conduct the survey of the proposed route from the point indicated on the drawing up to the existing mains from where water connection will be permissible. This item of bill of quantities includes survey, design and connection with water mains for sweet water from the water mains. The Contractor will submit his proposal for this work to the Engineer for approval, which shall include taking connection from the mains, providing and laying PE Schedule-80 water pipelines of appropriate diameters including all valves and specials, as required and connect with project pipelines.

3.0 SANITARY SEWERAGE SYSTEM

3.1 GENERAL

a) Scope

The sanitary sewerage system shall consist of all piping, manholes, sewage lift pumps and all ancillaries including connecting to the existing system as shown on the drawings.

b) Quality Assurance

i. Establish and maintain quality control to assure compliance with contract requirements and local codes for all construction operations required under this Section.

ii. Prior to shipment from factory, test all types of pipes and fittings at the place of manufacture. Submit to the Engineer for each consignment or shipment authenticated certificates to indicate that the manufacturer satisfactorily tests the pipes and fittings and found to comply with these specifications.

iii. **Codes and Standards**

Comply with the applicable requirements of the following codes and standards:

- IPC – International Plumbing Codes:

- Pipes for Potable Water of Un plasticized Plastic (Polyvinyl Chloride).

Methods of Testing of Pipes for Potable Water of Un plasticized Plastic (Polyvinyl Chloride).

- ASTM - American Society for Testing and Materials

- A 48 Specification for Gray Iron Castings

- A 126 Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings

- C 33 Specification for Concrete Aggregates

- C 270 Specifications for Mortar for Unit Masonry

c) General Requirements

i. Connections to manholes shall be watertight after installation.

ii. All piping shall conform accurately to the lines and grades shown on the Drawings.

iii. Any connections for existing systems shall be made with a minimum amount of disturbance to the existing lines.

iv. Any existing pipelines or structures which are damaged while making connections shall be replaced or reconstructed to the satisfaction of the Engineer without cost to the Employer.

v. All piping shall be examined for defects. Any defective piece discovered after installation and test shall be removed and replaced by the Contractor at no expense to the Employer.

vi. System shall be inspected and joints approved before any backfilling is placed over pipes.

vii. All pipe and fittings shall be kept clean until final acceptance of work. The exposed ends of all uncompleted lines shall be closed with wooden plugs adequately secured at all times when pipe laying is not actually in progress.

viii. All piping shall be installed on a good foundation and adequate means taken to prevent settlement.

ix. The Contractor shall trim the bottom of trenches to receive the pipes and shall round out bottoms so that the pipe will rest firmly on 200 mm undisturbed sand at proper line and grade.

x. All piping laid in trenches shall be provided with a solid uniform bearing throughout the entire length.

xi. Trenches shall be kept free from 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 dry areas.

xii. Precautions shall be taken to protect incomplete work from flooding due to storms or other causes. All pipe lines or structures not stable against uplift during construction shall be thoroughly braced or otherwise protected.

xiii. All work under this section shall conform to the requirements of the National Plumbing Code Handbook, International Plumbing Codes and Uniform Plumbing Code, unless otherwise specified hereinafter.

d) Submittals

i. If an inspection of the completed sewer or any part thereof shows any structures, pipes or joints which are defective, the defective work shall be replaced or repaired immediately and to the satisfaction of the Engineer.

ii. The Contractor shall perform, at his own expense, any tests or inspections required by local authorities. The Engineer shall witness the tests.

iii. All joints shall be inspected and an inspection of the line as a whole shall show pipes to be true to line and grade with full circles visible at all manholes.

e) Material Delivery, Storage and Handling

i. **General**

At every point of loading or unloading, provide suitable means for lifting and loading. Do not unload by means of rolling down planks or other form of inclined ramp. Ensure that pipes, fittings and other items are kept dry, clean and adequately stored. Perform work in accordance with manufacturer's instructions and to the approval of the Engineer.

ii. **Handling of UPVC Pipes**

- Store UPVC pipes in covered areas and protect from direct sunlight.
- During storage, ensure that UPVC pipes are not distorted. Stack pipes on a level surface off the ground or in suitable racks. Ensure that sockets are situated at alternate ends. Install bearing timber at appropriate spacing and of sufficient width to prevent denting of pipes. Stack pipes only to the extent recommended by manufacturer. Provide adequate protective measures for pipes and other items in transit.

- Distorted, buckled or defective pipes shall not be used in the work.

3.2 MATERIAL

a) Un plasticized Polyvinyl Chloride (UPVC), Pipes and Fittings

i. Pipes and Fittings

Unless otherwise indicated provide UPVC pipes and fittings that comply with British Standard. Provide pipes that are suitable for installation depths, bedding and loading conditions and working pressures to which they will be subjected.

ii. Joints

For pipe jointing provides rubber rings that comply with ASTM D 1869. Provide 2 rubber rings for each pipe joint.

iii. Testing

Provide manufacturer's certificates that testing of pipes and fittings complied with the specified requirements of BSC 15.

b) Pipe Embedment

Provide fine aggregate complying with ASTM C33 and consisting of natural sand, manufactured sand or a combination thereof.

c) Concrete Works

Concrete and all related works are to conform to Specifications of "Concrete".

d) Thermal and Structure Protection

Bituminous damp-proofing and joint fillers and sealants and all related works shall conform to British Standards.

e) Manholes

- Manholes shall have the minimum inside dimensions shown on the Drawings.

- Manhole walls shall be of poured-in-place reinforced concrete. Top section must be cast such as to suit elevation and accommodate size of manhole frame and cover.

- Manhole floor shall be of reinforced concrete and inverts stream lined with cement and mortar into a semi-circular path with sanitary turns and have their corners filled and sloped towards the water path to prevent any settlements of solids as detailed on the Drawings.
- Concrete foundation and benching for manholes shall be constructed in accordance with details as shown on the Drawings.

- All pipes or castings to be embedded in the manhole walls shall be accurately set, and if so required, headers shall be laid round the casting so embedded.

- All work must be carried out in a manner to ensure watertight work, and any leaks shall be caulked, repaired, or the entire work shall be removed and rebuilt. Attention is particularly called to the necessity of keeping the water level below all parts of the foundation and walls until the concrete has obtained adequate setting.

f) Frames, Covers and Gratings

- The Contractor shall furnish and set level and to the proper grade, a cast iron frame and cover or frame and grating of the form and dimensions shown on the Drawings. The concrete shall be neatly and accurately brought to the dimensions of the base of the frame. The frames shall be thoroughly embedded in mortar. All covers and frames shall be heavy-duty quality.

- All castings for frames, covers, and gratings shall be of gray iron unless specified in the BOQ/drawings. All castings shall be made accurately to dimensions and shall be machined to provide even bearing surfaces. Covers and gratings must fit the frames in any position and if found to rattle under traffic, shall be replaced. Filling to obtain tight covers will not be permitted. No plugging, burning-in or filling will be allowed. All castings shall be carefully coated inside and out with coal tar pitch varnish of approved quality.

3.3 EXECUTION

a) Inspection

The Contractor shall examine the substrates and the conditions under which the sanitary sewerage system shall be carried out and correct any unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

b) Excavation and Preparation of Trench

i. Unless otherwise specified herein or directed on drawings, comply with the requirements of Specification of “Site Work”, and “Concrete”.

ii. Open trenches only as far in advance of pipe laying in order to maintain continuity of operations. Keep trench and other excavations dry at all times, and 1ead drainage to natural drainage channels.

iii. Trench width varies in respect to depth, nature of soil and pipe diameter. Maintain widths indicated on the drawings for at least 300 mm above crown of pipes. Where the trench crosses under a pavement or floor slab, hold width of

the trench to the absolute minimum. Trench width shall be minimum of O.D. + 600.

iv. Excavate trenches to the depth indicated or required and carry the excavations to a depth below the bottom of pipes for pipe embedment, for the replacement of unsatisfactory soil materials, or for concrete encasement as indicated and specified.

v. Provide and maintain adequate barricades, construction signs, warning lights, and guards to protect persons from injury and to avoid property damage during, the progress of the work until the site is safe for traffic use. Rules and regulations regarding safety provisions shall be observed.

vi. Conduct excavations for pipe laying operations to cause the least interruptions to the traffic. Ensure that hydrants under pressure, valve pit cover, valve chambers and other utility controls are unobstructed and accessible during the construction period. Provide adequate provisions for the flow of sewers, drains and watercourses encountered during construction. Restore satisfactorily all structures and any property that has been disturbed to their original conditions.

c) Pipe Lying

i. **General**

The entire work of pipe laying and manhole construction shall be carried out in a manner to ensure watertight construction and any leaks shall be repaired as directed by the Engineer. Pipe laying shall proceed upgrade with the spigot ends' of bell and spigot pipes pointing in the direction of the flow.

ii. **Standards**

- *UPVC Pipes*
  Unless otherwise directed, install UPVC pipes and fittings in compliance with the manufacturer's instructions. Take adequate care and schedule operations to ensure protection of pipes and fittings against undue deflection and over stressing.

iii. **Alignment and Grade**

Lay and maintain pipes to the required lines and grades. Provide fittings, at the required locations with joints centred and watertight. No deviation shall be made from the required line or grade except with the written consent of the Engineer. Furnish temporary support, adequate protection and maintenance of all underground and surface utility structures, and other structures encountered during the progress of the work. Where the grade or alignment of the pipe is obstructed by existing utility structures, relocate, remove or reconstruct such obstruction as directed by the Engineer. Whenever necessary to determine the location of existing underground utility structures, after examining the available records, make all explorations and the Engineer may direct excavations for such purpose as. Lay pipes to the depth shown or as directed. Coordinate the levels, and routings of all utilities and services in order to avoid any interference prior to installation of the utilities and services.

iv. **Pipe Laying**

Unless otherwise indicated, lay pipes on a minimum 150 mm pipe embedment material shaped to provide continuous support for the pipe barrel between coupling holes. Before the pipe is lowered into the trench, provide the following:

- Level bottom of trench to the lines and grades indicated and fill in and compact a layer of pipe embedment material to a minimum of 150 mm compacted thickness.

- Excavate and form coupling holes with sufficient length, width and depth to permit assembly as required.

v. **Lowering of Pipe and Fittings into Trench**

Provide implements, tools and facilities satisfactory to the Engineer for the safe and efficient execution of the work. Carefully lower into the trench with suitable and adequate equipment all pipes and fittings and in a suitable manner that will prevent damage to pipes and fittings. Under no circumstances permit pipes and fittings to be dumped into the trench. Inspect pipes and fittings prior to their being lowered into the trench. Repair or replaced as directed all defective, damaged or unsound materials, remove all foreign matter or direct from the interior of pipes and fittings before jointing. Keep pipe clean by approved means during and after laying.

vi. **Pipe Joints**

- *Jointing with Rubber Rings*
  Immediately before assembly, clean ends of pipes to be jointed and the coupling grooves and rubber rings. Assembly shall be made as specified and as recommended by the manufacturer. Ensure by suitable gage that rubber rings are in the required position and pipes are well centred.

- Pipes shall not be deflected either vertically or horizontally more than the limits recommended by the manufacturer. When pipe laying is not progress, close the ends of installed pipes by an approved means, to prevent the entrance of foreign bodies, water, soil etc. into the line. No line shall be laid in wet soil conditions that preclude proper bedding or in the opinion of the Engineer, the trench conditions or the weather are unsuitable for proper installation. Seal socketed ends with approved flexible material to prevent entry bedding material.

vii. Pipes built into structure shall have two (2) flexible joints adjacent to the structure, obtained by the use of two short pieces as indicated.

viii. Stub out and stopper shall be installed in manhole walls where indicated or required for future connections. Ensure that the stub out is completely sealed by the stopper.

d) Pipe Embedment and Backfilling

i. Pipe Embedment Procedure

Unless otherwise indicated, provide pipe embedment material as specified. Deposit and compact material in the trench uniformly in layers of 150 mm

maximum thickness at both sides of the pipeline for the full width of the trench and up to 300 mm above the top of pipeline. Well compact material below and all around the pipe to provide firm and continuous support. Ensure that the pipeline and protective systems are not displaced or damaged by the embedment operations.

ii. Provide concrete encasement to pipeline where indicated to dimensions and lengths specified on the drawings. Concrete for encasement shall have compressive strength of not less than 21.0 MPa. Protect pipeline from damage or displacement by the encasement operations. Provide appropriate concrete saddles to support pipes prior to encasement. Concrete encasement shall be discontinued for a length of 150 mm each side of the centreline of each pipe joint, to maintain flexibility of the pipeline.

iii. Backfill Remainder of Trenches and Around Structures

Backfill and compact trenches above embedment or encasement and around structures in layers of 200 mm compacted thickness and to a density as per area classification specified.

e) Leakage, Tests for Gravity Sewers

i. General

Except as otherwise directed, all pipelines shall be given leakage tests in sections of approved length. The Contractor shall carry out such tests after the partial trench backfilling has been carried out over the pipe barrel, excluding pipe joints, in order that pipes are not displaced during testing and that joints are apparent for inspection.

The Contractor may at his option carry out any preliminary tests he considers necessary before trench backfilling in addition to the leakage tests specified herein.

The Contractor shall furnish and install suitable and approved temporary plugs, supports and caps, all necessary pressure pumps, pipe connections, meters, gauges and other necessary equipment and labour required.

ii. Air or smoke shall be used for testing gravity sewer pipelines and the Contractor shall provide and, use equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low pressure air or smoke.

iii. Tests by Air or Smoke

- Pipes shall be tested in accordance with ASTM C 828. The testing equipment shall be provided with an air regulator valve or air safety valve so set that the internal air pressure in the pipeline cannot exceed a predetermined value approved by the Engineer.

- Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

- If the section fails to pass the requirements, the Contractor shall at his own cost do all work of locating and repairing leaks, removal and replacement of defective pipes, joints, couplings or fittings, making good and retesting a the Engineer may require and to his satisfaction. The Contractor shall be responsible for the ultimate tightness of the pipeline within the test requirements stipulated hereinabove.

f) Pressure and Leakage Tests for Pressure Lines

a) General

Unless otherwise, directed, comply with the applicable requirements of the general provisions of leakage tests for gravity sewers above.

b) Test

- The section of the pipe to be tested shall be filled with potable water and all air shall be expelled from the pipe. If blow offs are not available at high points for releasing air, the Contractor shall carry out the necessary excavation, backfilling, tapping at such high points and plug and make good any damage after completion of the test.

- The section of the pipe under test shall be maintained full of water for a period of 24 hours prior to the start of the pressure and leakage test.

- The pressure and leakage test shall consist of first raising the water pressure (based on the lowest point of the section under test and corrected to the gauge location), to a pressure equal to 0.8 Map. While maintaining this pressure, the Contractor shall make a leakage test by metering the flow of water into the pipe. If the average leakage during two (2) hours period exceeds a rate of 25 litres per 25 mm diameter per 24 hours per kilometre of pipeline, the section shall be considered as having failed the test. Furthermore, the pipeline shall have no visible leakage.

- If the section 3hall fail to pass the pressure test, or the leakage, test, or both, the Contractor shall at his own cost do all work of locating and repairing the leaks, removal and replacement of defective pipes, joints, couplings, or fittings, making good and retesting as the Engineer may require and to his satisfaction. The Contractor shall be responsible for the ultimate tightness of the pipeline within the test requirements stipulated hereinabove.

g) Maintenance

Restoration and Cleanup: Restore and replace any removed or damaged paving, curbs, etc., or other disturbed surfaces and structures, to the satisfaction of the Engineer.

Remove all surplus pipeline material, tools, temporary structures. Dispose of all dirt, rubbish, excess excavated material to approved dumping areas, and leave construction site clean to the satisfaction of the Engineer.

3.4 CONNECTING TO THE EXISTING SYSTEM

The Contractor is required to submit his proposal how he intends to connect the sewage generated from the end marked on the drawing to the designated manhole of the existing city sewerage system. The works include survey and pumping machinery with all structures and laying of pipeline to connect with the city existing system, complete. The Contractor is required to submit his proposed design to the Engineer for approval.

3.5 EXCAVATIONS

a) Trenching out Ground for Pipes and Tunneling:

Excavation for the drains in open trench shall be to the line and depth as directed. Great care shall be taken to excavate only to such depths as are correctly required for regular gradient.

Gap for joint as required shall have sufficient width to allow adequate working space for the pipe jointer and should in no case be less than 375 mm or the external diameter of the pipe plus 300 mm. Trenches are to be kept clear of water including any necessary pumping. Perform all tunneling for pipe when required. In the event of the excavation being made deeper than necessary they shall be filled up to proper level with cement concrete 1:4:8 at the contractor's expense. Cement concrete 1:4:8 is to be laid before the pipes are placed in position.

b) Planking, Strutting and Staging:

Excavation materials shall not be deposited within 45 cm of the edge of the trench and sides of the excavation shall be supported by planking and strutting if necessary to ensure proper and speedy excavation works.

c) Blasting

No blasting shall be allowed near new works. The rocks shall be excavated by chiseling except where otherwise allowed in writing by the Engineer.

d) Buried Services:

All pipes, ducts, cables, main and other services exposed by all excavation shall be effectively supported by timber or other means and protected from all kinds of damage. In case of any damage to the services, these shall be adequately repaired and restored to original condition by the Contractor at his own cost.

e) Backfilling:

No trench shall be backfilled until after the sewer pipes therein has been tested and approved by the Engineer. Earth filling to the bottom of the trenches and to a height of 150 mm above the top of the pipes shall be of selected materials, hand packed, watered, if necessary, and well rammed on either sides of the pipe. Special care shall be exercised where pipes are laid direct on the earth or no beds without benching or covers. The remainder of the earth filling shall be in 150 mm layers, each layer wetted, if necessary and well rammed with mechanical rammers or other efficient means for effective of consolidation. Where vegetable soil has been removed it shall be replaced at top of the trench and similarly consolidated. Headings shall be filled with the excavated materials, packed tightly in layers and rammed by hand on concrete of mix 1:3:6 or broken or hard core kept to a stepped face as the work proceeds. Surplus earth shall be disposed off as directed to the Contractor's expense. The trenches under paving shall be backfilled with local sand will compact to 97% density.

f) Holes & Chases:

Perform all holes, chases, sinking, cutting, under piping, sealing courses and labor, no extra will be paid for such work.

g) Sewer Pipe Lying:

Each pipe shall be carefully examined on arrival. Any defective pipes shall not be used and shall be segregated and marked in a conspicuous manner. Minor damage to the protective coating on iron drain pipes shall be made good by painting with cut bitumen

or tar, if major defects in the coating exist, the pipes shall be returned to the works for recreating. Drains shall be laid in straight lines and to even gradients as shown on the drawings or as directed. Great care shall be exercised in setting out and determining the levels of the pipes and the Contractor shall provide suitable instrument to set up and maintain all sight rails, bending and bench marks etc., necessary for the purpose. All drains shall be kept free from earth in a clean condition. Pipes shall be laid with the sockets leading up hill and shall rest on solid and even foundations for the full length of the barrel. Socket holes shall be formed in the foundation, as short as practicable but sufficiently deep to allow the pipe jointer room to work right round the pipes.

h) Jointing:

i. Joining Concrete Hume Pipe

All joints or RCC Hume pipes shall, unless otherwise described, be made by wrapping one lap of tarred gas-kitting round the spigot of the pipe and placing it into the collar of previous pipe. It shall then be adjusted, fixed in its correct position and gas-kitting caulked home not so as to occupy more than one quarter of the collar depth, the collar shall then be completely filled with cement sand mortar (1:1) and fillet shall be formed round the joints with a trowel, forming an angle of 45 degree with the barrel of the Pipe. All joints of pipes with bitumen rings shall, unless otherwise described, be made by first smearing them with cement motor and forming fill round it as described above for standard cement joints. Pipes designed for water logged trenches shall be constructed with push-on rubber ring joints.

ii. Jointing of API Drain Pipes:

All joints of MS pipes shall be by electric arc welding. All welding shall be cleaned free from under cut, porosity and slag welding should be done in a manner to produce well penetrated weld.

iii. Jointing Feet of Vertical Pipes in Concrete:

The rest beds in the ground at the set of all soil, rain water ventilating and other vertical pipes, to be bedded on solid concrete 150 mm thick.

3.6 MANHOLE AND CHAMBERS:

The specified sizes of the manholes and chambers, refer to inside dimension in the table below. Execute the manholes and chambers of 250 mm thick C.C. brick masonry laid in 1:6 cement mortar on 150 mm 1:3:6 C.C. bed with 13 mm thick 1:4 cement plaster on inside of walls and finished smooth with cement.

The specified sizes of manholes and chambers refer to the inside dimensions, the following sizes should be regarded as the minimum for rectangular square manholes unless otherwise given:

	INTERNAL DIMENSION OF CHAMBERS		
TYPE	**DEPTH**	**LENGTH**	**WIDTH**
"A"	up to 1 M	0.75 M	0.75 M
"B"	up to 2 M	0.75 M	0.75M
"C"	beyond 2 M	1.00 M	1.00 M

The manhole shall be provided with iron rings as per drawings or as directed by the Engineer.

i. Manhole Covers and Gratings:

Heavy duty C.I. covers with frame shall be provided. The weight of the cover with frame shall not be less than 1 Cwt. The dimensions shall be as indicated on the drawings. If no dimension are provided in drawing and BOQ a minimum if 450mm x 450mm cover shall be installed.

ii. Testing:

Immediately after the drains are laid and joined but before launching with concrete (where required) and the fitting in done, they shall be inspected. tested and passed by the Engineer, as satisfactory. All length of sewer and drains shall be tested for water tightness by water pressure.

3.7 CLEAN OUTS:

Clean out shall be of uPVC as shown on drawing. Clean out turning up through floors shall be made by long sweep 'ells' bends with plugs, at face or deck plates to conform to architectural finish in the room.

3.8 GULLY TRAPS:

Gully traps of China clay duly glazed with 150 mm x 150 mm cast iron/PVC gratings shall be supplied and installed. Masonry plastered with 1:3 cement, sand mortar on both sides and outside shall be constructed over the gulley traps and fitted with C.I. cover and frame of required size.

4.0 STORM WATER DRAINAGE SYSTEM

4.1 GENERAL

a) Scope

Storm water drainage system is shown on the drawings and consists of the construction of the storm water drainage network complete. Storm water be drained by means of roof drains and leaders will be freely discharged to the surface as indicated on the drawings.

b) Quality Assurance

Establish and maintain quality control to assure compliance with contract requirements and local codes for all construction operations required under this Section.

c) Prior to shipment from factory, test all types of pipes and fittings at the place of manufacture. Submit to the Engineer for each consignment or shipment authenticated certificates to indicate that the manufacturer satisfactorily tests the pipes and fittings and found to comply with these specifications.

d) Codes and Standards

Comply with the applicable requirements of the following codes and standards:

i. IPC – International Plumbing Codes:

ii. Pipes for Potable Water of Un plasticized Plastic (Polyvinyl Chloride).

Methods of Testing of Pipes for Potable Water of Un plasticized Plastic (Polyvinyl Chloride).

i. ASTM – American Society for Testing and Materials

ii. A 48 Specification for Gray Iron Castings

iii. C 33 Specification for Concrete Aggregates

iv. C 270 Specification for Mortar for Unit Masonry

e) Submittals

Submit shop drawings, details and descriptive literature showing pipe dimensions, joint and fitting details, recommended methods of installation, testing equipment, bedding details and calculations, recommended methods of cutting pipes and other relevant details.

f) Material Delivery, Storage and Handling

i. General

At every point of loading or unloading, provide suitable means for lifting and loading. Do not unload by means of rolling down planks or other form of inclined ramp. Ensure that pipes, fittings and other items are kept dry, clean and adequately stored. Perform work in accordance with manufacturer's instructions and to the approval of the Engineer.

ii. Handling of uPVC Pipes

- Store uPVC pipes in covered areas and protect from direct sunlight.

- During storage, ensure that uPVC pipes are not distorted. Stack pipes on a level surface off the ground or in suitable racks. Ensure that sockets are situated at alternate ends. Install bearing timber at appropriate spacing and of sufficient width to prevent denting of pipes. Stack pipes only to the extent recommended by manufacturer. Provide adequate protective measures for pipes and other items in transit.

- Distorted, buckled or defective pipes shall not be used in the work.

4.2 MATERIAL

a) Un plasticized Polyvinyl Chloride (uPVC), Pipes and Fittings

i. Pipes and Fittings

Unless otherwise indicated provide uPVC pipes and fittings that comply with BSC 14, Class D. Provide pipes that are suitable for installation depths, bedding and loading conditions and working pressures to which they will be subjected.

ii. Joints

For pipe jointing provides rubber rings that comply with ASTM D 1869. Provide 2 rubber rings for each pipe joint.

iii. Testing

Provide manufacturer's certificates that testing of pipes and fittings complied with the specified requirements of BSC 15 3505.

b) Equipment

i. All equipment necessary and required for the proper construction of the structures shall be brought on the project site in first class working condition and shall have been approved by the Engineer before construction is permitted to start.

ii. The Contractor shall provide hand tampers and pneumatic tampers to obtain the required compaction of the pipe bed and the backfill as specified.

4.3 EXCAVATION

a) The width of the pit or trench for the structure shall be sufficient to permit satisfactory jointing of the pipe and/or pouring of concrete and thorough tamping of the bedding material under and around the structure, but it shall not be less than the external diameter of the pipe or structure plus 0.30m on each side. Trench or pit walls shall be approximately vertical.

b) Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it from below the foundation grade for a depth of at least 0.15 m. The excavation below grade shall be backfilled with selected fine compressive material.

c) Where a firm foundation is not encountered at the design grade, due to unsuitable material, this soil shall be removed and replaced with approved fill material for the full trench width. The Engineer shall determine the depth of removal. The fill material shall be compacted to provide adequate support for the pipe.

d) The Contractor shall do such trench or pit bracing, sheeting, or shoring necessary to perform and protect the excavation and structure as required for safety and conforming governing laws, and perform and protect the excavation and the structure as required for safety and conforming governing laws, and perform all grading and pumping, if necessary, to prevent water running into the trench and to keep the trench dry. The Contractor shall remove the bracing, sheeting, or shoring after placing at the structure. Removal shall be done in such a way that it will not disturb the structure.

4.4 PLACING PIPE

a) General

Proper facilities shall be provided for lowering the pipe when it is to be placed in a trench. The pipe shall be laid carefully and true to lines and grades on a bed, which is uniformly firm throughout its entire length. Any pipe which is not in true alignment, or which shows any undue settlement after being laid, or is damaged, shall be taken up and re-laid or replaced without extra compensation. The laying of the pipe in the finished trench shall be started at the lowest point and laid upgrade. The bed of the trench shall be such that at least the lower quarter of the pipe shall be in continuous contact with the bed.

b) Pipe Laying

The Engineer shall inspect all pipes before they are laid, and reject any section that is damaged by handling or is defective to a degree, which will materially affect the function and service of the pipe.

When bell and spigot pipe is used, the bell shall be laid upgrade.

If tongue and groove pipe is used, the grooved end shall be laid upgrade.

The pipe shall be firmly and accurately set to line and grade so that the invert will be smooth and uniform. The pipe shall be protected from water during placing and until the mortar in the joints has thoroughly set.

4.5 MORTAR

Mortar shall be mixed in a ratio of 1 part by volume of Portland cement and 2 parts by volume of sand. The mortar shall be of the desired consistency for caulking and filling between the pipe and the drainage structures. Mortar, which is not used within 45 minutes after water has been added, shall be discarded.

4.6 PIPE JOINTS

a) Before any joint is made, the previously installed unit shall be checked to assure that a close joint with the adjoining unit has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to the required grade by striking it with a shovel handle, timber or other unyielding object.

b) All joint surfaces shall be cleaned.

c) Where any two-pipe units do not fit each other closely enough to enable them to be properly jointed, they shall be removed and replaced with suitable units and new gaskets.

d) Open ends of pipe and branches shall be closed with stoppers and secured in place in an acceptable manner.

e) The Contractor shall take all necessary precautions to prevent flotation of the pipe in the trench.

f) All times when pipe installation is not in progress, the open ends of the pipe shall be closed with temporary watertight plugs or by other approved means. If water is in the trench when work is to be resumed, the plug shall not be removed until suitable provisions have been made to prevent water, earth, or other substances from entering the pipe.

g) Pipelines shall not be used as conductors for trench drainage during construction.

h) Care shall be taken to prevent earth, water, and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipe and manholes, being careful to prevent soil, water, and debris from entering any existing pipe.

4.7 WORKMANSHIP

Bedding of Pipelines

a) The minimum thickness of bedding material beneath the pipe shall be 150 mm (minimum 100mm under sockets) for pipes not exceeding 200 mm internal diameter except when bedded on rock.

b) The time interval between placing bedding material on the trench formation and commencing pipe-laying shall be as short as is practicable.

c) The bedding material shall be compacted in layers not exceeding 200mm with one pass of a plate vibrator for gravels and two passes for sands or other approved equivalent mechanical method. Hand tamping or punning will only be permitted where insufficient space is available to allow the use of mechanical plant.

d) Recesses shall be formed in the bedding to accommodate pipe joints while ensuring continuous even support along the pipe length. Bedding material shall be prevented from entering pipe joints. After the joint has been made bedding material shall be carefully placed and hand compacted beneath the joint barrel to close any void left by the recess. Where the formation of the trench is of silt or soft clay and is below the natural water table a 75mm blinding layer of sand shall be substituted for the specified bedding material directly above formation and carefully compacted if directed on site.

e) Granular material for pipe bedding shall be free-draining, hard, clean, chemically stable gravel, crushed stir crushed slag, graded in accordance with the following table:

Percentage by Weight Passing Sieve

Test Sieve mm	**For Pipes of Diameter 500mm and below**
63	---
37.5	---
20	---

14	100
10	85 - 100
5	0 - 25
2.36	0 - 5

f) The material shall have a Compaction Fraction value not exceeding 0.2 when determined in accordance with the following test:

A representative sample of about 40kg shall be heaped onto a clean surface and quartered to obtain approximately 10kg. The moisture content of the sample should not differ materially from that of the main body of material, at the time of use in the trench.

4.8 LEAKAGE TESTS FOR GRAVITY PIPES

a. The pipelines shall be as nearly watertight as practical and leakage tests and measurements shall be made. Tests shall be carried out between each two manholes in the presence and to the satisfaction of the Engineer's Representatives.

b. Before commencing with the tests, all pipelines and concrete works shall be clean.

c. The Contractor shall furnish suitable test plugs, water pumps and appurtenances, and all labor required to properly conduct the leakage tests on the pipelines.

d. Upon completion of a section of the storm water bulkheads shall be installed, as required, to permit the test of the storm water pipe.

e. The storm water pipe shall be subjected to an internal pressure by plugging the pipe at the lower end and then filling the pipelines and manholes with clean water to a height of 60 cm above the top of the pipe at its upper end. Where conditions between manholes may result in test pressures, which would cause leakage at the stoppers in branches, provisions shall be made by suitable ties, braces, and wedges to secure the stoppers against leakage resulting from the pressure. The rate of leakage from the storm water shall be determined by measuring the amount of water required to maintain the level 60cm above the top of the pipe.

f. Leakage from the storm water pipe under test shall not exceed the requirements 1890 liters per 100mm diameter per km of the storm pipe per 24 hrs.

g. The Contractor shall construct weirs or other means of measurement as may be required, furnish water and do all necessary pumping to enable the tests to be properly made.

h. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating, repairing leaks, and retesting as the Engineer may require without additional compensation.

j. If the Engineer is in doubt that any damage had occurred in the pipelines in the process of pouring the concrete or backfilling, he shall have the right to order retesting of the doubted part. If the second test proves that the pipeline is not serviceable then the Contractor shall have to locate the damage, make it good, and carry out retesting until he secures satisfactory results. The cost of all such works shall be at the Contractor's expense.

k. All manholes shall be constructed so as to prevent leakage of water . Normally no testing for the Contractor conducts leakage of water from manholes unless it is in the opinion of the Engineer that the method of construction carried out does not fulfill the requirements.

l. In such a case, the Engineer shall have the right to ask the Contractor to carry out the testing to the manholes (in connection with water leakage) prior to backfilling and any damage revealed as a result of such testing shall be made good. All these works shall be carried out at the Contractor's expense and in accordance with the direction of the Engineer.

m. The Contractor shall prepare on site, and at his own expense, all work requirements, i.e. plugs for all diameters of pipes, pumps, etc., which should be acceptable to the Engineer.

n. The Contractor shall only use acceptable water for the purpose of testing. The Contractor shall bear all the costs regarding serviceable water used in testing, flushing and satisfactory disposal thereof.

o. The Contractor shall have to fix the plugs in ends of pipes to be tested and shall have to take necessary precautions to prevent plugs or fixings tools from getting inside the pipes as a result of water flushing.

p. Should the selections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing the leaks and retesting as the Engineer may require without additional compensation.

4.9 BACKFILLING OF PIPELINES

a. After completion of placement and Compaction of the surrounds to the pipelines and leakage test backfilling shall proceed using selected excavated materials in accordance with the specifications for earthworks.

b. The use of power rammers will not be permitted over any pipe until the depth of fill above the crown of the pipe is at least 300 mm.

c. Movement of construction machinery over a pipe drain shall be at the Contractor's risk. Any pipe damaged thereby shall be replaced at the expense of the Contractor.

4.10 CONNECTIONS

Where the drawings call for connections to proposed structures, these connections shall be watertight and so made that a smooth uniform flow line will be obtained throughout the system.

4.11 CLEANING AND RESTORATION OF SITE

After the backfill is completed the Contractor shall remove all tools, surplus material, dirt, and rubbish from the site. For paved areas the Contractor shall restore all disturbed areas to their original condition.

4.12 INSPECTION

Prior to final approval of the drainage system, the Engineer accompanied by the Contractor, shall make a thorough inspection. Any indication of defects in material or workmanship, or obstruction to flow, or poorly constructed joints in the system, shall be

further investigated and corrected. Defects due to the Contractor's negligence shall be corrected by the Contractor without additional compensation and as directed by the Engineer.

4.13 GENERAL EQUIPMENT

- All horizontal piping shall be pitched not less than one percent.
- Changes in direction of piping shall be made with long radius fittings.
- PVC non-pressure pipes and fittings for storm drainage should be capable to hold sufficient pressure and to the satisfaction of the Consultant.
- All roof drains shall be set 1 / 8" below normal finished floor, with a gradual pitch extending away from the drain.
- All pipe and fittings shall be kept clean, with the exposed ends of incomplete or unconnected work to be plugged.
- Cleanouts shall be placed at all changes in directions.

4.14 TESTS

When the roughing in work is complete, the entire system shall be subjected to flushing and then to a water test by plugging- up all openings and fillings all of the lines to the roof level. Any apparent defect shall be corrected or removed. The Consultant shall witness the test and inspect the workmanship.

4.15 DRAINS

Shall be PVC with large sump and flange, threaded or caulked bottom outlet, removable non-clogging low silhouette dome strainer, flashing clamping device and integral gravel stop. Each roof drain shall be provided with its own lead flashing.

4.16 MEASUREMENT AND PAYMENT

Measurement for PVC-non pressure pipe shall be in running length and the work to be done shall include earthwork, providing and fixing of pipe, pipe fittings, jointing, cutting, breaking concrete and then making it good applying protective painting, cleaning, testing and the measurement will be made for the full work specified herein.

Payment will be made at the unit rate quoted in the BOQ per running foot length of PVC pipe. The amount bid shall be full payment for the work specified herein.

5.0 PLUMBING FIXTURES

5.1 General

a) Scope of Work

The work included in this section of Contract consist of providing and installing complete system 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 respect.

All model numbers not indicated or approved equal implies that the contractor shall submit for the approval of Engineer a summary of the plumbing fixtures proposed indicating type, manufacturer name, model number. If samples are required by the Engineers then they shall be provided at no additional cost. No materials shall be purchased, before such approval is obtained in writing from the consultant.

b) General Requirements

All fixtures shall be free from imperfections, true as to line, angles, curves and colors, smooth, water tight and complete in every respect.

All fixtures specified to be of vitreous ware, shall be fired vitreous China ware of the best quality nonabsorbent and burned so that the whole mass is thoroughly fused and vitrified producing a material white or colored, which when manufactured will show a homogeneous mass, close grained and free from pores. The glazing and vitreous China fixture shall be of color approved by the Consultant thoroughly fused, and united to the body, without discoloration, chips, or flaws and shall be free from craze. Warped or other imperfect fixtures will not be accepted.

All plumbing fixtures and fittings shall be supplied by Contractor, all fixtures should be approved by the Consultant prior to installation.

All fittings, cast brass set screws, escutcheons, faucets, traps, exposed piping etc., shall be brass chrome plated over nickel plate with polish finished. Any hanger nuts visible shall likewise be chrome plate over nickel plate.

After installation of plumbing accessories, the Contractor shall ensure their protection against damage, misuse and general deterioration. Fixture outlets shall be plugged with suitable material to prevent external debris. All chrome plated and other metallic fittings shall be provided with a coat of grease to prevent their deterioration. All items prior to handing over must be in perfect condition in the visual and operational sense.

c) Materials Required

i. <u>Lavatory</u>

White vitreous china lavatory with pedestal / counter top shall be “PORTA/ICL BOSH MODEL" or equivalent with approved fittings.

Lavatory shall be completed with the following accessories

- Exquisite Line PORTA/ICL BOSH MODEL”.
- Fix 11, concealed 1 / 2 inch diameter basin mixer with hot and cold brilliant handles, cast spout with mousseure, pop-up waste set.
- Handles trecorn deluxe.
- 1 / 2" diameter stop cocks with flexible / chrome plated pipe.

- o 1-1 / 2" diameter C.P Bottle Trap with removable sump, outlet with compression nut.
- o C.P Towel rail of required length.
- o 1-1 / 2" inch diameter stainless steel waste pipe with chain waste and plug.
- o Soap tray of ICL BOSH MODEL".

ii. <u>Water Closet WWC-1 (WESTREN WATER CLOSET)</u>

White vitreous china siphon jet water closet with P or S trap shall be "PORTA MODEL" or equivalent with approved fittings.

Water closet shall be complete with the followings accessories.

- o 4" diameter flush pipe of required length
- o Vacuum breaker
- o Solid plastic closed front seat with cover and screws.
- o 1 / 2" diameter C.P. Inlet spout.
- o C.P Toilet paper holder.
- o Floor Flange gasket rubber bumper.
- o 1 inch diameter Flush valve.

iii. <u>Water Closet AWC-1 (EASTREN WATER SLOSET)</u>

White vitreous china siphon jet water closet Orissa type, with P or S traps shall be "PORTA MODEL" or equivalent with approval fittings.

Water closet shall be complete with the following accessories.

- o 4" diameter flush pipe of required length.
- o Vacuum breaker.
- o 1 / 2" diameter C.P. Inlet spout.
- o Floor Flange gasket rubber bumper.
- o 1 inch diameter Flush valve.

iv. <u>Shower</u>

Shower accessories will consist of the following approved fittings.

-) 1 / 2" diameter concealed valves threaded pipe connection with brilliant handles blue and red.
-) 1 / 2" inch diameter 4 way diverter.
-) Bath combination 1 / 2" inch.
-) Adjustable ball joint shower head 3 inch diameter with 1 / 2 inch shower arm.
-) 3 / 4 inch diameter bath spout with mousseur.

v. <u>Kitchen Sink</u>

Kitchen sink shall be "PORTA/ICL BOSH/REGINOX MODEL" or equivalent approved with "MASTER" approved fittings.

Kitchen sink shall consist of the following accessories.

- o Double bowl 20 gauge nickel stainless steel sink with double drain board.
- o PVC waste coupling, and 1-1 / 2" P.V.C bottle trap.
- o C.P 1 / 2 inch. Combination mixer (hot & cold) with pipe.
- o Cabinet fitted, size 550"x900x150" deep and 1100"x 900" x 150 deep.
- o Stain finish, self rim, Back Ledge with holes.
- o 1 / 2 inch single hole mixer.
- o Brilliant handles.
- o Extractable rising spray with diverter.
- o Set / spray metal tube.

- o Chain support.
- o 1-1 / 2" diameter PVC flush pipe of required length.

vi. <u>Shower Jet</u>

- Shower Jet shall be "PORTA" or equivalent approved.
- Shower Jet will consist of the following accessories.
- Double hole mixer.
- Hand spray with trigger control.
- Pressure proof flexible hose of SFS of required length.
- Jet / spray, tube socket.
- 3 / 4 inch diameter extractable spout.

d) Fixture Supports / Settings

Provide all hangers, supports, brackets, etc, for the proper installation of water closet, urinals, lavatories, suits etc, requiring supports shall be in accordance with the manufacturers recommendation, as approved and where necessary built into partitions or walls, and shall be set with the Construction progress.

e) Fixture Settings

Fixture shall be set in a neat, finished and uniform manner making the connections to all fixtures at right angle to the wall unless otherwise directed by the Consultant. Roughing for this work must be accurately laid out so as to conform with finished wall materials. Fixtures are not being set until as directed by the Consultant.

Each fixture and piece of equipment including floor drain, requiring connections to drainage system shall be equipped with a trap. Traps are to be supplied with the fixtures. Each trap shall be placed as near to the fixtures as possible and no fixture shall be double trapped, except as otherwise indicated. Trap installed on bell and spigot pipe shall be cast iron.

All fixtures and trimmings in so far as practicable shall be of one manufacturer.

All exposed chromium plated fittings such as pipes; valve etc. shall be protected immediately after installation. During installation s-trap or p-trap added wrenches shall be used on charge plated pipe and fittings etc.

All fixtures shall be set straight and true. The setting shall be level and flush with finished floors and partitions.

Plumbing fixtures shall be supplied complete with all required trimming; vitreous china fixtures shall be first class quality with smooth glazed surfaces, free from warp, cracks, discolorations or other imperfections.

Fixture mounting heights and spacing shall be as detailed on the Architectural and Engineer's drawings.

Protect fixtures from damage before and after installation.

Fasten fixture carriers securely to slab construction with power driven expansion shields and bolts.

f) Cleaning

Clean and adjust all fixtures and trim before acceptance.

g) Measurement and Payment

Measurement for payment of mirrors shall be made as net actual area in square feet of the mirror acceptably provided and installed in position as per drawings and instructions of the Consultant.

Payment for wash basins, kitchen sinks, water closets, urinals, showers, mirrors, and foot rest pairs shall be made at the applicable unit price as bid in the Bill of Quantities. The amount bid shall be full payment for the work specified herein.

6.0 DRAINAGE LIFT PUMP (not used)

6.1 GENERAL

a) Scope of Work:

Install and provide: complete assembled Drainage Duplex Lift Pump submersible type with controls as per drawings, specification and bill of quantities, complete in all respect to the satisfaction of CONSULTANT.

b) Material Required

Complete assemble including motor-driven submersible pump and all necessary auxiliary component, level controller, controls, wiring and interconnecting flexible aero flex rubber piping.

c) Pumps:

Pumps shall be Submersible type by Grundfos /KSB/ AMSTRONG. Entirely of stainless steel, wholly submerged in the liquid. The pump shall be capable of handling clean or slightly dirty waste water.

All external bolts and nuts shall be stainless steel. The impeller shall be capable of passing clean or slightly dirty waste water.

d) Controls:

Automatic sequence of pump with level controller as indicated in drawings.

The pump manufacturer shall warrant the pump being supplied to the consultant against defects in workmanship and materials for a period of one year after the system is handed over to the consultant by the contractor.

All sections of specification in section "Pumping Equipment" shall also apply in this section.

The sequence of control shall be such as stated on the drawings. The relevant electrical specification shall be as per electrical specification and to approval.

e) Sequence of Drainage Pump

Furnish and install cellar drainage pump with sufficient electrical cable to control pump operation. The built in switch shall automatically the pump operation to start/stop between two liquid levels. In case of pump failure a water alarm consisting of light and horn shall be suitably mounted on the control panel.

7.0 PUMPING EQUIPMENT [Pumps to fill Overhead tank]

7.1 GENERAL

a) Scope of Work:

Furnish and install pumps for the water filling/drainage & sewerage system as per drawings, specifications, and Bill of Quantities and as approved by the CONSULTANT.

b) Materials Required:

Install best quality Grundfos/KSB pumps complete with Siemens electric motors to CONSULTANT satisfaction.

c) Approval:

Before purchase of any pumping equipment, the Contractor shall submit all relevant data about the equipment to the Engineer for his approval. No equipment to be purchased before such approval is obtained in writing from the consultant. Also approval given by the consultant does not relive the Contractor for his responsibility of providing the pumping system complete in all respect, as per drawings, bill of quantities, and specification to the satisfaction of the CONSULTANT.

d) Installation:

Pumps and motors shall aligned in vertical/horizontal and leveled throughout the length and width and wherever necessary suitable support shall be provided to facilitates pipe connections and leveling.

Pumps shall be secured to bases with proper size anchor bolts.

Drains for packing glands etc. shall be piped to the nearest drain.

Pumps shall be located in accessible location for repairing and maintenance.

Grout base plates completely to provide a rigid non deflection support.

e) Testing:

Pumping equipment shall be tested for operating characteristics and duration of test shall be set by the CONSULTANT. Apparent defective equipment shall be repaired or replaced and such adjustments made to the equipment as may be necessary, all to the satisfaction of the CONSULTANT.

Also provide to the CONSULTANT the following information.

i. Pump data Make, Model, number, serial Number Design and Actual GPM, BHP, maximum shut off and design head, rpm suction and discharge pressures.

ii. Motor data; Make model and serial number, hp, rpm, locked rotor amps, Voltage, phase, frequency and actual volts and amps.

iii. Starter data: Make, size, model number, heater sizes, ampere reading, live voltage, control voltage frequency.

iv. The contractor shall also provide equipment catalog/certified performance curves, showing impeller diameter, BHP, and design conditions.

f) Controls:

All electrical equipment shall be operated at either 3 phase 380 volts or single phase 220/240 volts, 50 hertz or otherwise approved.

All electrical works, i.e. wiring, pumps starters & controls, etc., shall confirm with the approval of the CONSULTANT.

g) Sequence of Water in U/G:

Furnish & install a mechanical float valve in the U.G and Overhead Water Tanks. This shall cut off incoming water supply once the tank is full.

8.0 SEWER APPURTENANCES

8.1 GENERAL

a) Scope of Work

The work to be done under this section of the Specifications consists of providing all material, labor, equipment and appliances and in performing all operations including earthwork, concrete, block masonry, plaster, fixing manhole cover and frame, making holes etc. in connection with proper installation of miscellaneous sewer appurtenances i.e. manholes, grease traps, gulley traps etc. complete in strict accordance with this section of the Specifications and the drawings, and subject to the terms and conditions of the Contract. All sewer appurtenances shall be placed at locations to lines and levels as shown in the drawings and as directed by the CONSULTANT.

b) Material and Installation

i. <u>Manholes / Inspection Chambers</u>

Manholes and inspection chambers shall be built on sewers of the size, form, thickness and positions shown on the drawings or as directed by the CONSULTANT. The foundations and bed shall be made of concrete and the walls shall be of block masonry plastered with 1/2" thick 1:4 cement sand plaster. The inverts and benching shall be properly shaped to the forms and dimensions shown and shall be rendered with two coats of granolithic concrete and brought up to a smooth face to the forms and gradients indicated on the drawings. Unless otherwise indicated on the drawings, every manhole shall be provided with a cast iron frame and cover of dimensions shown on the drawings. The frame and cover shall be cast iron from good quality.

All manhole covers shall be true to pattern in form and dimensions, free from faults, cracks and other defects affecting their strength. The cover shall have a continuous and even bearing on the frame, and shall be properly set to avoid knocking. All inequalities, projections or roughness on abutting surfaces of the cover and the frame shall be removed, and the cover fitted into the frame as neatly as possible without jamming.

ii. <u>Grease Trap</u>

Grease traps shall be installed on waste line in the kitchen. The size, thickness and position shall be as shown on the drawings or as directed by the CONSULTANT. The grease trap shall be PDI Certified. The inlet and outlet pipes in the grease trap shall have Roding eyes.

Grease trap shall be provided with a G.I. sheet frame and cover of dimensions shown on the drawings.

iii. <u>Gully Trap</u>

Cement concrete gulley trap with chamber having cast iron frame and cover, shall be used on the downstream side of a manhole for isolating the drainage system from the sewer as shown in the drawings or as directed by the CONSULTANT. It shall have a water seal and a Roding arm to permit the outgoing pipeline to be rodded. The Roding eye shall have a remarkable air-tight plug which shall be provided with a chain.

c) Measurement and Payment:

Measurement for payment of sewer appurtenances shall be made on the basis of actual number of such fixtures acceptably provided and installed; of complete units as specified herein, inclusive of earthwork, concrete work, block masonry, plaster, iron steps, making holes etc. complete as per Contract Documents and/or as directed by the CONSULTANT.

Payment for sewer appurtenances shall be made at the applicable unit price per number bid in the Bill of Quantities. The amount bid shall be full payment for the work specified herein.

9.0 MISCELLANEOUS ITEMS

9.1 GENERAL

a) Scope of Work:

The work to be done under this section of the Specifications consists of providing all material and labor, equipment, appliances etc. for proper installation of miscellaneous plumbing items of valves, cocks, floor traps, rain water pipes, cleanouts, towel rails, service connections, water heaters, as specified herein or as shown on the drawings and/or as directed by the CONSULTANT.

b) Material and Installation:

i. Bronze/Malleable/Ductile Valves

All valves of 4" diameter and below shall be of bronze/Malleable iron/Ductile iron conforming to BSS 1952 and shall be of appropriate class for the working pressure. on which they are installed. Open and shut indicators shall be marked on the handle. The ends may be threaded or flanged. The valves are to be installed inclusive of all fittings and accessories.

ii. Float Valves

Float valves shall be made of cast iron body, gunmetal leather faced valve and seating, forged Bronze spindle, gunmetal links and pins and gunmetal lined cylinder, wrought iron lever and copper ball, and capable for working pressure 300 psig.

iii. Foot Valves

Foot valves shall be made of brass as per PN16 with strainer, and renewable disc ring.

iv. Taps

All the fittings shall be of approved model and appropriate class for 125 psig working pressure on which they are installed.

v. Floor Traps

Floor traps shall be of PVC. They shall have minimum water seal of 3" and shall be provided with removable stainless steel grating.

The traps shall be of self-cleaning type. The open area of the grating shall be at least two thirds of the cross-section area of the drain line to which it connects. Floor traps shall be well set in position so that there is no leakage at the joint between traps and the floor.

vi. Cleanouts

Cleanouts shall be of the same nominal size as that of the pipe on which it is installed. Cleanout shall consist of the same material as pipe i.e. PVC. Cleanouts shall be turned up through floor by long sweep fittings, wherever the space so permits. Top finish of cleanout shall be flush with the floor when located in open area. They may not be flush with the floor when installed near wall levels and not deep enough to make them flush.

Cleanouts shall be so installed that there is a clearance of at least 1'-6".
Cleanouts near walls shall be embedded in concrete. All other work of ferrule, plug, concrete work, frame and cover etc, shall be paid under cleanout item.

vii. Service Connection

Service connection of water to building shall consist of cast iron saddle clip, gasket, bolts, polyethylene pipe up to plug stop-cock with access pipe and cover etc. All material and equipment shall be suitable for pressure of potable water system.

Complete work including excavations, backfilling, supply and installations of all material as shown in the Contract Documents shall be covered under this item.

10.0 BOOSTER PUMPS

PACKAGED BOOSTER PUMPS

10.1 SUMMARY

Variable -speed, [Triplex], packaged booster pumps for domestic water piping systems.

10.2 QUALITY ASSURANCE

Quality Standard: UL 778 and ASME B31.9.

Packaged Booster Pumps: Listed and labeled by an NRTL as pumping systems.

10.3 PRODUCTS

Variable-Speed, Duplex Booster Pumps:

Pump: Overhung impeller, close coupled, multistage stage, end suction, centrifugal.

Casing: Radically split, cast iron.
Impeller: Stainless Steel/Cast bronze.
Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
Seal: Mechanical.

Pump Data:-

Capacities and Characteristics:

Capacity: As per Schedule
Discharge Head: As per schedule
Discharge Size: As per schedule
Motor Horsepower: As per Schedule
Volts: <**400**>
Phases: <3>
Refer schedules for further details.

Motor: Variable speed, with oil-lubricated bearings.
Piping: PPR PN-20.
Valves: Control, relief, shutoff, and check valves.
Sensors: Pressure and flow switches.
Dielectric fittings.
Control Panel:
High-suction pressure cutout.
High-discharge pressure cutout.
Remote signal contacts.

Hydro pneumatic tank. [As per drawings]

11.0 NATURAL GAS PIPING

11.1 PIPING MATERIALS

Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black. Wall thickness of wrought-iron and steel pipe shall comply with ASME B36.10M.Retain one of first two subparagraphs below.

Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.

11.2 SPECIALTY VALVES

Gate and Check Valves, NPS 2 (DN 50) and Smaller: Class 125, bronze body, valves suitable for fuel oil service, with "WOG" indicated on body.

Gate valves shall have solid wedge.
Swing check valves shall have bronze disc.
Lift check valves shall be vertical pattern; two-piece construction with bronze disc.

Ball Valves: UL 842; metal-body ball valve with threaded ends according to ASME B1.20.1 for pipe threads.

Pressure-Reducing Valves: UL listed for fuel oil service. Include bronze body with 150-psig (1035-kPa) minimum pressure rating.

11.3 PIPING INSTALLATION

General piping installation requirements are specified for water supply.

Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

Install strainer on inlet side of control valves, pressure-reducing valves, fuel oil pumps, and oil burner connections.

11.4 VALVE INSTALLATION

General valves installation requirements are specified for Water Supply.

Install valves in accessible locations, protected from damage.

Install ball valves at branch connections to supply mains and at equipment.

Install drain valves at piping low points.

11.5 CONNECTIONS

Install piping adjacent to equipment to allow service and maintenance.

Connect piping to equipment with ball valve and union. Install union between valve and equipment.

Install flexible piping connectors at final connection to burners or oil-fired appliances that must be moved for maintenance access.

SECTION - 2
FIRE FIGHTING SYSTEMS

1.0 FIRE EXTINGUISHING SYSTEM

1.1 DESCRIPTION OF WORK

Extent of Work: The extent of fire fighting equipment including is indicated on the drawings and as defined in these specifications. The type of fire protection is by portable fire extinguishers (Co_2 and Dry Powder chemical).

1.2 QUALITY ASSURANCE

a. Comply with governing regulations and use products produced by a sound firm with not less than 5 years experience in manufacturing similar products, and installed in similar service.

b. Comply with local fire department regulations for sizes, threading and arrangement of connections, and with NFPA-10 / Local Fire Code portable fire extinguishers.

c. Comply with Factory Mutual Approval Guide and with governing regulations.

1.3 SUBMITTALS

Submit manufacturer's data for Fire Extinguishing equipment.

1.4 MATERIALS

a. **Dry Chemical Powder Fire Extinguisher**
6 Kg capacity, enamelled steel container with pressure indicating gage. Provide manufacturer's standard mounting brackets for above extinguishers.

b. **CO_2 Fire Extinguisher**
6 Kg capacity, enamelled steel container with pressure indicating gage. Provide manufacturer's standard mounting brackets for above extinguishers.

c. **Mounting Brackets**
Provide manufacturer's standard bracket designed to prevent accidental dislodgement of extinguisher, or proper size for type and capacity of extinguisher indicated, in manufacturer's standard plated finish.

1.5 INSPECTION

The Contractor shall examine the condition of the substrate to receive work, and the conditions under which the work will be performed, and shall correct unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

1.6 INSTALLATION

Install fire protection accessories where shown and in accordance with manufacturer's written instructions. Install in locations and at mounting height to comply with governing

regulations. Securely fasten to Structure Square and plumb, in accordance with recognised industry practices.

1.7 IDENTIFICATION

After installation and finishing is completed, apply red-letter indicating contents by appropriate wording "FIRE EXTINGUISHER" and similar words' Provide 38mm high lettering of style approved by the Engineer. Extinguisher identification shall be in Arabic and English languages.

2.0 FIRE HOSE CABINETS AND STAND PIPES

2.1 DESCRIPTION OF WORK

Extent of Work: The extent of fire fighting equipment including is indicated on the drawings and as defined in these specifications. The type of fire protection is by Fire Hose Cabinets which are fed by piping system connected to Fire Pumps set located in a pump room located at basement floor.

2.2 QUALITY ASSURANCE

a. Comply with governing regulations and use products produced by a sound firm with not less than 5 years experience in manufacturing similar products, and installed in similar service.

b. Comply with local fire department regulations for sizes, threading and arrangement of connections, and with NFPA-14 / Local Fire Code for "Standard for the Installation of Standpipe and Hose Systems".

2.3 SUBMITTALS

Submit manufacturer's data for Fire Hose Cabinets with its contents & accessories complete.

2.4 FIRE HOSE CABINETS & ACCESSORIES

Dual Compartment Fire hose Cabinets be wall recess type, made of 1.5 mm thick epoxy painted steel sheet, complete with hinged door 180^{o} open wind-poof lock.

Fire Hose Cabinet shall comprise of the following:-

Upper Compartment:-

- One roll of 30 Meter long, 1¼" woven synthetic filament hose, one end with adjustable spray to straight spray to straight stream nozzle,

Lower Compartment:-

- 2 ½" Diameter Landing Valve with Spanner.
- One CO2 Fire extinguisher not less than 4.5 Kg Capacity.
- One Dry Powder Chemical Fire Extinguisher not less than 4.5 kg Capacity.
- Spare Hose and Nozzle.

2.5 MATERIALS

a. **Piping**
The Material and dimension of the piping material shall be black and hot-dipped zinc coated (Galvanised) welded and seamless steel pipes.

b. **Fittings**
Fittings shall be designed to withstand the system working pressures, but not less than 175 psi (12.1 bars) cold water.

Material and dimensions of fittings are:

Steel Factory made wrought steel Butt welded fittings ANSI-16.9.

Butt welding Ending pipe, valves, Flanges & fittings ANSI16.25

Steel pipe flanges and flanged fittings ANSI 16.5

Forged Steel Fittings, Socket welded and threaded ANSI 16.11

a. **Dry Chemical Powder Fire Extinguisher**
At least 4.5 Kg capacity, enamelled steel container with pressure indicating gage. Provide manufacturer's standard mounting brackets for above extinguishers.

b. **CO_2 Fire Extinguisher**
At least 4.5 Kg capacity, enamelled steel container with pressure indicating gage. Provide manufacturer's standard mounting brackets for above extinguishers.

3.0 FIRE PUMPS AND ACCESSORIES

3.1 DESCRIPTION OF WORK

a) Section Includes

i. Fire pumps.
ii. Pressure maintenance (Jockey) pumps.
iii. Pump control panels.
iv. Fire pump accessories.
v. Electrical works in connection with fire pumps.

b) Related Works

References

i. NFPA-20 Automatic fire pumps and controllers.
ii. National electrical code.
iii. IEE Regulations

c) Quality Assurance

i. Conform to the requirements of the following:

- National Fire Protection Association of U.S.A./ Local Fire Code.

ii. Refer specifications of the Electrical works of the project for system power supply ratings, fault levels of breakers and other similar general criteria. These shall be binding and mandatory for works covered by this Section.

iii. Conform to NFPA-20 / Local Fire Codes in respect of fire pump controllers. Comply with additional requirements, if stated.

d) Submittals

i. Submit product data and manufacturer's assembly drawings.

ii. Submit certified pump performance characteristics, with selection plotted.

iii. Submit data on equipment dimensions, service connections, operating weights etc.

iv. Submit characteristics such as full load starting KVA, power factor and current, full load running current and power factor etc. for all motors connected to standby diesel generator.

v. Submit wiring diagrams, details of components and panel construction and mounting details in respect of control panels.

vi. Furnish all relevant information, in a form as prescribed by the Ministry of Electricity and Water for obtaining approvals.

vii. Submit certificates, that the pump assembly, construction and performance equals or exceeds NFPA / Local Fire Code requirements.

e) Delivery, Storage And Handling

i. Deliver products to site, store and protect under provisions.

ii. Retain weatherproof covering on pumps and control panels until commissioning.

f) System Interfaces

All electrical works starting from the outgoing terminals of switch fuses / sub-main switchboards onwards, for fire protection equipment are included in this Section.

3.2 PRODUCTS

a) GENERAL

i. Equipment like fire pumps, control panels and fire pump accessories must be approved by NFPA/ Local Fire Code.

ii. Components such as fuses, contactors, indicators, timers, etc. which may require replacement in future, shall be products of the same standard / manufacture as that of the electrical works of the project.

iii. Equipment like fire pumps and the control panels shall have local dealers / representatives certified to check, test, adjust and commission this equipment.

b) Horizontal Split Case Fire Pumps

i. Description: factory-assembled and -tested, electric-drive, Horizontal Split case fire pumps capable of furnishing not less than 150 percent of rated capacity at not less than 65 percent of total rated head and with shutoff head limited to 140 percent of total rated head.

- Refer to Approved Manufacturer List
- Fabricate base and attachment to fire pumps and controllers with reinforcement to resist movement of pumps and controllers during a seismic event when their bases are anchored to building structure.
- Finish: Manufacturer's standard red paint applied to factory-assembled and -tested unit before shipping.
- Nameplate: Complete with capacities, characteristics, and other pertinent data.
- Pump: Horizontal Split Case pump

- Construction:
  1. Pump Head: Cast iron, for aboveground discharge, with discharge flange machined to ASME B16.1, Class 300 dimensions, unless otherwise indicated.
  2. Shaft: Stainless steel.
  3. Pump Line Shaft Bearings: Rubber sleeve, water lubricated.
  5. Pump Line Shaft Bearings: Corrosion resistant, oil lubricated.
  6. Pump Bowl Assemblies: Cast iron with closed-type bronze impellers.

- Driver: open-drip proof, squirrel-cage, induction motor complying with NFPA / Local Code. Include wiring compatible with controller used.

ii. Horizontal Split Case Fire Pump :

Type Fire Pump Plan No.: FP-01 & 02

1. Rated Capacity: As per schedule
2. Total Rated Head: As per schedule
3. Discharge Flange Size: 150 mm (6")
4. Discharge Flange Class: 300
5. Speed: Same as driver.

- Electric-Motor Driver: __ KW, 2900 rpm, 400V, 3 phase, 50 Hz.

c) Fire Pump Control Panels

The controller shall be of the combined manual and automatic type suitable for star (Wye) - delta starting at 415 v / 3 ph / 50 Hz supply. Refer to schedules on drawings for power ratings. The panel components / functions shall be as listed below:

i. Mains isolator switch (4 pole) and circuit breaker combination, mechanically interlocked to operate with a single, flange mounted, external handle. The interlocking shall be such that the circuit breaker (with minimum 22 KAmps rupturing capacity) will engage or break the load current. Both of the above shall be suitable for padlocking in ON or OFF position and shall be interlocked with the panel door; restricting access to the controller with the switch in 'ON' position, except by a hidden tool operator defeater. Provide external emergency release for the circuit breaker.
ii. Audio visual earth leakage alarm.
iii. Power on (supply healthy) indicator wired through normally closed contacts of the power available relays to give true indication. Loss of power in any one phase shall cause the light to go off.
iv. Control circuit healthy indicator.
v. Pump on demand indicator.
vi. Pump run indicator.
vii. Manual, pump start and stop push buttons.
viii. Emergency start lever with latch.
ix. Adjustable star to delta change over timer (consult motor manufacturer for change over timing.)
x. Adjustable, 10-300 psi, combination pressure gauge switch, mounted on the enclosure flange. Extend piping to outside of the panel with union. Pressure switch shall be wired for automatic start only.
xi. Starter contactor with auxiliary relays.
xii. Fused control power circuit, with voltage not exceeding 240 v / 1 ph / 50 Hz. Use transformers where appropriate.
xiii. Terminal block for interlocking wiring.
xiv. Earthing bar for equipotential bonding.
xv. Set of terminals / relays with volt free contacts for connecting to building automation system and remote alarm panel.

d) Remote Alarm Panels

Remote alarm panels shall be complete with 24-hour standby battery pack, battery charger, alarm bell with mute push button etc. to indicate the following.

i. Supervisory voltage normal.
ii. Pump 1 phase failure.
iii. Pump 2 phase failure.
iv. Pump 1 on demand.
v. Pump 2 on demand.
vi. Pump 1 running.
vii. Pump 2 running.

e) Jockey Pump Starters. (Not Applicable)

This starter shall be of the combined manual and automatic type, suitable for direct on line (DOL) starting at 415 v / 3 ph / 50 Hz supply. Refer to schedules on drawings for power ratings. The panel components / functions shall be as listed below.

i. Mains isolator switch (4 pole) with 'power on' indicator.
ii. DOL starter contactor with overload trip and set of fuses.
iii. Hand / off / automatic selector switch.
iv. Pump run and trip indicators with audible alarm for trip.
v. Adjustable, 10 to 300 psi, combination pressure gauge-switch, mounted on the enclosure flange. Extend piping to outside of the panel with union. Pressure switch shall be wired for automatic start and stop of the pump.
vi. Start / stop push buttons.
vii. Adjustable minimum run timer with 0 to 6 minutes range.
viii. Fused control power circuit, with voltage not exceeding 240v/1ph/50 Hz.
ix. Earthing bar for equipotential bonding.

f) Reassure Relief Valves For Fire Pumps

Cast iron body with bronze trim, angle pattern, pilot operated diaphragm valve. The valve shall be rated class 125, factory preset at 7.5 Bars (110 psig) and shall be bypass (to pump suction) type. Provide pressure gauge with unit.

g) Low Meters

Stainless steel, shunt orifice type flow meter complete with mating flanges; fixed, direct reading type meter with safety housing; copper capillary connections; strainer; shutoff cocks etc. all as approved by FOC.

3.3 FIRE PUMPS INSTALLATION

Install pumps in such a manner that avoids horizontal elbows at pump suction, excludes air entrapment in suction

Line and allows unrestrained movement of the pump assembly (for vibration isolation purposes).

Make required adjustments to pipe sizes, immediately after the pump flanges. Use flanged eccentric reducing spool with level crown at pump suction and concentric type at discharge.

Install pump flexible connections at suction and discharge to prevent carryover of pump vibrations to system piping. Anchor piping immediately after the flexible connections.

Install the suction header horizontally. Make foundations for different models of pumps to suit the suction header, so that all the suction lines are horizontal.

3.4 CONTROL PANELS

Panels shall be fabricated from minimum 1.5mm thick sheet steel and shall have continuously welded butt joints. Apply two coats of red oxide primer and two coats of baked on fire red enamel. All required holes and cut outs shall be done at the factory.

All internal wiring shall be done in a neat and professional manner, using cable ties, slip-on spiral plastic bundle sheaths etc. Provide ample free lengths to allow full swing of doors.

Provide suitable legs, drilled for bolting down to housekeeping pads.

Wall mounted panels shall be stiffened with profiled sections welded to the back plate, as required. Top of wall mounted panels shall be at 180 cms above FFL.
All panels shall have enclosures to IP-44 as minimum requirement and ant condensation heaters within.

3.5 CONDUITS, TRUNKING AND CABLE TRAYS

Fix conduits to walls / ceilings with two piece clamps, spaced at not more than 120cm.

Trunking shall be attached to walls by brass screws in plastic expansion plugs.

Cable tray hangers shall be attached to ceilings with expansion anchors and studs. Support vertical cable trays by bolting to steel angles extending from floor to ceiling.

The general arrangement of power distribution in the Fire protection plant room shall be as follows:

Rise from ESMSB to a horizontal network of cable trays. Drop to free standing panels in cable trays.

Rise from panels to another layer of horizontal network of cable trays. Drop to motors in cable trays.

Flow Meters
Install flow meters with minimum five (5) diameters upstream and two (2) diameter downstream, of straight piping. Install the pressure tap offs in horizontal position (vertical position prohibited) as far as possible.

3.6 INSPECTION, TESTS AND ADJUSTMENTS OF FIRE PUMPS

Prior To Start Up:

Check the pump motor assembly alignment. Adjust if necessary. Weld steel cleats on pump and motor bases to lock them in aligned position.

Tighten and lock foundation and coupling bolts.

Check pump shaft for free rotation.

Check electrical continuity and insulation of motor and the control panel.

Ensure that the relief valve is correctly calibrated and installed.

Shut off the system isolating valve/s and open the test line.

Ensure that the circuit breaker trip rate is correctly selected and the elements properly installed. Adjust the star delta change over timer to the period recommended by the motor manufacturer.

Check system power supply voltage. Perform all other checks outlined in the controller operation manual, before energizing the controller.

Ensure that the suction lines and the pump casing are full of water.

3.7 START UP

Check and correct, if necessary, the direction of rotation of the pump, by momentary operation of the emergency start lever.

Close the valve on the test line partially to avoid the operation of the pump at high discharge rates.

Start the pump on manual mode.

Check the motor full load current by manipulating the flow.

Check the pressure relief valve for proper operation by gradually closing the test valve.

Check the pump and motor bearings for signs of overheating.

Check the suction line for signs for entry of air and proper suction intake flow.

3.8 VERIFICATION OF PERFORMANCE

Check the pump head at nominal flow and at 150 % of nominal flow and ensure conformity with design requirements.

Close the test line and stop the pump. Release the system pressure gradually
with the test valve. Check and adjust the pressure switch setting for automatic cut-in. Check and adjust the pressure switch setting for automatic cut-in and cut-out of jockey pump.

Put System into Service

Isolate the fire pump controllers.

Close the test line and open the system isolating valve. Ensure that the system outlets are closed.

Fill the system with the jockey pump. Maintain pressure for 24 hours and ensure that there are no leaks.

Energize fire pump controllers and ensure that the system is in automatic mode.

3.9 GUARANTEES AND WARRANTIES

Furnish the client with manufacturer's guarantee and warranty certificates, duly registered with the manufacturer.

VOLUME - III

BOQ

CONSTRUCTION OF ACADEMIC BLOCK AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY



PROJECT OF:

TACE PVT. LTD

www.tace.com.pk

CONSULTANT:

NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY

WWW.TACE.COM.PK

CONSTRUCTION OF ACADEMIC BLOCK AT NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY, KARACHI

BILL OF QUANTITIES

Client:

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

Consultant:

TACE (Pvt.) Limited
Consulting Engineers, Architects, Planners & Project Managers
R-210 Abid Town, Block - 2, Gulshan-e-Iqbal, Karachi.
Phone:021-34964622, e-mail: info@tace.com.pk

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CONSTRUCTION OF ACADEMIC BLOCK
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EXECUTIVE SUMMARY

Sr.	Description	Amount (Pak Rs.)
1	**Civil Works**	
	SCHEDULED ITEMS	
	NON-SCHEDULED ITEMS	
2	**Electrical Works**	
	SCHEDULED ITEMS	
	NON-SCHEDULED ITEMS	
3	**Plumbing Works**	
	SCHEDULED ITEMS	
	NON-SCHEDULED ITEMS	
4	**Provsional Sum**	
	TOTAL	

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CIVIL WORKS

Pak PWD Scheduled Rate 2022

S.No.	PWD Schedule 2022 Ref. No.	Description	Quantity	Unit	Rate	Amount
		Note:				
		The Contractor is required to visit the site to fully acquaint himself as to the nature and extent of the works and the value of the work to be demolished and to provide in his tender for any item not specifically mentioned, but which the tender might deem to be necessary for the proper execution and completion of the works. The Contractor shall provide all sharing, needling, struttling, and whatever else may be necessary to ensure the stability of all structures associated with alteration work and remove the same at completion of such work. The contractor is hereby deemed to have included in his tender for the costs associated with such stability. The contractor hereby indemnifies employer and his agents against all liabilities associated with damages, loss,etc,arising from failure of such stability for whatever reason and from the lack of provision of such stability.				
1	Code 114 Sr. # 166	**Steel Reinforcement** Providing and laying hard grade ribbed deformed (minimum yield point 60,000 psi) reinforcement bars with & including the cost of straightening, cutting, bending, binding, wastage, and such overlaps as are not shown in the drawings, placing in position on cement concrete 1:2:4 precast or m.s. chairs, tying with binding wire, cost of chairs and wires etc. in all kinds of RCC work in foundation, basement, plinth and ground floor of building including septic tanks and under ground tanks and in projections for future extension .	103537	Kg	282.45	29,244,026
1.1	Code 114 Sr #174	Extra for lift in first floor on item Nos. 165,166,167 and 168.	103537	Kg	4.44	459,704
1.2	Code 114 Sr #175	Extra for lift in every additional floor above first floor on item Nos. 161, 162 and 163.	103537	Kg	4.44	459,704

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S.No.	PWD Schedule 2022 Ref. No.	Description	Quantity	Unit	Rate	Amount
1.3	Code 114 Sr # 4+135+ 138	**SUPER STRUCTURE (Columns)** **Note: All RCC Concrete will be used only Ready mixed.** **REINFORCED CONCRETE WORKS** Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 4500 lbs. per sq. inch (31.04 N/mm2 at 28 days) with a mix not leaner than 1:1:2 in columns of square or rectangular shape of regular section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in the ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
a	Item # 24+135+ 138+92	First Floor to Roof	5971	100 C.ft.	66,840.40	3,991,040
b	Item # 24+135+ 138+ 92+93+93	Stair Tower columns / pick up columns for Over head water tank	287	100 C.ft.	71,261.58	204,521

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S.No.	PWD Schedule 2022 Ref. No.	Description	Quantity	Unit	Rate	Amount
1.4	Code -114	**Beams /Arches/ purdi / bracing / lintels / nibs / sills / coping / parapet wall /bands/around opening and projections** Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight beams lintels cantilever beams of required shape or section including form work and its removal, compacting and curing etc. but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
a	Item # 38+136+ 92+93+93	Roof	7739	100 C.ft.	54,555.53	4,222,052
1.5	Code -114	**Slab i/c projections** Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in ordinary slab more than 6 inches (152 mm) thick including form work and its removal compacting and curing etc. complete but excluding the cost of reinforcement, in basement and ground floor etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
a	Item # 57+136+ 92+93+93	Roof/tower	12220	100 C.ft.	50,949.28	6,226,002
1.6	Code -114	**Stair Case / steps /seats (Steps, Landing & Waist slab)** Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight stairs and landing of required section including form work and its removal, compacting and curing etc. complete but excluding the cost of reinforcement, in basement plinth and ground floor.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.				
a	Item # 50+136+ 92	First Floor to Roof	657	100 C.ft.	60,641.49	398,415

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S.No.	PWD Schedule 2022 Ref. No.	Description	Quantity	Unit	Rate	Amount
1.7	Code -114 Item # 114+136+ (127x2),	**OH Water Tank Bottom Slab** Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in a square of rectangular bottom slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement .etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	348	100 C.ft.	63,286.48	220,237
1.8	Code -114 Item # 112+136+ (127x2),	**OH Water Tank Walls** Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in straight walls in over head water tank bins, bunkers, intze tanks and silo up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	907	100 C.ft.	66,282.17	601,179

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S.No.	PWD Schedule 2022 Ref. No.	Description	Quantity	Unit	Rate	Amount
1.90	Code -114 Item # 118+136+ (127x2),	**OH Water Tank Top Slab** Providing and laying reinforced cement concrete with using crushed graded boulders 3/4" inch (19 mm) and down gauge having a minimum works cube crushing strength of 3000 lbs. per sq. inch (20.69 N /mm 2 at 28 days) with a mix not leaner than 1:2:4 in roof slab of over head water tank up to a height of 30 feet (9 m) above ground including form works and its removal, compacting and curing etc. complete but excluding the cost of reinforcement.etc. complete in all respects as per drawing, standard , specifications and as directed by the Engineer.	261	100 C.ft.	57,678.88	150,542
2.0		**WALL FINISHES**				
	Code-122	**Internal Wall Plaster** 1/2" (13 mm) thick cement plaster 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, and curing etc., complete ., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
2.1	Item # 4+87	First Floor	34621	100 Sft	4,689.34	1,623,496
2.2	Item # 4+87+90+90	Roof / Tower / Overhead Tank	6676	100 Sft	5,161.84	344,604
2.3	Item # 30	Providing and mixing water proofing agent pudlo in cement mortar of any description in any floor etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.	30	Kg	179.31	5,379

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S.No.	PWD Schedule 2022 Ref. No.	Description	Quantity	Unit	Rate	Amount
3.0		**CEILING FINISHES**				
		Internal Ceiling Plaster 1/4" (6.4 mm) thick cement plaster 1:4 on soffits of ceiling, cantilever slabs, sides and soffits of beams etc., in basement, mezzanine and ground floor including making edges, corners and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
a	Item # 2+87	First Floor	23597	100 Sft	4,160.09	981,656
b	Item # 2+87+90+90	Roof / Tower / Overhead Tank	1425	100 Sft	4,632.59	66,014
4		**EXTERNAL FINISHES**				
	Code-122	**External Plaster** 3/4" (19 mm) thick cement plaster (Plain) 1:4 on walls and columns etc. in basement, plinth, mezzanine and ground floor including making edges, corners, grooves as specified and curing etc., complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer.				
a	Item # 8+88	First Floor	15210	100 Sft	5,745.06	873,824
b	Item # 8+88+91+91	Roof / Tower / Overhead Tank	6676	100 Sft	6,375.06	425,599
4.1	Code-122 Item # 83	Extra for providing horizontal or vertical joints or grooves 3/8" x 1/4" (9.5 mm x 6.4 mm) size of approved design over item No. 11.1	14435	100 Sft	1,575.00	227,351
5		**Aluminum Works**				
5.1	Code-119 Item # 98	Providing and fixing fully glazed Champagne anodized aluminium Sliding windows as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan Cables and A.C.P. (fixing through their approved fabricators), Prime model box section 101mm x 30mm and 2mm thick including the cost of aluminium netting ,fittings, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	2786	Sft	1,367.19	3,808,991
5.2	Code-119 Item # 62	Providing and fixing fully glazed Champagne anodized aluminium Fixed windows Partition as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan Cables and A.C.P. (fixing through their approved fabricators), Deluxe model box section 101.76mm x 44.50mm and 2mm thick including the cost of aluminium fittings, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	2720	Sft	865.97	2,355,438

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S.No.	PWD Schedule 2022 Ref. No.	Description	Quantity	Unit	Rate	Amount
5.3	Code-119 Item # 121	Providing and fixing Tinted glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height.	2786	Sft	371.82	1,035,891
5.4	Code-119 Item # 120	Providing and fixing plain glass panes 5mm thick to M.S. Box pipe / Aluminium doors, windows and ventilators etc including the cost of labour but excluding the cost of M.S. square pipe beading, rubber packing and screw in any floor at any height.	2786	Sft	297.02	827,498
5.5	Code-119 Item # 116	Providing and fixing fully glazed Champagne anodized aluminium Hinged door with frame as per British standard manufactured by Lucky, Alcop, Krudson, Pakistan Cables and A.C.P. (fixing through their approved fabricators), Deluxe model section, 101.6mm x 30mm and 2mm thick including the aluminium fittings, with all accessories cutting hole etc. and making good damages to walls etc. complete as required in any floor as per direction of engineer-in-charge, but excluding the cost of glass pans.	288	Sft	1840.63	530,101
6		**WOOD WORKS**				
	Code-120 Item # 61	Providing and fixing solid core 1st class teak wood veneered flush door shutters of 1-1/2 inches (38 mm) thickness with and including the cost of teak wood veneer facing of not less than 1 mm thickness on either side, cross band of standard specification, with solid fully laminated core, 2 inches (51 mm) wide best quality deodar wood outer faces alround as commercially produced by standard manufacturers under power driven hydraulic press as approved by Engineer-in-Charge including brass fittings etc., complete but excluding the cost of handles and locking arrangement .	1922	Sft	2,164.85	4,160,842
7		**PORCELAIN TILES SKIRTING**				
		Providing & laying light/colour unglazed vitrified porcelain tiles (polished) not exceeding 1600 Sq.cm. each on walls & floors foreign make (Italian or equivalent except China make) in any floor laid with dry bond (stile bond) over on 1" thick cement mortar (1:3) including jointing the tiles with joint filler of approved quality as per direction of the Engineer incharge.				
a	Code 117 Sr. # 185	First Floor	1666	100 Sft	49,776.93	829,284

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S.No.	PWD Schedule 2022 Ref. No.	Description	Quantity	Unit	Rate	Amount
8		**PAINTS**				
8.1		**CEILING**				
		Distempering with vinyle distemper (ICI) Dulux Paintex of approved make and shade in two coats over and including the cost of one priming coat of lime wash including sand papering, dusting, and filling the holes, cracks and inequalities, if any, at any height in any floor.				
a	Code 122 Sr. # 151	First Floor / Stair Tower	25380	100 Sft	3,401.25	863,237
8.2		**INTERNAL WALLS**				
		Painting with (ICI) Dulux plastic emulsion paint VIP of approved shade two coats over and including the cost of wall putli / priming coat complete over plastered surface at any height in any floor.				
a	Code 122 Sr. # 162	FIRST FLOOR	34621	100 Sft	6,737.38	2,332,548
b	Code 122 Sr. # 162	PARAPET WALL	3371	100 Sft	6,737.38	227,117
8.3		**EXTERNAL PAINTS**				
	Code 122 Sr. # 172	Painting three coats with weather shield paint deluxe (ICI) make of approved shade on plaster surface (External) and including the cost of cleaning the surface, sand papering etc. complete at any height in any floor.	18581	100 Sft	4,408.75	819,190
9		**LACQUER POLISHING**				
	Code 122 Sr. # 189 a	Lacquer polishing including sealer (ICI) on wood work at any height in any floor.	2811	100 Sft	19,760.85	555,477
10		**FALSE CEILING**				
	Code 124 Sr. # 186	Providing and fixing Gypsum board 2' x 2' x 12mm tiles ceiling including Aluminum T & L angle 1" x 1" i/c hanger clips jointing clips and G.I Wire etc complete as required in any floor.	23597	Sft	172.73	4,075,910
11		**ALUMINIUM SHEET ON BATHROOM DOORS**				
	Code 124 Sr. # 130	Providing and fixing Aluminium Sheet of 22 gauge (1.15mm) thick on wooden surface with sunken aluminium screw of required size as per direction of the Engineer-in-charge.	2811	Sft	260.74	732,940

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S.No.	PWD Schedule 2022 Ref. No.	Description	Quantity	Unit	Rate	Amount
12		**WOODEN ARCHITRAVE**				
	Code 120 Sr. # 235	Providing and fixing with sunk iron screws wooden Architrave approved design/ shape having width not less than 21/2 inch as directed by Engineer In-charge	2047	Rft	402.29	823,528
13		**MISCELLANEOUS**				
	Code-124 Item # 202	Providing & fixing 2" dia stainles steel pipe (18 guage) railing alongwith 4 Nos 3/4" dia parallel pipe having S/S pipe vertical post 2" dia at 3 ft c/c average spacing and 4" diavertical post at start turning and end point including cost of labour, welding charges fitting & fixing in marble floor and wall etc complete as per direction of the Engineer Incharge.	110	Sft	2,234.38	245,782
				TOTAL		
				ABOVE (+) / BELOW (-)		
				COST OF SCHEDULED ITEMS (CIVIL WORKS)		

BILL OF QUANTITIES

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CIVIL WORKS

Non-Scheduled items

Sr.	Description	Quantity	Unit	Rate	Amount
1	**Dismantling (Demolition)**				
a	Dismantling Cement Block Masonry of any size at any height including stacking lifting, shifting all disposing outside the University premises / at suitable place outside University on director by Engineer / Consultant	1	Lum sum / Job		
b	Dismantling of cement concrete plain / pre-cast slab and girders / roof screeding including stacking lifting, shifting all disposing outside the University premises / at suitable place outside university on director by Engineer / Consultant	1	Lum sum / Job		
c	Dismantling of Cement Concrete reinforced (columns, beams, slab parapet projections etc. (Separating reinforcement from concrete, cleaning and straitening of the same including stacking lifting, shifting all disposing outside the University premises / at suitable place outside university on director by Engineer / Consultant	1	Lum sum / Job		
2	**CLEARING THE SITE**				
	Dismantling, cleaning the site, cutting the bushes, trees, PCC Pavers/floor, block wall debris, excavated material and rubbish of all kind, etc., for proper execution of work including layout of structures, making centre line, C.C pillars upto required height etc., completed as per drawing and removing old debris and rubbish of all kind and sizes including all lead and lifts, specification as directed by the consultant,	1	Lum sum / Job		

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Non-Scheduled items

Sr.	Description	Quantity	Unit	Rate	Amount
3	**Water Proofing / Bitumen Coating**				
	Providing, laying and applying hot bitumen to the Horizontal surfaces of the Slab and the vertical surface of beams in 1st slab, 2nd slab and roof at the location of bath room in two layers with 10/20 at 1.64 kg per sqm, applied hot over the completely dry surfaces of the concrete works, after the curing period is over, complete as per drawings, specifications and as per instructions of Engineer In-charge.	1533	Sq.ft		
4	**Metal Lathing for all Plaster Works (Internal & External)**				
	Providing and applying nailing 6" wide heavy duty metal lath strip 18 SWG nailed at junction of RCC & masonry joint horizontal or vertical, internal and external, complete as per specifications & drawings and approval of Engineer (upto any floor any height).	11484.00	Sq.ft		

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Non-Scheduled items

Sr.	Description	Quantity	Unit	Rate	Amount
5	**Door Locks (Heavy Duty) and Accessories**				
	Providing and fixing Heavy Duty with C.P brass screws Alpha handle set lock of approved design, manufacturer, and color, cutting wood of required shape and size with three operation keys (Taiwan make) etc. including handles, tower bolt, Door stop complete in all respect as per specification of the Engineer In-charge	50	Nos.		
6	**Block Masonry**				
	Providing and laying of cc 1:3:6 solid block masonry with minimum strength of 1500psi of specified thickness (upto any height) with good workmanship in cement motor 1:4 ratio with filling joints, racking out joints on both sides and also proper curing complete as per drawing / specifications and instructions of Engineer In-Charge				
a	FIRST FLOOR	23056	Cu.ft.		
b	ROOF / STAIR TOWER	3181	Cu.ft.		
7	**Roof Screeding & Water Proofing**				
7.1	Providing and laying over roof (average) 3" thick C.C. 1:2:4 laid in panels in proper slopes including two coats of PB4 laid hot each coat @15 lbs per % sft of surface blinded with sand / pea gravel, making sump 12"x12" size sump floor (Khurra) at roof with Cement Mortar Ratio 1:4 making connection for P.V.C. pipe providing proper slope to drain out rainwater, making C.C. Gola 3"x 3" Cement Mortar Ratio 1:4, including curing, finishing etc. upto any height and any floor, complete in all respect as per drawing and approval of Engineering.	5900	Sft.		
7.2	**Rain Water Pipe**				

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CIVIL WORKS

Non-Scheduled items

Sr.	Description	Quantity	Unit	Rate	Amount
	Providing and fixing 4" dia PVC rain water pipe of approved make fixed with clamps including joints / bends and necessary fixtures required, filling with Cement Mortar 1:3 pto any height and any floor,complete in all respect as per drawing and approval of Engineering.	720	Rft.		

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Non-Scheduled items

Sr.	Description	Quantity	Unit	Rate	Amount
7.3	**PORCELAIN TILES FLOORING**				
	Providing & laying porcelain tiles flooring of approved Pakistan make, shade, thickness and size 2' x 2' at any floor and height, cartage to site placing at equal distance using spacer of 2-3mm thickness as separator including and over a 3" thick layer of 1:4 cement sand mortar and grouting the joints with neat pigmented slurry to match the colour of tiles including curing, washing and cleaning the tiles etc. complete in all respect as per the requirements of drawing and direction of the Engineer- in-charge.				
a	FIRST FLOOR	23597	Sq.ft		
8	**CERAMIC MATT FINISH TILES (BATHROOM FLOORING)**				
	Providing & laying light colour non-skid Matt Finish Ceramics tiles of approved make, shape & thickness of 8" x 16" or 8" x 20" or 12" x 16" on bath floor laid over a 3" thickness bed cement mortar 1:4 (1 cement and 4 sand) including washing leveling, watering, curing, hoisting, finishing, filling the joints with joint filler of matching colour slurry with cost of all materials, labours, tools, lifting, leveling, compacting, wastage, transportation etc. at any floor complete as per drawing, specifications and instruction of the Engineer.				
(a)	FIRST FLOOR	911	Sq.ft		

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Non-Scheduled items

Sr.	Description	Quantity	Unit	Rate	Amount
9	**GLAZED TILE DADO (BATHROOM WALLS)**				
	Providing & laying Ceramic Glazed tiles of approved make, shade & thickness of 8" x 16" or 8" x 20" or 12" x 16" sizes on walls upto lintel height flushed with ¾" thick base of cement plaster in 1:3 (1 cement and 3 sand or bond approved quality) and filling the joints with grout to match the colour of tiles at any floor including curing, washing and cleaning the tiles, wastage, transportation, hoisting leveling, etc.complete in all respect and conforming to the requirement as per drawing, specifications and instruction of the Engineer.				
(a)	First Floor	1526	Sq.ft		
10	**GRANITE FIXING**				
10.1	Providing & laying 3/4" thick pre polished approved Granite or equivalent (approved by Consultant) in single piece on Bathroom vanity & Kitchen / Pantry Top on any floor as shown on drawings including preparation and laying of base plaster in 1:5 cement sand mortar including Nosing, filling/grouting joints in matching colour grout as required, mechanical cutting and polishing using white cement slurry as shown on drawing and as per instruction of Engineer Incharge.	97	Sq.ft		

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Non-Scheduled items

Sr.	Description	Quantity	Unit	Rate	Amount
10.2	Providing & laying 3/4" thick pre polished approved Granite or equivalent (approved by Consultant) in single piece on stair steps on any floor as shown on drawings including preparation and laying of base plaster in 1:5 cement sand mortar including nosing, filling/grouting joints in matching colour grout as required, mechanical cutting and polishing using white cement slurry as shown on drawing and as per instruction of Engineer Incharge.	540	Sq.ft		
10.3	Providing & laying 3/8" thick pre polished approved Granite or equivalent (approved by Consultant) on stair riser on any floor as shown on drawings including preparation and laying of base plaster in 1:5 cement sand mortar, pointing in matching colour grout as required,mechanical cutting and polishing using white cement slurry as shown on drawing and as per instruction of Engineer Incharge.	271	Sq.ft		
10.4	Providing & laying 3/4" thick pre polished approved (size 1'-0" x 1'-0") Granite or as approved by Consultant on all stair landing on any floor as shown on drawings including preparation and laying of base plaster / concrete (2" thick) in 1:5 cement sand mortar, pointing in matching colour grout as required, mechanical cutting and polishing using white cement slurry as shown on drawing and as per instruction of Engineer Incharge.	354	Sq.ft		

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Non-Scheduled items

Sr.	Description	Quantity	Unit	Rate	Amount
10.5	Providing & laying 3/8" thick pre polished approved Granite on any floor as approved by Consultant Skirting 4" high as shown on drawings including preparation and laying of base plaster in 1:5 cement sand mortar, pointing in matching colour grout as required, mechanical cutting and polishing using white cement slurry as shown on drawing and as per instruction of Engineer Incharge.	347	Sq.ft		

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CIVIL WORKS

Non-Scheduled items

Sr.	Description	Quantity	Unit	Rate	Amount
11	**G.I DOOR FRAMES**				
	Providing and fixing moulded hollow steel door frame of 2" x 7", 2' x 5", 2" x 9" size manufactured from G.I sheet 18 gauge conforming to BS 1245 having a double rebate size 1-1/2" x 1/2" , provision of 3 Nos. plate section 1-1/2" x 1/4" welded with frame with holes and threads for fixing steel hinges, fitted with one locking box of same sheet 6 Nos. 6" long flat iron lugs of 1-1/4" x 3/16" section, including cutting holes and filling the cavity with C.C 1:2:4 including painting 3 coats with approved enamel paint over a coat of shop primer as per drawing and approval of Engineer.				
(a)	FIRST FLOOR	515	R.ft		
12	**IRON GRILL ON WINDOWS**				
	Providing and fixing in position of M.S Grill in walls at any floor fabricated from ½" x ½" vertical square bars @ 6" C/C and 4 No.s of horizontal square bars welded with ¼" x ¾" M.S. flat frame including M.S. holdfast fixed in RCC work or masonry work including painting 3 coats with approved enamel paint over a coat of shop primer (red oxide) plus cartage of item to site, etc. complete in all respects and conforming to the requirements of drawings, specification and approval of the Engineer.	2786	Sft.		

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CIVIL WORKS

Non-Scheduled items

Sr.	Description	Quantity	Unit	Rate	Amount
13	**C.I. COVER**				
	Providing and fixing 2'x2' C.I. manhole cover with frame including cutting holes and making good the same after fixing of frame and painting the cover with black bitumentic paint, complete as directed.	3	Nos.		
14	**SAND FILLING**				
	Providing and filling of Sand in Sunk areas including clay pots as per drawing and approval of Engineer.	1061	Sft		
15	**S.S HAND RAILING (STAIR-CASE & BALCONY)**				
	Providing, making and fixing S.S Railing in stair case and balcony at any height/elevation including Stainless Steel hand railing consisting of 3 inch diameter hand grip, 19mm m.s. round bars @ 8 inch c/c horizontal and vertical making any design with using 12mm tempered glass as per approved, 1x1 inch, s.s. flat, hold fasts grouted in RCC steps including wax polishing to all surfaces complete as per drawings, specifications, and / or as directed by the Consultant.	110	R.ft		
				Total(Non-Scheduled Items)	

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ELECTRICAL WORKS

Pak PWD Scheduled Rate 2022

S.No	Ref. E/M Works PWD 2022	DESCRIPTION OF ITEM	QTY.	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1		**LIGHT FIXTURES**				
1.1		Providing, Installation, Testing & Commissioning of recessed/ surface mounted LED ceiling lights/ downlights including driver, having warm/ neutral white/ cool white colour, 80-90 lm/watts efficiency, 0.9 or above power factor, 20000-25000 hours life cycle, including connection, complete in all respect as approved by the Engineer Incharge.				
(a)	Pg#49, Cd#2-77-01	6-8 watts	100	Nos	1,945.00	194,500.00
(b)	Pg#49, Cd#2-77-01	11-14 watts	300	Nos	2,737.00	821,100.00
1.2		Providing, installation, testing and commissioning of LED Tube/batten Lights i/c. driver having warm/ neutral white/ cool white colour, 80-90 lm/ watts efficeincy, 0.9 or above power factor, 10,000-15,000 hours life cycle, including connection, complete in all respect as approved by the Engineer In Charge				
(a)	Pg#52, Cd#2-78-03	2 Feet 18-20 watts	15	each	1,957.00	29,355.00
1.3		Providing, Installation, Testing & Commissioning of recessed/ surface mounted LED wall lights including driver, having warm/ neutral white/ cool white colour, 80-90 lm/watts efficiency, 0.9 or above power factor, 20000-25000 hours life cycle, including connection, complete in all respect as approved by the Engineer Incharge.				
(a)	Pg#49, Cd#2-77-03	12-18 Watts	150	Nos	2,737.00	410,550.00
(b)	Pg#49, Cd#2-77-01	6-8 watts	30	Nos	1,945.00	58,350.00
2		**ELECTRIC FAN FIXTURES**				
(a)	Pg#54, Cd#2-80-03	Providing & installing 140 cm (56") sweep ceiling fan with blades, canopy, standard length of download including connection with 14.0076" flexible wire complete as required.(without regulator) Pak, Royal, GFC, Younas, Millat.	170	Nos	9,349.00	1,589,330.00
(b)	Pg#55, Cd#2-84-01	Providing and installing 20cm (8") Sweep, plastic body exhaust fan complete with blades, motors, etc fixed in existing hole i/c. connection with 14/.0076 flexible wire complete as required. Pak, Royal, GFC, Younas, Millat	4	Nos	3,015.00	12,060.00
(c)	Pg#55, Cd#2-83-02 Pg56, Cd#2-88-01 Pg#56, Cd#2-87-03	(i) Metallic Exhaust Fan Providing and installing 30cm (12") Sweep, metallic body exhaust fan complete with blades, motors, etc fitted in existing hole i/c. connection with 14/.0076 flexible wire complete as required. Pak, Royal, GFC, Younas, Millat (ii) Shutter for Exhaust Fan Providing & fixing heavy gauge metallic shutter suitablee for 12" to 14" sweep exhaust fan fitted on existing hole as required. (iii) Making hole Making hole in the wall for 12" to 16" sweep metallic exhaust fan and fixing of holefast, duly plaster and making good the damage as required.	4	Nos	6,808.00	27,232.00

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ELECTRICAL WORKS

Pak PWD Scheduled Rate 2022

S.No	Ref. E/M Works PWD 2022	DESCRIPTION OF ITEM	QTY.	UNIT	RATE (Rs.)	AMOUNT (Rs.)
(d)	Pg#56, Cd#2-87-02	Providing and installing of Ceiling fan down rod 1/2" dia heavy gauge GI pipe of require length, one end arrangement for fan insulator and other end duly threaded and hole for split pin etc to be hold all sweep ceiling fan as required.	350	P.Rft	200.00	70,000.00
(e)	Pg#56, Cd#2-87-06	Providing and fixing 3" x 4" x 5" size (14SWG) thick recessed type fan clamp box with 1/2" dia MS bar fan clamp fixed in roof at casting time as required.	170	each	1,376.00	233,920.00
(f)	Pg#56, Cd#2-87-07	Providing and fixing 4-1/2" x 4-1/2" size MS die casted, powder coated recessed type fan clamp box with 1/2" dia MS bar fan clamp fixed in roof at casting time as required.	170	each	1,062.00	180,540.00
(g)	Pg#44, Cd#2-65-01	Providing and fixing 10 amp polycarbonate flame retardant SP switch with fancy ivory gang plate fixed on die fabricated, powder coated, metal bolt recessed in the wall or column including connection as required (MATRIX / SOK/ TJ SERIES/ TRUST MAKE)	60	each	294.00	17,640.00
(h)	Pg#44, Cd#2-65-04	Providing and fixing 10 amp polycarbonate flame retardant Bell Push with fancy ivory gang plate fixed on die fabricated, powder coated, metal bolt recessed in the wall or column including connection as required (MATRIX / SOK/ TJ SERIES/ TRUST MAKE)	3	each	308.00	924.00
(i)	Pg#44, Cd#2-65-05	Providing and fixing polycarbonate flamed retardant click type fan dimmer of all any sweep with fancy ivory gang plate fixed on die fabricated, powder coated, metal bolt recessed in the wall or column including connection as required (MATRIX / SOK/ TJ SERIES/ TRUST MAKE)	170	each	689.00	117,130.00
3		**L.V SWITCHGEAR**				
		Supply & installation of following distribution boards concealed in wall / surface mounted or floor standing, 1.5/2.0mm sheet steel fabricated, powder coated, suitable for 500 volts, 3 phase, 4 wires, 50Hz, incorporate following components and configuration, complete with all mounting & connecting accessories as per drawings.				
3.1		**DISTRIBUTION BOARD**				
	Pg#48, Cd#2-73-01	Distribution Board Providing and fixing Cubical type metal sheet Distribution board with locking arrangement as per drawing, vermin protected duly powder coated paint i/c all fastening material including wiring with suitable guage PVC x PVC wire complete as required.	16	P.Sft	6,006	96,096

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Pak PWD Scheduled Rate 2022

S.No	Ref. E/M Works PWD 2022	DESCRIPTION OF ITEM	QTY.	UNIT	RATE (Rs.)	AMOUNT (Rs.)
3.2		**MOLDED CASE CIRCUIT BREAKERS (MCCBs)**				
(a)	Pg#47, Cd#2-71-01	Providing & Fixing 6 to 32 Amps, S.P MCCB fixed on existing board, i/c. interconnection as required	60	Each	870	52,200
(b)	Pg#48, Cd#2-72-01	Providing & Fixing 6 to 32 Amps, D.P MCCB fixed on metal board recessed in the wall duly covered with fiber sheet, i/c. interconnection as required	45	Each	2,410	108,450
(c)	Pg#47, Cd#2-71-04	Providing & Fixing 10 to 60 Amps, (High breaking capacity) T.P MCCB fixed on existing board, i/c. interconnection as required	50	Each	10,338	516,900
(d)	Pg#47, Cd#2-71-05	Providing & Fixing 75 to 100 Amps, (Low breaking Capacity) T.P MCCB fixed on existing board, i/c. interconnection as required	2	Each	5,977	11,954
(e)	Pg#47, Cd#2-71-06	Providing & Fixing 250 to 400 Amps, (Low breaking Capacity) T.P Circuit Breaker fixed on existing board, i/c. interconnection as required	2	Each	28,572	57,144
(f)	Pg#47, Cd#2-71-09	Providing & Fixing 400 to 630 Amps, (Low Breaking Capacity) T.P Circuit Breaker fixed on existing board, i/c. interconnection as required	2	Each	53,623	107,246
(g)	Pg#47, Cd#2-71-11	Providing & Fixing 800 Amps, (Low Breaking Capacity) T.P Circuit Breaker fixed on existing board, i/c. interconnection as required	2	Each	60,519	121,038
3.3		**BUS BAR**				
(a)	Pg#48, Cd#2-74-01	Providing and fixing 10 to 60 Amps, 4 pole, three phase bus bar strip fitted in given distribution board complete with bus bar insulator, screws, bolts etc as required	16	Each	10,529	168,464
(b)	Pg#48, Cd#2-74-02	Providing and fixing 70 to 100 Amps, 4 pole, three phase bus bar strip fitted in given distribution board complete with bus bar insulator, screws, bolts etc as required	16	Each	12,973	207,568
(c)	Pg#48, Cd#2-74-03	Providing and fixing 110 to 150 Amps, 4 pole, three phase bus bar strip fitted in given distribution board complete with bus bar insulator, screws, bolts etc as required	16	Each	15,760	252,160
(d)	Pg#48, Cd#2-74-04	Providing and fixing 160 to 200 Amps, 4 pole, three phase bus bar strip fitted in given distribution board complete with bus bar insulator, screws, bolts etc as required	16	Each	15,887	254,192
(e)	Pg#48, Cd#2-74-09	Providing and fixing 400 Amps, 4 pole, three phase bus bar strip set (standard size) fitted in suitable size metallic sheet steel box with hinged type front door duly painted and fixed on existing board i/c. interconnection as required.	16	Each	18,406	294,496
3.4		**PILOT LAMP**				
(a)	Pg#48, Cd#2-75-01	Providing and fixing pilot lamp set fitted on existing board i/c. connection as required	4	Set	872	3,488
3.5		**ENERGY METER**				
(a)	Pg#49, Cd#2-76-01	Providing and fixing single phase 10 to 40 Amps, 220/230 volts energy meter fitted on existing board i/c connection as required. (PEL)	1	Each	8,931	8,931
(b)	Pg#49, Cd#2-76-02	Providing and fixing three phase 15 to 90 Amps, 400/440 volts energy meter fitted on existing board i/c connection as required. (PEL)	1	Each	19,860	19,860

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S.No	Ref. E/M Works PWD 2022	DESCRIPTION OF ITEM	QTY.	UNIT	RATE (Rs.)	AMOUNT (Rs.)
4		**2 CORE CABLE WITH ECC WIRE IN EXISTING PIPE OR CABLE DUCT**				
(a)	Pge#40, Cd#2-56-03	Providing and laying, 2 core, 4 mm2, strander copper conductor, PVC insulated & PVC sheathed cable i/c 1.5mm2 single core PVC insulated wire as ECC in all kinds of existing or given conduit/cable dust as required.	800	Mtr	539.00	431,200.00
(b)	Pge#40, Cd#2-56-04	Providing and laying, 2 core, 6 mm2, strander copper conductor, PVC insulated & PVC sheathed cable i/c 2.5mm2 single core PVC insulated wire as ECC in all kinds of existing or given conduit/cable dust as required.	200	Mtr	737.00	147,400.00
5		**uPVC CONDUIT & DUCT**				
(a)	Pge#41, Cd#2-61-07	Supply & fixing 25mm (1") uPVC conduit with all especial such as bends, sockets, Junction etc recessed in the wall or column as required.	800	Mtr	181.00	144,800.00
6		**AIR CONDITIONING**				
6.1		Providing, installation, testing of Split Type Wall Mounted Air Conditioner (cool only) in the specified place. The job includes connection of copper piping of out door unit fitted on roof or angle iron frame, making inter connection of the unit with suitable sizes of wire also piping for condensed water etc as required approved make (local make).				
(a)	Pg#81, Cd#6-1-04	1.5 Ton (18000 BTU)	45	No	141,710.00	6,376,950.00
6.2		Supply & installation of UPVC pipe with all accessories including cutting of wall / floor etc.				
	Pg#2, Sr#111	20 mm (3/4") Dia uPVC conduit	310	Mtr	52.00	16,120.00
6.3		Providing, installation, testing and commissioning of Refrigerant Copper Pipe, 22 gauge with all type of fittings like, elbow, clamping, aero flex insulation, wrapping tape, etc complete in all respect as approved by the Engineer Incharge.				
	Pg#84, Cd#6-4-01	5/8" dia	1200	Rft	815.00	978,000.00
					TOTAL OF SCHEDULE ELECTRICAL WORKS (Rs.)	
					ABOVE (+) / BELOW (-)	
					GRAND TOTAL OF SCHEDULE ELECTRICAL WORKS (Rs.)	

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Non-Scheduled items

S.No	DESCRIPTION OF ITEM	QTY.	UNIT	RATE (Rs.)	AMOUNT (Rs.)
1	**WIRING AND ACCESSORIES**				
	Supply & installation of following items, clipped to the surface or concealed in the building fabric including all Conduit & wiring accessories as per drawing & complete in all respect				
(a)	Wiring of light / fan point controlled by one Switch with 3x1.5 sq.mm cables drawn in 20/25mm dia PVC conduits including 16 SWG Powder Coated MS back box, fancy switch plate and gang switches.	765	Nos.		
(b)	Wiring of light point to light point with 3x1.5 sq.mm cables drawn in 20/25mm dia PVC conduits.	595	Nos.		
(c)	Wiring of light circuits from DB to Switch board(s) with 2x2.5 sq.mm + 1x1.5 sq.mm cables drawn in 20 mm dia PVC conduits, including termination & labelling at both ends with 16 SWG Powder Coated MS back box.	60	Nos.		
(d)	Wiring of AC circuits from DB to AC with 2x6.0 sq.mm + 1x2.5 sq.mm cables drawn in 20 mm dia PVC conduits, including termination & labelling at both ends with 16 SWG Powder Coated MS back box.	45	Nos.		
1.2	Supply & Installation of following Switch Socket Outlets and Fancy/ Decorating Lights on MS back box / technology box.				
(a)	10A - 13A 3-Pin/ Multi-plug Single Switch Outlet (SSO)	80	Nos.		
(b)	16A - 20A 3-Pin Single Switch Outlet (SSO)	40	Nos.		
(c)	16A - 20A 3-Pin Single Switch Outlet (SSO) - Weatherproof	20	Nos.		
(d)	20A Double Pole (D.P) Heavy Switch	45	Nos.		
(e)	Fancy Indoor LED Wall Light of steel / wooden make i/c 9-12 Watt LED Bulb	195	Nos.		

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S.No	DESCRIPTION OF ITEM	QTY.	UNIT	RATE (Rs.)	AMOUNT (Rs.)
2	**INTERNET CABLE SYSTEM**				
	Supply, Installation & Commissioning of Optical Fibre, Wi-Fi and LAN. to Sports Resource Center using below mentioned equipment with allied accessories should be done according to the instructions of engineer				
a	3M / Corning Original 4-Core Single mode 9/125µm Duct type G.652 D Fiber Optic Cable or Equivalent.	250	Meters.		
b	3M / Corning Original Volition 1U Modular Patch Panel with up to 4 Splice Trays, Partially loaded with Splice Trays and Crimp Splice Protectors and equipped with 4 SC Duplex, Single mode Modules, Pigtails high-grade Steel. Gauge Size 1U) or Equivalent.	4	Nos.		
c	3M / Corning Original Volition Fibre Optic SC to SC / SC to LC Patch Cord Single mode 9/125µm 3 meters in length (Factory Finished) or Equivalent.	4	Nos.		
d	3M / Corning Original Volition Cat-6 UTP Patch Panel including 24 I/Os, with integrated strain relief with rear cable management or Equivalent.	80	Nos.		
e	3M / Corning Original Volition Front cable organizer or Equivalent.	4	Nos.		
f	3M / Corning Original Volition Cat-6 UTP Cable or Equivalent.	6	Box.		
g	3M / Corning Original Volition Cat-6 UTP I/O or Equivalent.	50	Nos.		
h	3M / Corning Original Volition Cat-6 UTP Dual Shutter Face Plate or Equivalent.	50	Nos.		
i	3M / Corning Original Volition Cat-6 UTP Patch Cord 1 Meter (Factory Finished) or Equivalent.	50	Nos.		

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S.No	DESCRIPTION OF ITEM	QTY.	UNIT	RATE (Rs.)	AMOUNT (Rs.)
j	3M / Corning Original Volition Cat-6 UTP Patch Cord 3 Meter (Factory Finished) or Equivalent.	20	Nos.		
k	3M / Corning Original Volition Cat-6 UTP Patch Cord 8 Meter (Factory Finished) or Equivalent.	10	Nos.		
l	MS Back Box for Cat-6 UTP Dual Shutter Face Plate or Equivalent.	50	Nos.		
m	15U Wall Mounted Network Switch Cabinet/Rack. Dual Section with lockable front glass door and two way Exhaust fan communication cabinet and 1 Four Socket Power Panel (Clipsal / Schneider) (Structure of Cabinet: 20 Gauge, Mounting Frame : 16 Gauge) Rack bolts/Rawl bolt and nuts must supplied. The above mentioned item should also have cable manager. (Titan RD) Brand or Equivalent.	4	Nos.		
n	PVC Pipe 25mm dia Original (Galco) or Equivalent.	500	Meters.		
o	PVC Socket 25mm dia Original (Galco) or Equivalent.	100	Nos.		
p	PVC Band 25mm dia Original (Galco) or Equivalent.	100	Nos.		
q	Cable Junction Box 8"x10"x4" made of 1.2mm sheet steel powder coated with locking arrangment with 1x6 way line splitter or Equivalent.	6	Nos.		
r	Poly Ethylene (PE) Duct outer diameter 63 mm, wall-thickness 5.3 mm, IIL, Dadex or Equivalent. Unit length 50 meters with (PE) coupler (63 x 63 mm) (DADEX) or Equivalent..	250	Meters.		
s	Fiber Optic Cable Route Locators Metallic Superior Quality with fluorescent paint.	10	Nos.		
t	Cisco CBS350 managed 24 port switch GE, 4x1G SFP CBS350-24T-4G or Equivalent.	4	Nos.		

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Non-Scheduled items

S.No	DESCRIPTION OF ITEM	QTY.	UNIT	RATE (Rs.)	AMOUNT (Rs.)
u	Ai-Tek 8 Port 10/100 POE Switch + 2 Uplink 10/100 Ethernet Ports (SKU: AI901-AF-82N) or Equivalent.	4	Nos.		
v	Grandstream 802.11ax 2x2:2 WiFi 6 PoE Access Point (GWN-7660) or Equivalent. Genuine Distributor's Warranty.	4	Nos.		
w	Concrete Hand-Hole (Cast-on-site or Pre-cast) Supply & Install (2.5 x 2.5 x 3 ft) with compact cover, with caution written onto it, " Caution, Fibre Optic Network NEDUET", top painted with Yellow Colour embossed with " F.O Cable " in Black.	4	Nos.		
x	Ai-Tek Fiber Media Converter 10/100/1000 Base-Tx to 1000Base-Fx with 1 Fiber Port + 2 RJ45 Ports (Pair) (SKU: AI900-1G2E-20R) or Equivalent.	4	No.		
GRAND TOTAL OF NON-SCHEDULE ELECTRICAL WORKS (Rs.)					

BILL OF QUANTITES

CONSTRUCTION OF ACADEMIC BLOCK

ÀT

NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY

PLUMBING WORKS

Pak PWD Scheduled Rate 2022

S.No	Ref. PWD 2022	DESCRIPTION OF ITEM	UNIT	QTY	RATE	AMOUNT
		All items under this head to be carried out as per specifications, Drawings and relevant BSI/ASTM Standards to the entire satisfaction of the Engineer.				
1		**WATER SUPPLY:** **COLD/HOT WATER PIPING:**				
a)		Providing and fixing PPRC pipe PN-20 with specials,and clamps etc, including cutting and fitting complete with and in-cluding the cost of breaking through walls and roof and making good etc;after cleaning the pipe and cartage within 10miles.				
	Pg # 567 Sr # 29	(i) ¾" dia.	Rft.	250	153.45	38,363
	Pg # 567 Sr # 30	(ii) 1" dia.	Rft.	710	215.32	152,877
c)		**ISOLATION/BALL VALVE:** **Brands:-** *Kitz, Econosto* Providing and fixing ball valve (with PVC Ball) made to B.S.S **Brands:-** *Dadex, Vesbo*				
	Pg # 567 Sr # 29	(ii) 1" dia.	Nos.	10	703.70	7,037
d)	E/M WORKS Pg #66 Cd # 4-3-02(b)	**WATER GEYSER:** Providing, Installing, Testing & Commissioning of Dual Supply (Gas & Electric) 35 Gallons Geysers, with fully automatic thermostat, complete in all respect, as approved by the Engineer Incharge.	Nos.	1	59170	59,170
		Total for Water Supply				**257,447**

BILL OF QUANTITES

CONSTRUCTION OF ACADEMIC BLOCK

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NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY

PLUMBING WORKS

Pak PWD Scheduled Rate 2022

S.No	Ref. PWD 2022	DESCRIPTION OF ITEM	UNIT	QTY	RATE	AMOUNT
2		**SOIL SANITARY WASTE AND VENT & RW PIPES:**				
		SOIL, WASTE & VENT SYSTEM:				
a)		uPVC Pipe Type 'B'				
	Pg # 709 Cd # S-945	(ii) 3" dia.	Rft.	200	1198.79	239,758
	Pg # 709 Cd # S-941	(iii) 4" dia.	Rft.	200	1311.15	262,230
		DRAINAGE SPECIALTIES				
c)	Pg # 708 Cd # S-937	uPVC Multi Floor Trape	Nos	15	774.4	11,616
d)		uPVC Vent Cowel				
	Pg # 709 Cd # S-948	(i) 3" dia.	Nos.	15	1072.38	16,086
	Pg # 709 Cd # S-947	(ii) 4" dia.	Nos.	15	1087.69	16,315
e)	Pg # 709 Cd # S-941	uPVC Pipe Type 'B'	Nos	15	1311.15	19,667
		Manhole, Gully Traps and Catch Basins				
g)	Pg # 588 Sr # 1	Providing & fixing 6" x 4" cement concrete gully trap with 4" outlet, complete with 4 " thick 1:2:4 cement concrete for bed and kerb, 1/2" thick cement plaster 1:3 to the kerb, C.I grating 6" x 6" and C.I cover and frame 12" x 12" (inside) etc. complete	Nos.	6	2339	14,034
h)	Pg # 590 Sr # 1	Providing & fixing type A size 2' x 1-1/2' (inside dimensions) x 2' deep as per approved design and specifications complete for 4" to 12" dia pipes up to 3'-11" depth with C.I cover and frame 16" dia, inside (weight=1 Cwt. 1 Qtr) or 63.5 Kg. fixed in 4 " thick RCC 1:2:4 slab, 8" thick c.c 1:3:6 block masonry walls set in 1:3 c.m; 6" thick 1:3:6 c.c in foundation 1:2:4 c.c in benching, 1/2" thick cement plaster in 1:3 C.M. to all inside wall surface, channels and benching etc. and to top including making requisite umber of main and branch channels but excluding the cost of excavation back filling and disposal of excavated stuff, manhole cover and frame.	Nos.	6	10617.49	63,705
i)	Pg # 681 Cd # C-4317	C.I Grating ; 6" x 6"	Nos.	6	360	2,160
		Sub Total for Drainage				**645,571**

BILL OF QUANTITES

CONSTRUCTION OF ACADEMIC BLOCK

ÀT

NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY

PLUMBING WORKS

Pak PWD Scheduled Rate 2022

S.No	Ref. PWD 2022	DESCRIPTION OF ITEM	UNIT	QTY	RATE	AMOUNT
3		**PLUMBING FIXTURES:**				
a)	pg 553, s # 05	Providing and fixing Pakistani best quality European style white glazed earthenware W.C pan complete with and including cost of plastic seat with Buffers, best quality low level plastic flushing cistern of standard size with internal fittings complete P.V.C flushing pipe with fitttings and making requisite number of holes in walls,plinth and floor for pipe connections and making good in ce-ment concrete 1:2:4.	Nos.	10	14,312.50	143,125
b)		Providing and fixing first quality Eastern water closet by Porta model HD-16 with 6 liters flush tank, S-Trap , stop cock and flexible pipe as per as per drawings, specifications and Engineers Approval. **Brands:-** *Porta , Sonex/Master, Zilver*	Nos.	4	10572	42,288
c)	p.g 556 , s # 29	Providing and fixing approved earthen ware glazed vanity basin (porta or equivelent) stander size (White/light colour) and including the cost of 1-1/4" dia brass wste 1-1/4" rubber plug and chrome plated brass chain PVC waste pipe 1-1/4" dia of approved pattern etc.	Nos.	13	16,420.63	213,468
f)	pg 558 S#12	Providing and fixing Royal bath room accessories of set of 6 pieces consist of one towl rod with bracket,one tooth brush holder with glass and cover,one double hook one towel ring etc complete . Of approved quality as per direction of Engineer in-charge.			10,405.25	
		(i) Toilet Paper Holder	Nos.	14	1320	18,480
		(ii) Hand Spray / Muslim shower	Nos.	14	2400	33,600
		(iii) Towel Rail	Nos.	14	1500	21,000
		(iv) Soap Dish	Nos.	14	800	11,200
		(v) Mirror - 2' x 5'	Nos.	14	876	12,264
		Sub Total for Fixtures				**495,425**
		Grand Total for Plumbing works				
		ABOVE (+) / BELOW (-)				
		GRAND TOTAL OF SCHEDULE PLUMBING WORKS (Rs.)				

BILL OF QUANTITIES

CONSTRUCTION OF ACADEMIC BLOCK
ÀT
NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY

PLUMBING WORKS

Non-Scheduled items

S.No	DESCRIPTION OF ITEM	UNIT	QTY	RATE	AMOUNT
	WATER TANK:				
a)	Connection from external network to RCC water tanks including fittings, float valves, vent pipes, accessories, valves, supports, warning pipes, low and high level float switches, etc. as per specifications	item	3		
b)	Cover For RCC water tanks	Nos.	3		
	GAS SUPPLY Works: **GAS PIPING / SERVICES :**				
a)	Providing and fixing of PVC Rubber Pipe and fitting high quality, conforming to API and approved by Local Gas Company standards to correct Lines, Levels and Grade, coating and wrapping including fixing and laying, fitting, valve, flanges, reducers, tees, sockets, bends, clamps, support, excavation works complete with testing and as per drawings, specifications and requirements of local gas company complete in all respects. **Brands:-** *IIL Medium* (i) 1" dia.	Rft.	250		
b)	Making service connection with existing Gas Company mains with necessary approval and directions by the Local Gas Company.	Nos.	1		
c)	Installation and provision of Gas meter and Regulator to the Gas Service Lines as per specifications and requirements of Local Gas Company including taking approval and making all payments to the Gas Company in this regard.	Nos.	1		
d)	Providing and fixing brass ball valve with unsoldered copper ball conforming to API standards and approved by Local Gas Company. **Brands**:- *KITZ, Econosto* (i) 1" dia.	Nos.	1		
	Sub Total for Gas works				
	GRAND TOTAL OF NON-SCHEDULE PLUMBING WORKS (Rs.)				

VOLUME - IV

TENDER DRAWINGS

CONSTRUCTION OF ACADEMIC BLOCK AT NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY

PROJECT OF:
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

CONSULTANT
TACE PVT. LTD.

LIST OF DRAWINGS

S.NO	Dwgs. NO	DRAWING TITLE	REV. STATUS
ARCHITECTURE DRAWINGS			
1	LI-00	LIST OF DRAWINGS	-
2	AR-00	MATER PLAN	-
3	AR-01	GROUND FLOOR PLAN (EXISTING)	-
4	AR-02	FIRST FLOOR PLAN (PROPOSED)	-
5	AR-03	FIRST FLOOR (PART PLAN-1)	-
6	AR-04	FIRST FLOOR (PART PLAN-2)	-
7	AR-05	FIRST FLOOR (PART PLAN-2)	-
8	AR-06	ROOF PLAN	-
9	AR-07	SCHEDULE OF DOORS AND WINDOWS	-
10	AR-08	SECTIONS A-A, B-B & C-C	-
11	AR-09	ELEVATIONS 01 & 02	
12	AR-10	SCHEDULE OF FINISHES	-
13	AR-11	TOILER BLOCK PART PLAN	
14	AR-12	STAIR PLAN & DETAILS	
15	AR-13	STAIR PLAN & DETAILS	
16	AR-14	MISCELLANEOUS DETAILS (SHEET-1)	
17	AR-15	MISCELLANEOUS DETAILS (SHEET-1)	
STRUCTURE DRAWINGS			
18	GN-00	GENERAL NOTES	-
19	ST-01	FIRST FLOOR FRAMING PLAN (EXISTING) COLUMN LAYOUT PLAN & DETAILS	-
20	ST-02	ROOF FRAMING PLAN	-
21	ST-03	ROOF FRAMING PLAN (PART PLAN-1)	-
22	ST-04	ROOF FRAMING PLAN (PART PLAN-2)	-
23	ST-05	ROOF FRAMING PLAN (PART PLAN-3)	-
24	ST-06	ROOF REINFORCEMENT PLAN (PART PLAN-1)	-
25	ST-07	ROOF REINFORCEMENT PLAN (PART PLAN-2)	-
26	ST-08	ROOF REINFORCEMENT PLAN (PART PLAN-3)	-
27	ST-09	OHW TANK REINFORCEMENT PLAN & DETAIL	-
28	ST-10	STAIR PLAN, SECTION & DETAILS	-
29	ST-11	STAIR PLAN, SECTION & DETAILS	-

ELECTRICAL DRAWINGS			
30	EL-01	FIRST FLOOR ELECTRICAL PLAN	-
31	EL-02	FIRST FLOOR ELECTRICAL PLAN	-
32	EL-03	FIRST FLOOR ELECTRICAL PLAN	-
33	EL-04	FIRST FLOOR ELECTRIC WIRING PLAN	-
34	EL-05	FIRST FLOOR ELECTRICAL PLAN	-
35	EL-06	FIRST FLOOR ELECTRICAL PLAN	-
36	EL-07	FIRST FLOOR ELECTRICAL PLAN	-
37	EL-08	FIRST FLOOR ELECTRIC POWER SOCKETS PLAN	-
38	EL-09	FIRST FLOOR ELECTRICAL PLAN	-
39	EL-10	FIRST FLOOR ELECTRICAL PLAN	-
40	EL-11	FIRST FLOOR SPLIT A/C PLAN	-
41	EL-12	FIRST FLOOR ELECTRICAL PLAN	-
PLUMBING & SEWERAGE DRAWINGS			
42	PS-01	FIRST FLOOR SEWERAGE PLAN	-
43	PS-02	FIRST FLOOR PLUMBING PLAN	-

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

CONSULTANT
TA CE
TANVEER AHSAN CONSULTING ENGINEERS
Architect, Planners & Project Managers
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Gulshan-e-Iqbal, Karachi-75300 Pakistan
Telephone : +92 21 34964622

PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
LIST OF DRAWINGS

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-LI-00

(TENDER DRAWINGS)

VOLUME IV:-

CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

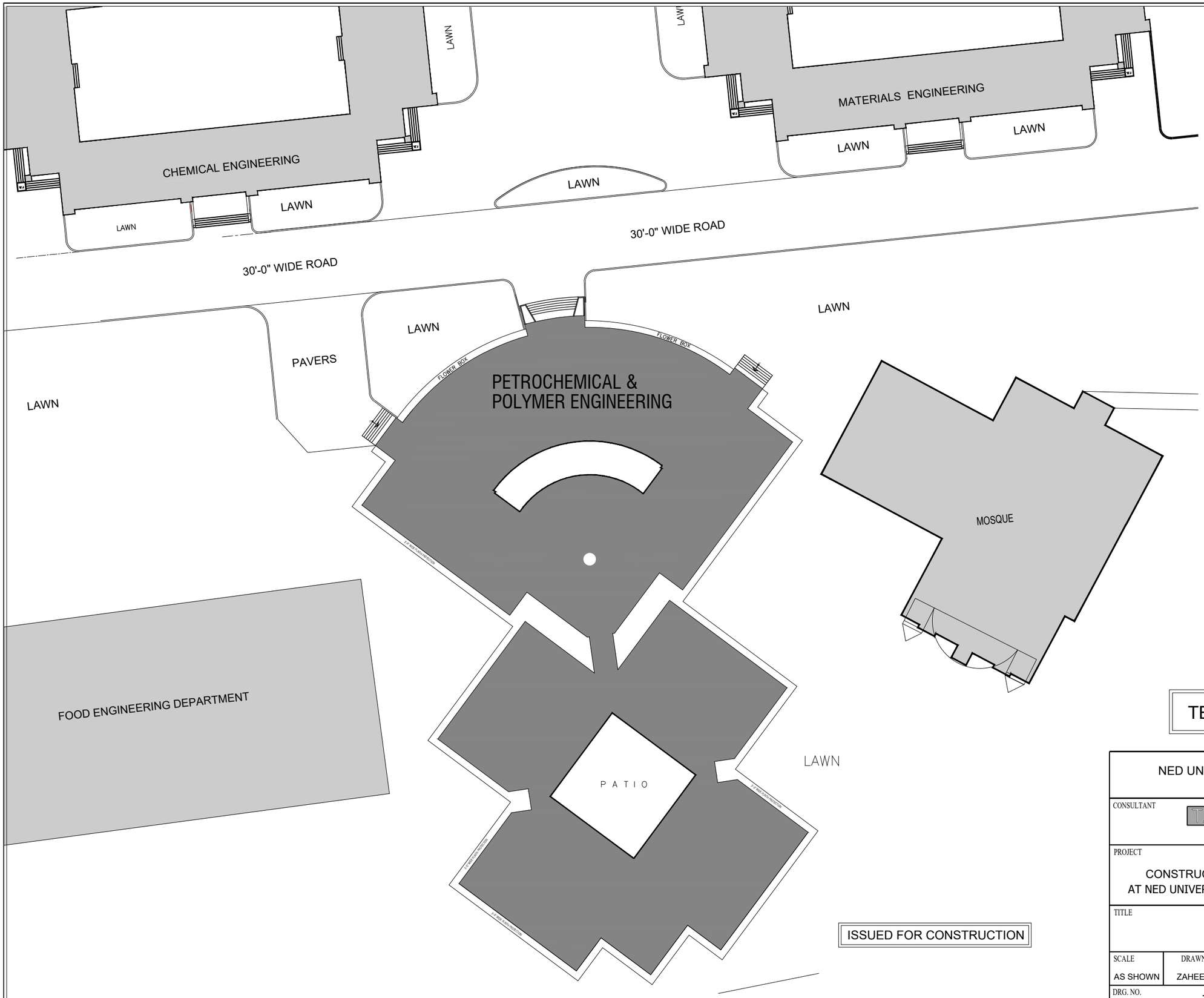
SCHEME:-

ENHANCEMENT OF ACADEMIC FACILITIES
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

(ARCHITECTURAL DRAWINGS)

CONSULTANT :

TA CE
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PROJECT

CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE

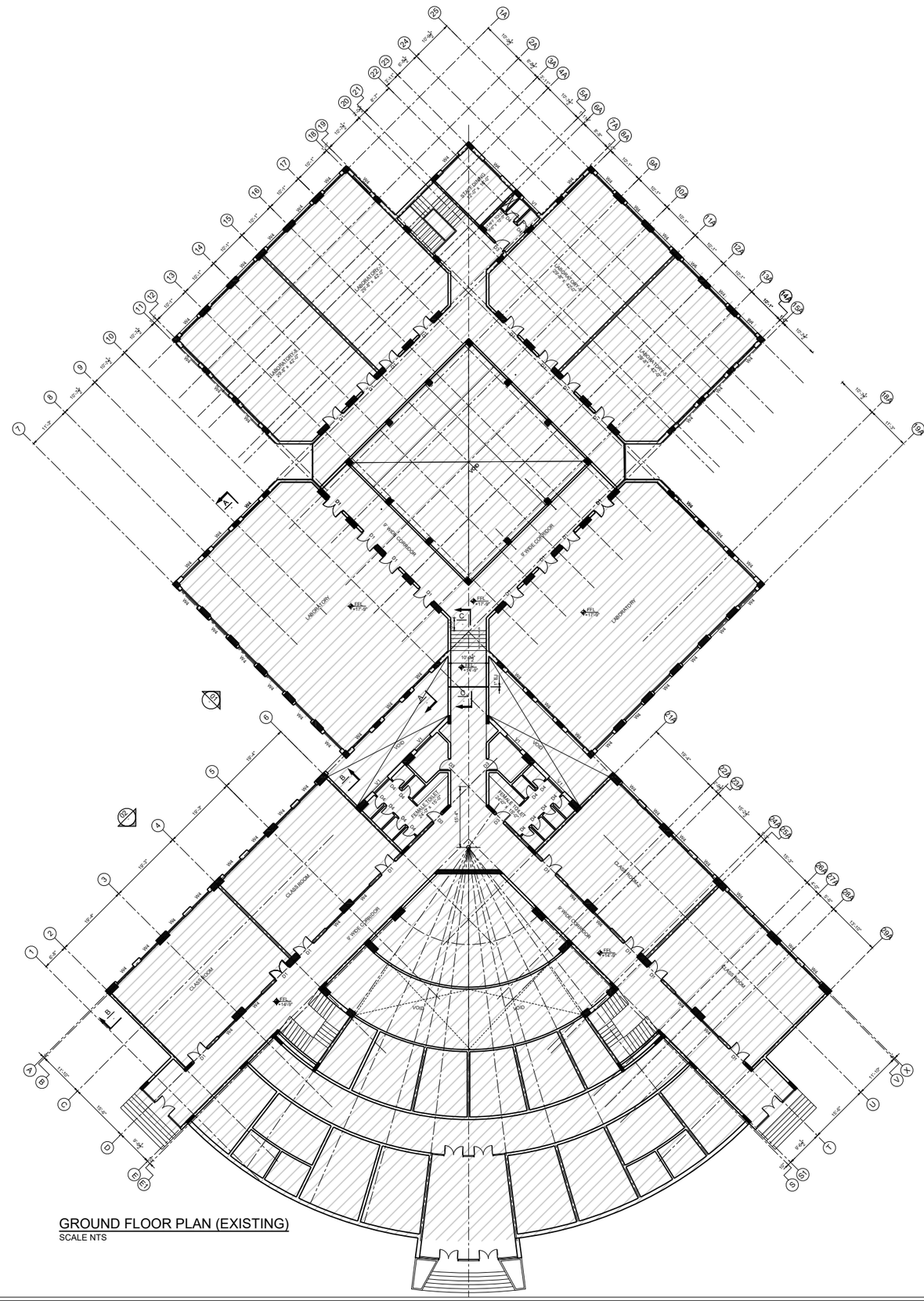
MATER PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

DRG. NO.

TACE-NED-PPE-AR-00

ISSUED FOR CONSTRUCTION



GROUND FLOOR PLAN (EXISTING)
SCALE NTS

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

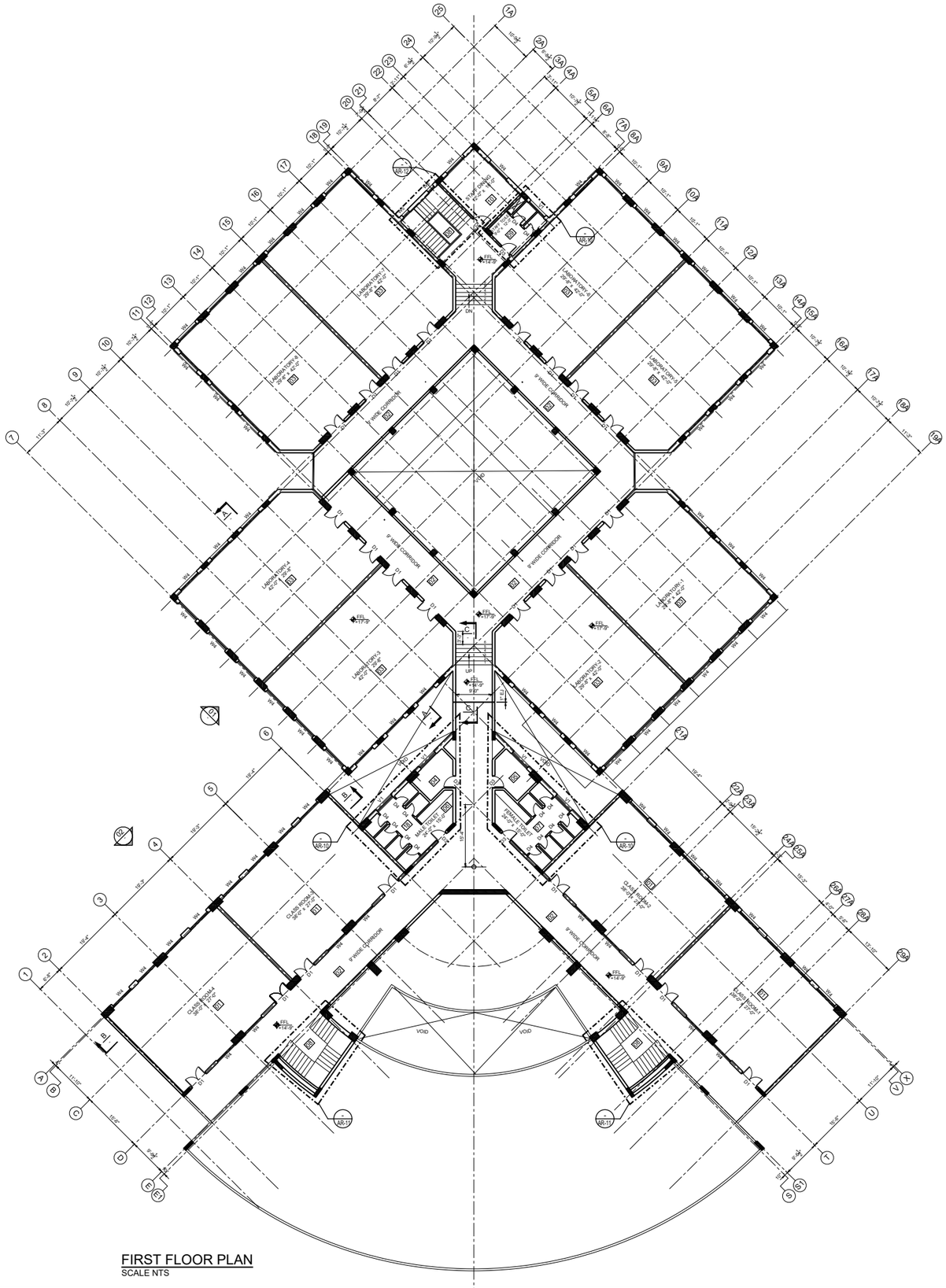
CONSULTANT
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
GROUND FLOOR PLAN (EXISTING)

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-AR-01



FIRST FLOOR PLAN
SCALE NTS

TENDER DRAWING

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NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

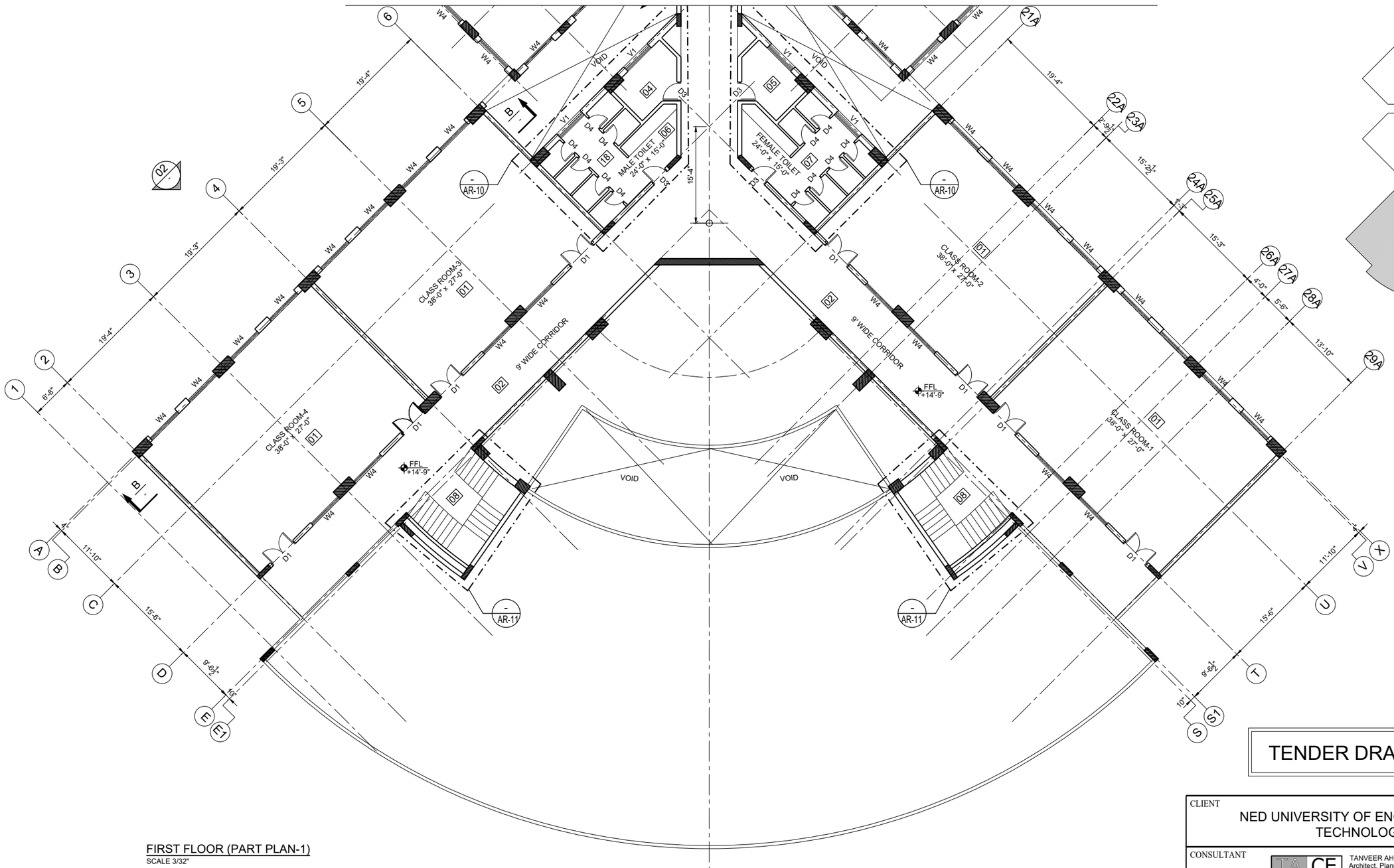
CONSULTANT
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

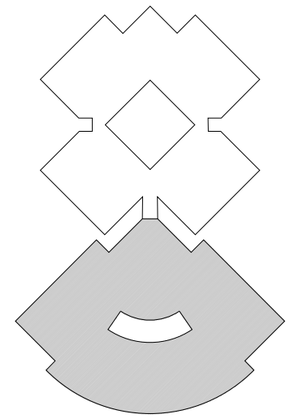
TITLE
FIRST FLOOR PLAN (PROPOSED)

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-AR-02



FIRST FLOOR (PART PLAN-1)
SCALE 3/32"



KEY PLAN

TENDER DRAWING

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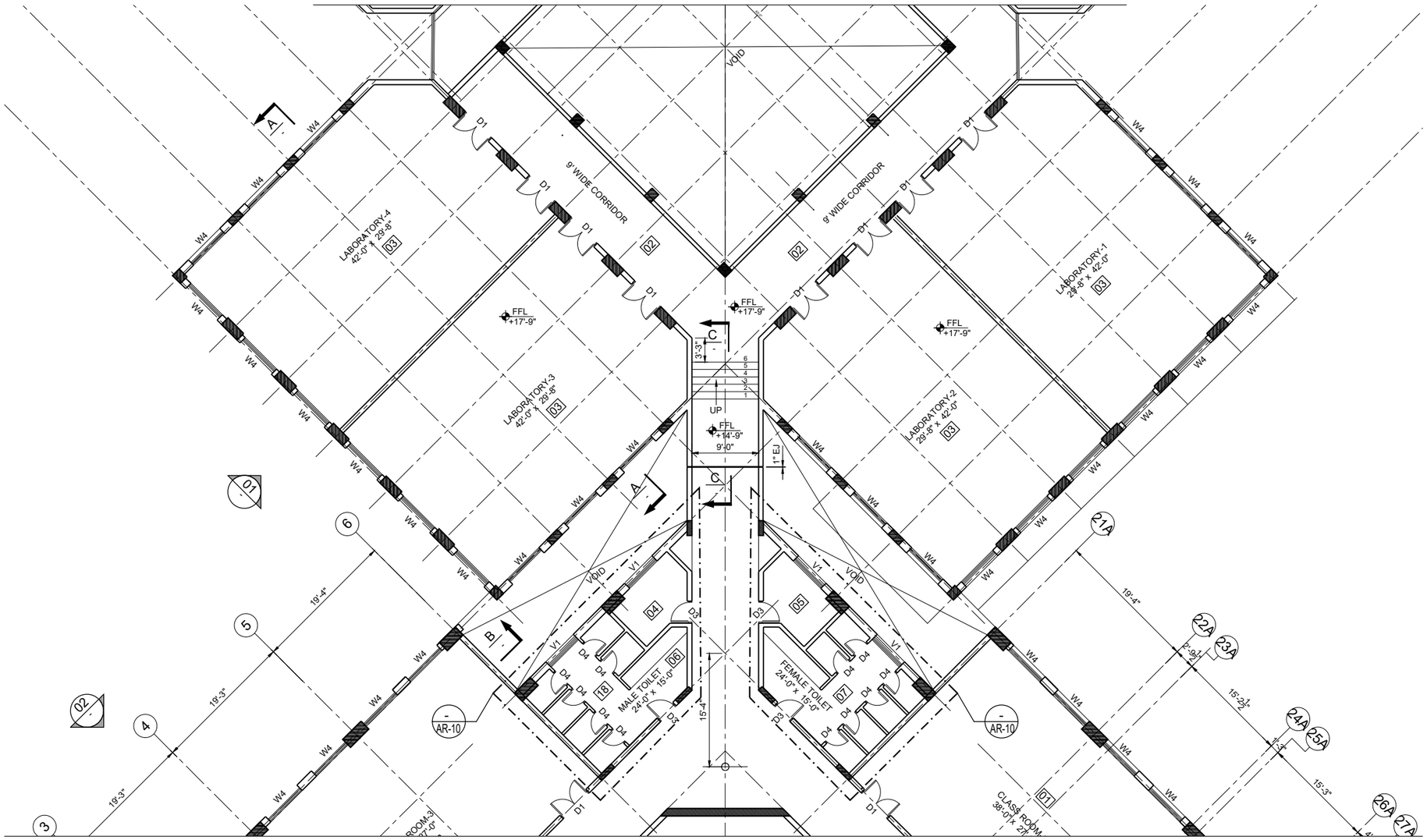
CONSULTANT
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

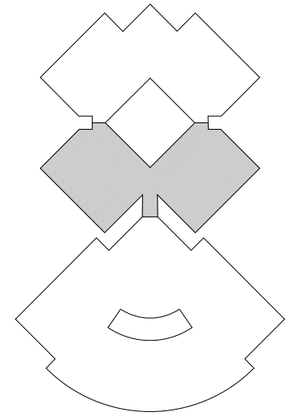
TITLE
FIRST FLOOR (PART PLAN-1)

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-AR-03



FIRST FLOOR (PART PLAN-2)
SCALE 3/32"



KEY PLAN

TENDER DRAWING

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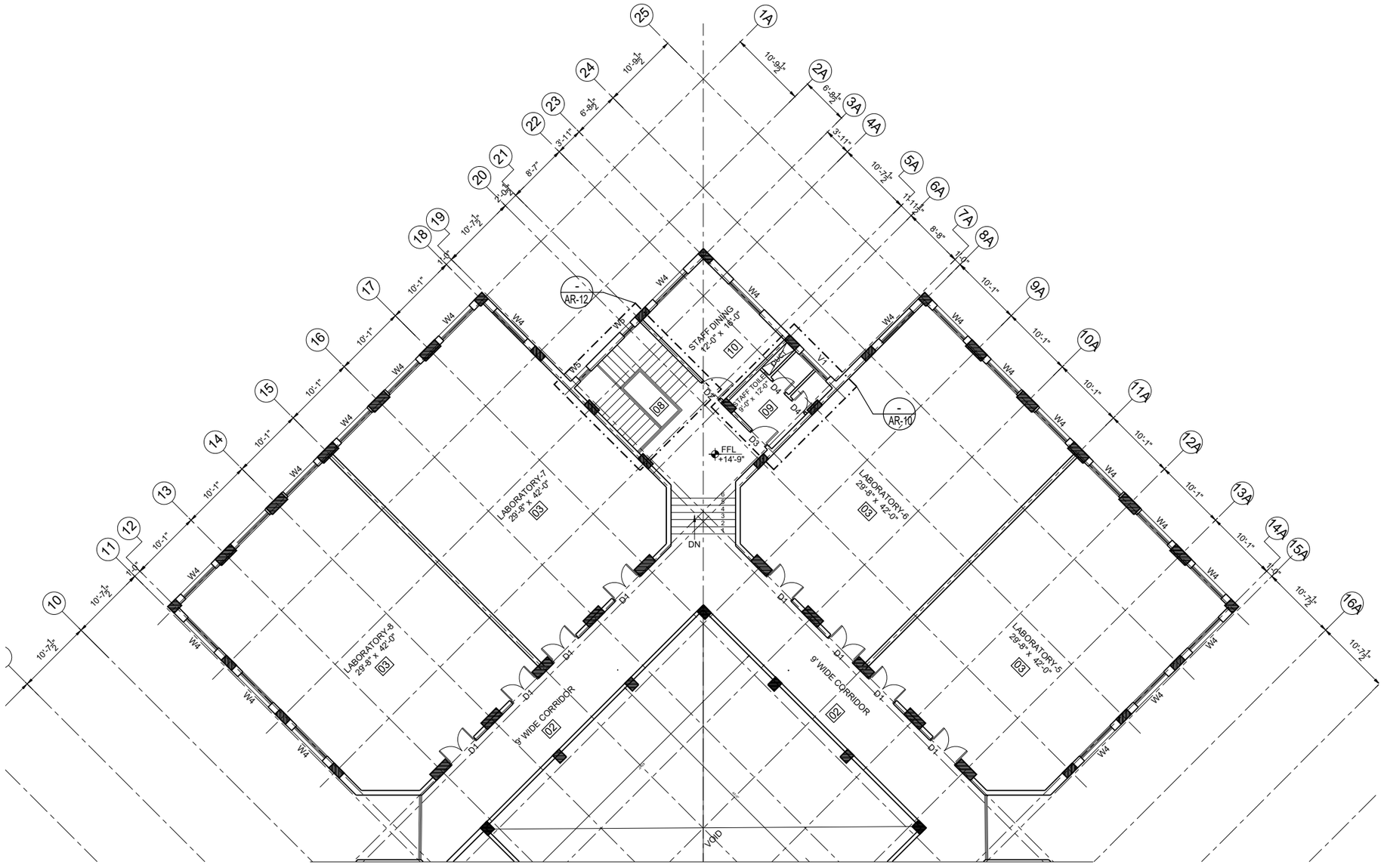
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

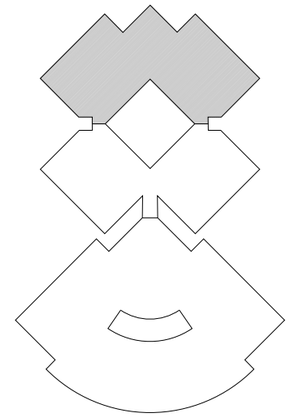
TITLE
FIRST FLOOR (PART PLAN-2)

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-AR-04



FIRST FLOOR (PART PLAN-3)
SCALE 3/32"



KEY PLAN

TENDER DRAWING

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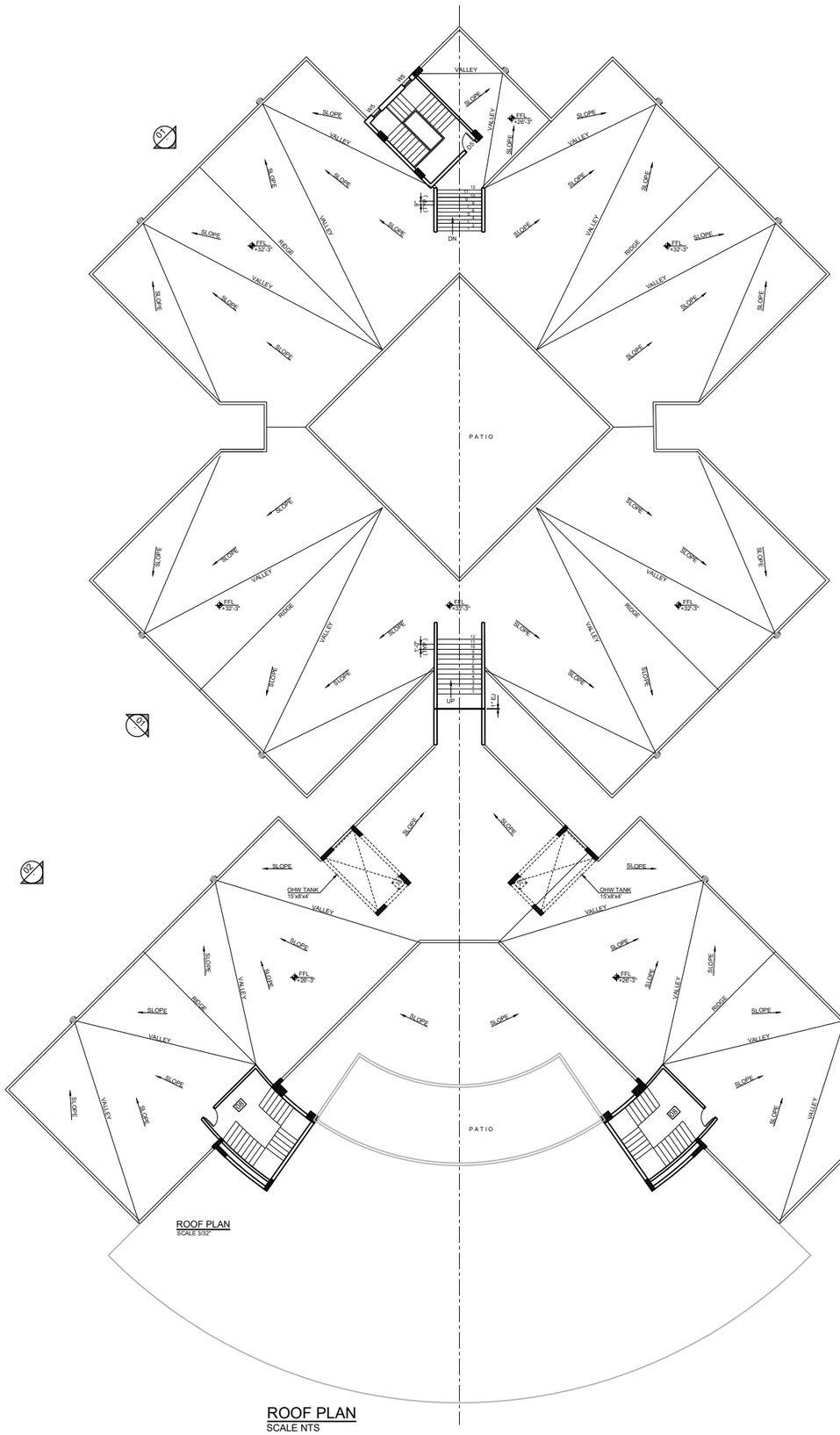
CONSULTANT
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

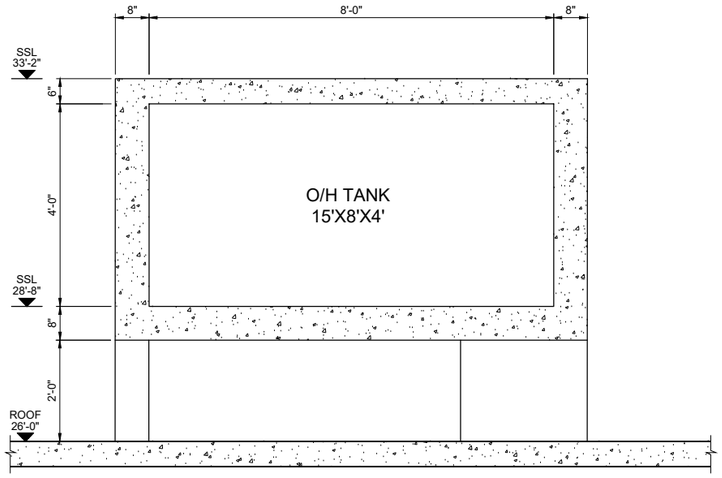
TITLE
FIRST FLOOR (PART PLAN-2)

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

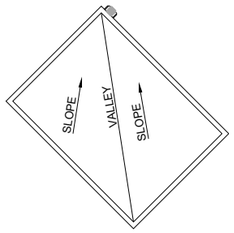
DRG. NO.
TACE-NED-PPE-AR-05



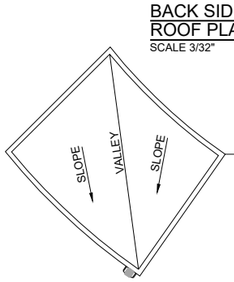
ROOF PLAN
SCALE NTS



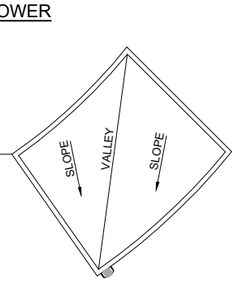
OHW TANK
SCALE 1/2"



BACK SIDE TOWER
ROOF PLAN
SCALE 3/32"



FRONT SIDE TOWER
ROOF PLAN
SCALE 3/32"



FRONT SIDE TOWER
ROOF PLAN
SCALE 3/32"

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

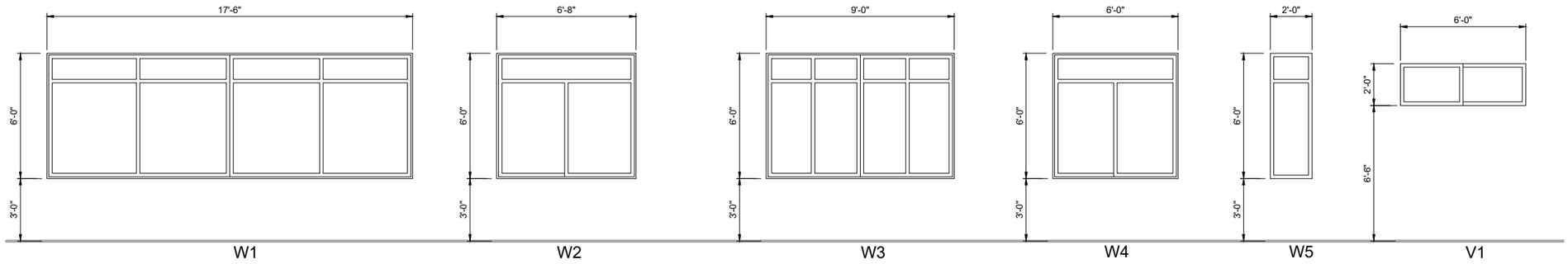
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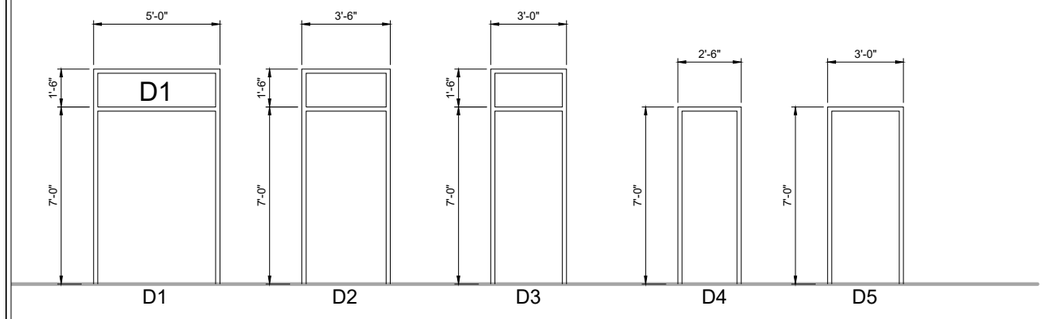
PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
ROOF PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-AR-06





NOTES

1- TEAK PLY SHUTTER WITH WITH WOOD LIPING FACTORY MADE DESIGN AS APPROVED BY ARCHITECT.

2- FOR ALUMINUM WINDOW AND VENTILATOR HEAVY DUTY AND APPROVED QUALITY IS TO BE PROVIDED.

3- ALL NECESSARY HARD WARE FOR DOOR, WINDOWS AND VENTILATOR ARE TO BE PROVIDED OF APPROVED QUALITY.

4- FOR THE DOORS WITH 8"TH. & 12"TH. WALL USE 2"X7" HOLLOW METAL AND FOR 4"TH WALL USE 2"X5" FRAME.

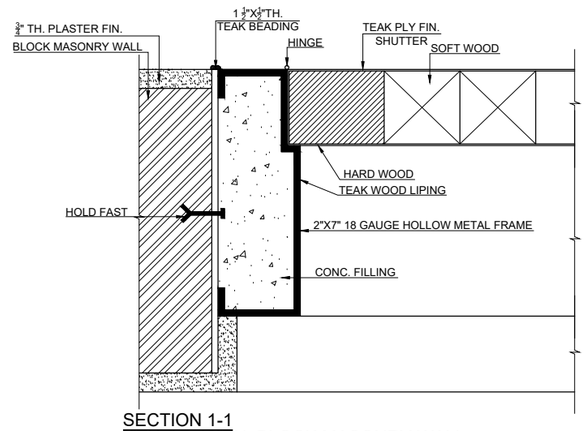
5- ALL THE TOILETS WINDOWS ARE FIXED FROSTED GLASS.

6- PUSH BAR SAFETE DOOR=SHOP DRAWING WILL FINISHED WITH SPECIFICATIONS AS APPROVED BY ENGINEER.

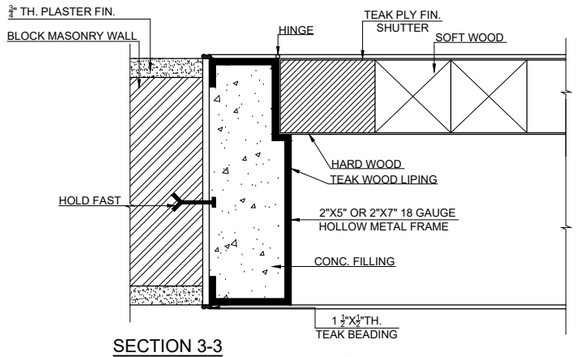
SCHEDULE OF DOORS, WINDOWS & VENTILATOR

WOODEN DOOR				ALUMINIUM GLAZED WINDOW			
NOS	Size			NOS	Size		
	Width		Height		Width		Height
D1	5'-0"	x	8'-6"	W1	17'-6"	x	5'-6"
D2	3'-6"	x	8'-6"	W2	6'-8"	x	5'-6"
D3	3'-0"	x	8'-6"	W3	9'-0"	x	5'-6"
D4	2'-6"	x	7'-0"	W4	6'-0"	x	5'-6"
D5	3'-0"	x	7'-0"	W5	2'-0"	x	5'-6"

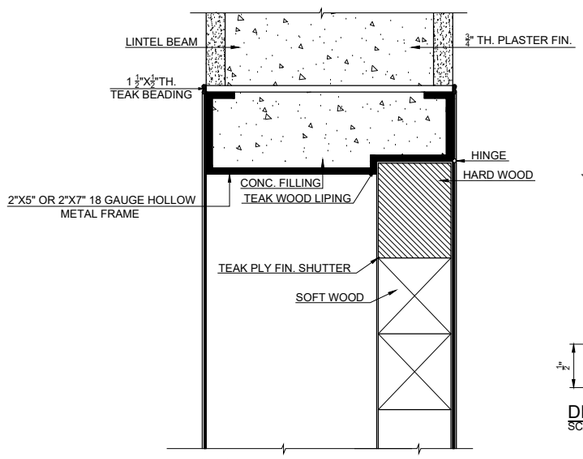
VENTILATORS			
NOS	Size		
	Width		Height
V1	6'-0"	x	1'-6"



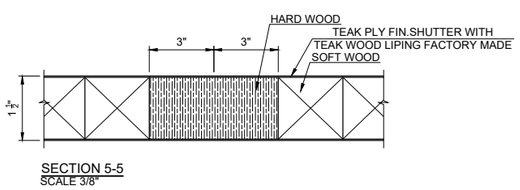
SECTION 1-1
8"TH OR 12"TH. BLOCK MASONRY WALL
SCALE 3/8"



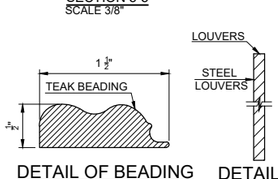
SECTION 3-3
4"TH OR 6"TH. BLOCK MASONRY WALL
SCALE 3/8"



SECTION 4-4
4"TH OR 6"TH. BLOCK MASONRY WALL
SCALE 3/8"



SECTION 5-5
SCALE 3/8"



DETAIL OF BEADING
SCALE 3/8"

DETAIL (D)
SCALE 3/8"

SECTION AT-2
SCALE 3/8"

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

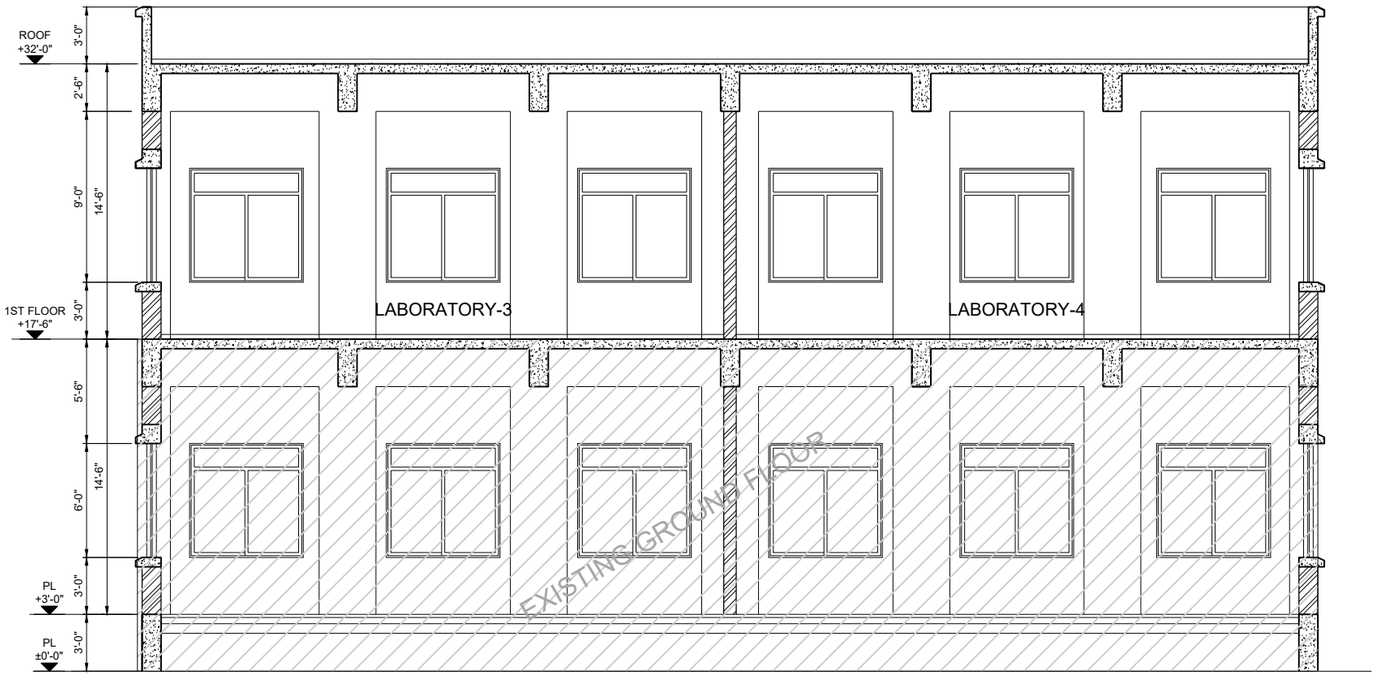
CONSULTANT
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

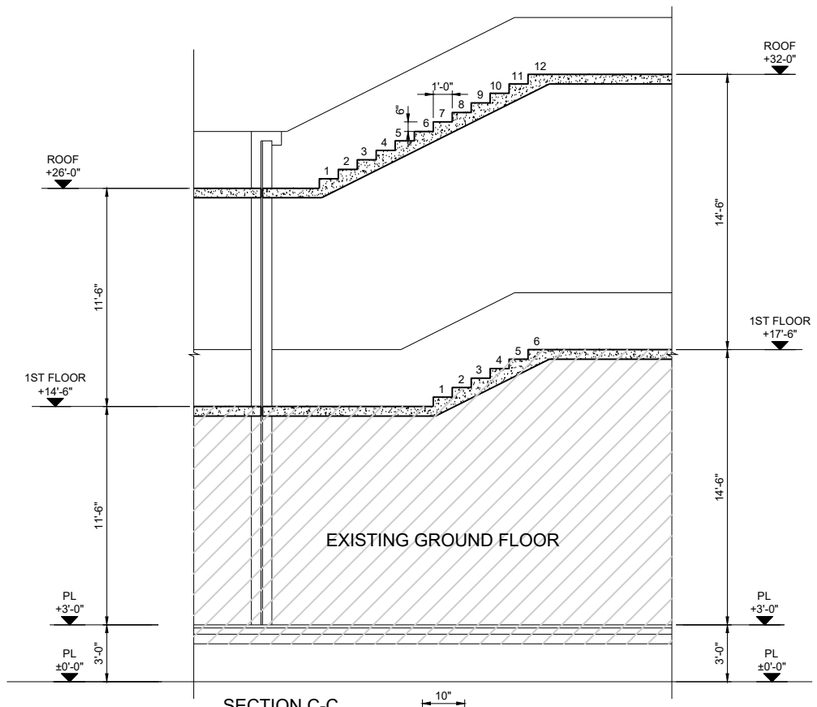
TITLE
SCHEDULE OF DOORS AND WINDOWS

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

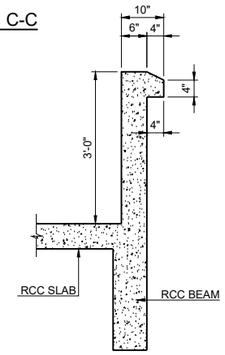
DRG. NO.
TACE-NED-PPE-AR-07



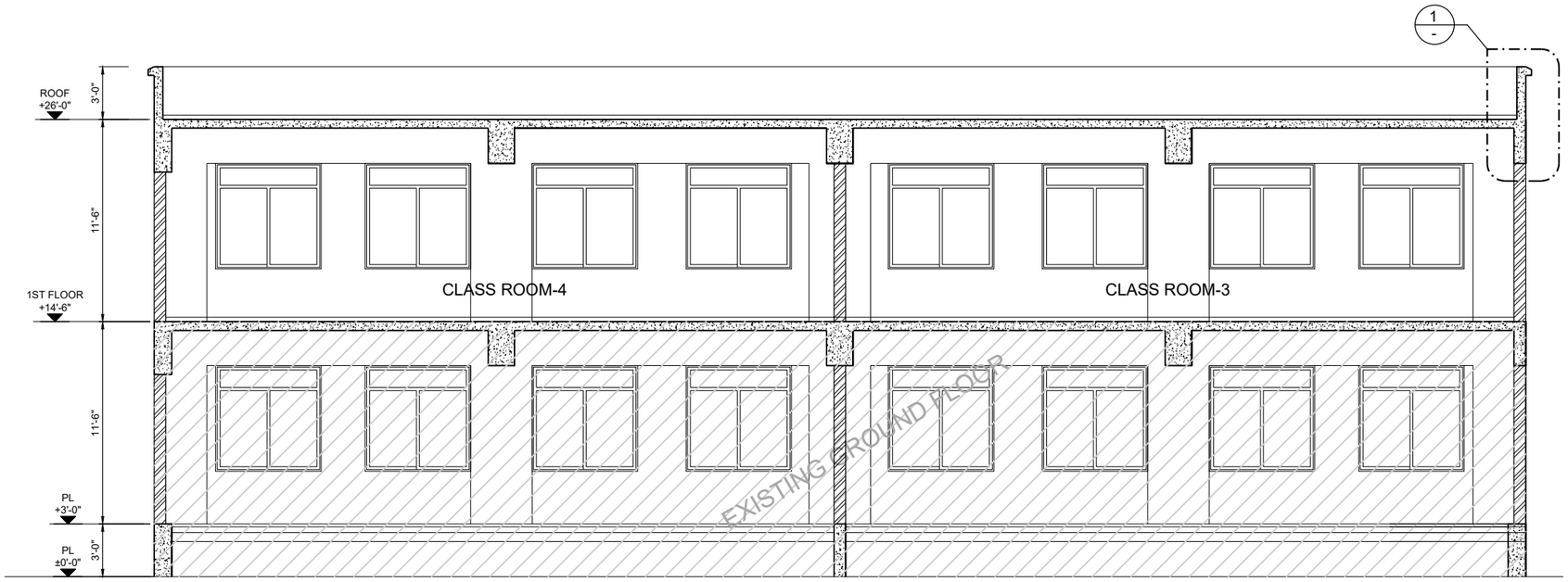
SECTION A-A
SCALE 3/16"



SECTION C-C
SCALE 3/16"



DETAIL-1
TYPICAL PARAPET DETAIL
SCALE 1/2"



SECTION B-B
SCALE 3/16"

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

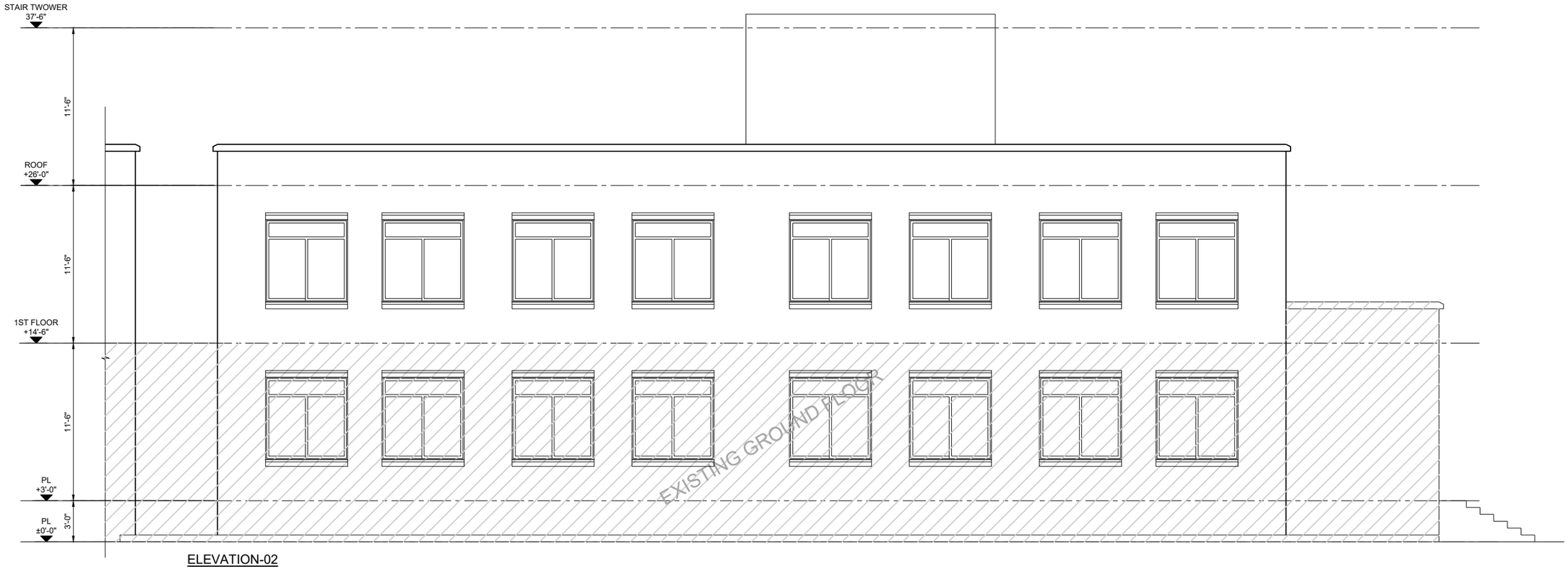
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

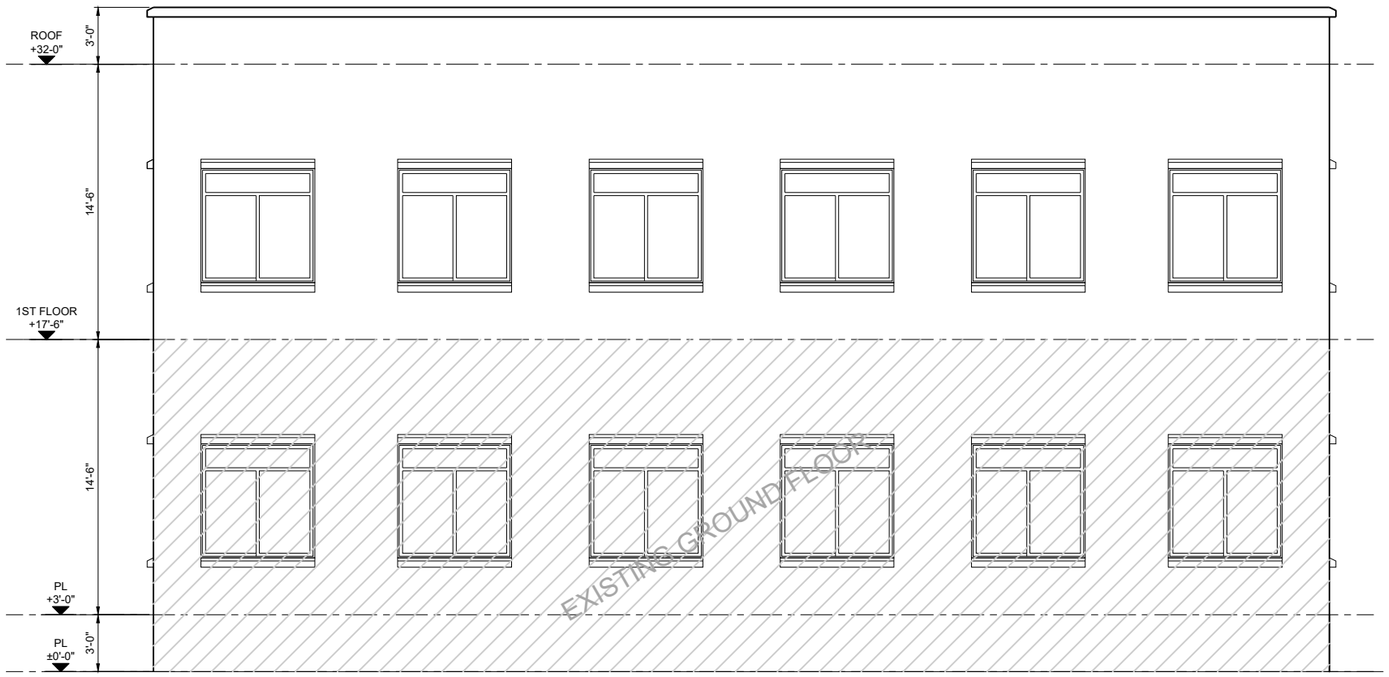
TITLE
SECTIONS A-A, B-B & C-C

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-AR-08



ELEVATION-02
SCALE 3/16"



ELEVATION-01
SCALE 3/16"

TENDER DRAWING

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NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
ELEVATIONS 01 & 02

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-AR-09

SCHEDULE OF FINISHES

S.NO	TITLE	FLOOR	SKIRTING DADO	WALL	CEILING	REMARKS
01	CLASS ROOM	P.T.F	P.T.S	M.F.P	O.B.D	SKIRTING UP TO 6" HIGH
02	CORRIDOR	P.T.F	P.T.S	M.F.P	O.B.D	SKIRTING UP TO 6" HIGH
03	LABORATORY	P.T.F	P.T.S	M.F.P	O.B.D	SKIRTING UP TO 6" HIGH
04	ELECTRIC ROOM	P.T.F	P.T.S	M.F.P	O.B.D	SKIRTING UP TO 6" HIGH
05	JANT.	M.T.F	G.T.D	M.F.P	O.B.D	DADO UP TO 7'-0" HIGH
06	MALE TOILET	M.T.F	G.T.D	M.F.P	O.B.D	DADO UP TO 7'-0" HIGH
07	FEMALE TOILET	M.T.F	G.T.D	M.F.P	O.B.D	DADO UP TO 7'-0" HIGH
08	STAIR CASE	P.T.F	P.T.S	M.F.P	O.B.D	SKIRTING UP TO 6" HIGH
09	STAFF TOILET	M.T.F	G.T.D	M.F.P	O.B.D	DADO UP TO 7'-0" HIGH
10	STAFF DINING	P.T.F	P.T.S	M.F.P	O.B.D	SKIRTING UP TO 6" HIGH

NOTES:-

1	ALL FLOORS, SKIRTING & DADO SHALL BE FINISHED ACCORDING TO DETAIL DRAWINGS SPECIFICATIONS & INSTRUCTION OF ENGINEER.
2	ALL FINISHING MATERIALS USED MUST BE APPROVED BY ENGINEER.
3	ALL INTERNAL. $\frac{3}{4}$" TH. CEMENT SAND PLASTER
4	ALL INTERNAL. $\frac{3}{4}$" TH. PLAIN PLASTER WITH WEATHER SHIELD PAINT FINISH
5	NO CEILING PLASTER WHERE FALSE CEILING IS PROVIDED
6	PORCELAIN TILES FLOOR FINISHES & SKIRTING
7	ALL TOILET MATT.FINISH CERAMIC TILES FLOOR
8	ALL TOILET GLAZED TILES 7'-0" OR 5'-0" HIGH DADO
9	ALL ALUMINIUM FIXTURES ARE TO BE NATURAL COLOUR OF ANODIZING
10	ALL STEEL FRAMES & FIXTURES ARE TO BE PAINTED WITH ENAMEL PAINT.
11	ALL TEAK WOOD SHUTTERS & BEADINGS ARE TO BE FINISHED IN LACKER POLISH.

LEGEND

1	P.T.F	PORCELAIN TILES FINISH
2	P.T.S	PORCELAIN TILES SKIRTING
3	M.F.P	MATT FINISH PAINT
4	O.B.D	OIL BOND DISTEMPER
5	M.T.F	MATT FINISH CERAMIC TILES FLOOR
6	G.T.D	GLAZED TILES DADO 5'-0" & 7'-0" HIGH
7	C.C.F	CEMENT CONCRETE FLOOR FINISH

TENDER DRAWING

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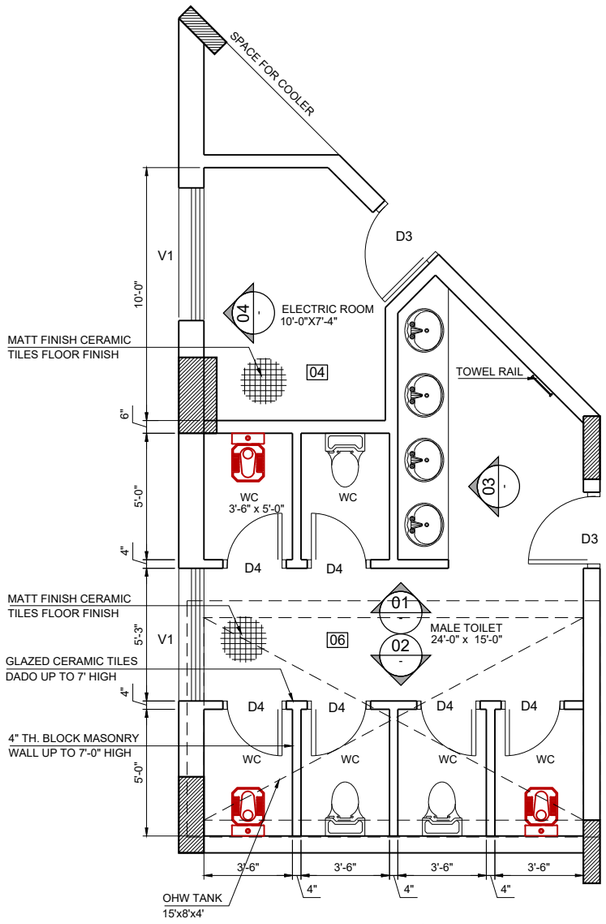
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

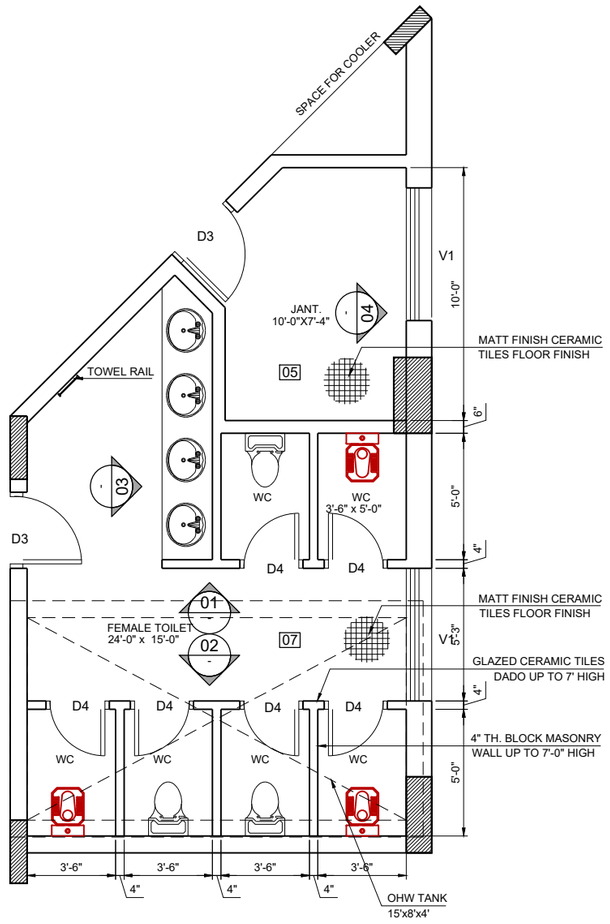
TITLE
SCHEDULE OF FINISHES

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

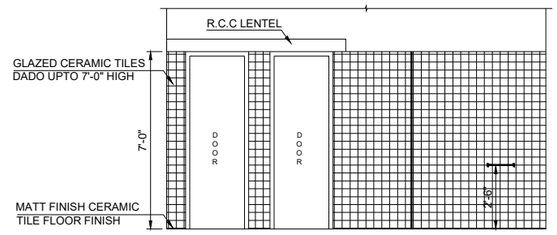
DRG. NO.
TACE-NED-PPE-AR-10



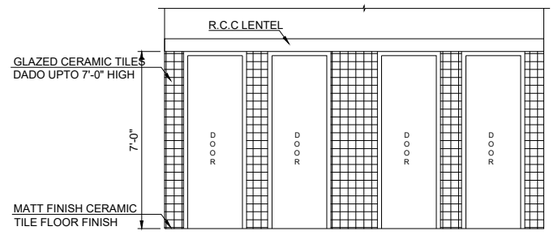
TYP. DETAIL PLAN OF TOILET
(MALE TOILET)
SCALE 1/4"



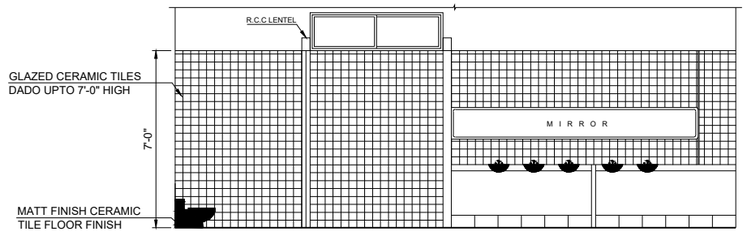
TYP. DETAIL PLAN OF TOILET
(FEMALE TOILET)
SCALE 1/4"



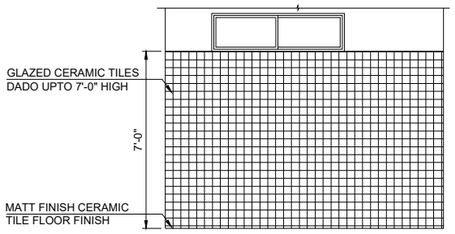
ELEVATION-01



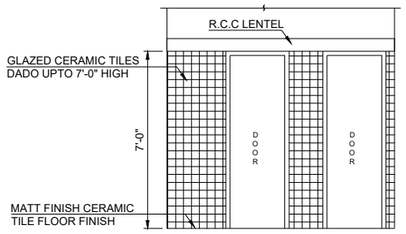
ELEVATION-02



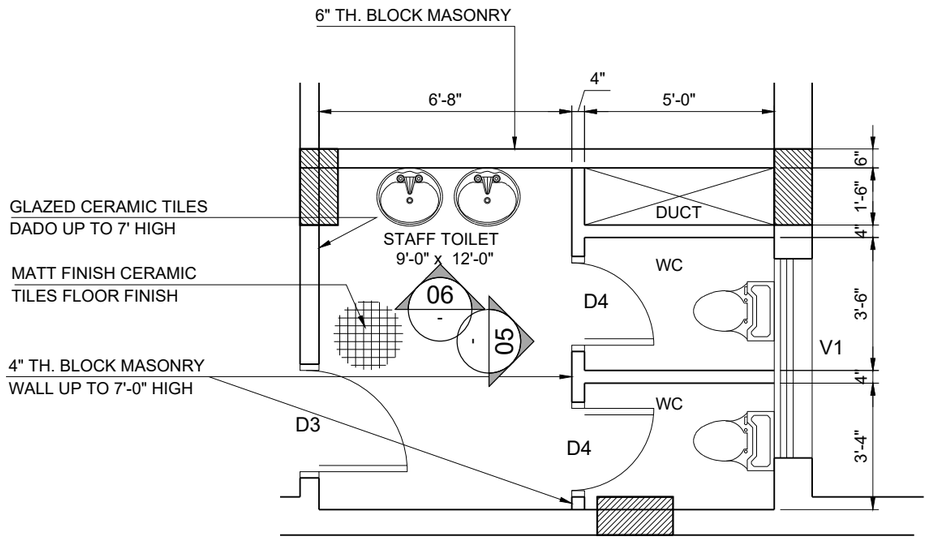
ELEVATION-03



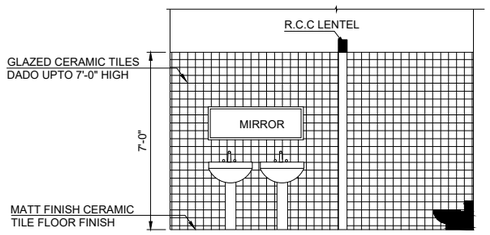
ELEVATION-04



ELEVATION-05



TYP. DETAIL PLAN OF TOILET



ELEVATION-06

TENDER DRAWING

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TECHNOLOGY

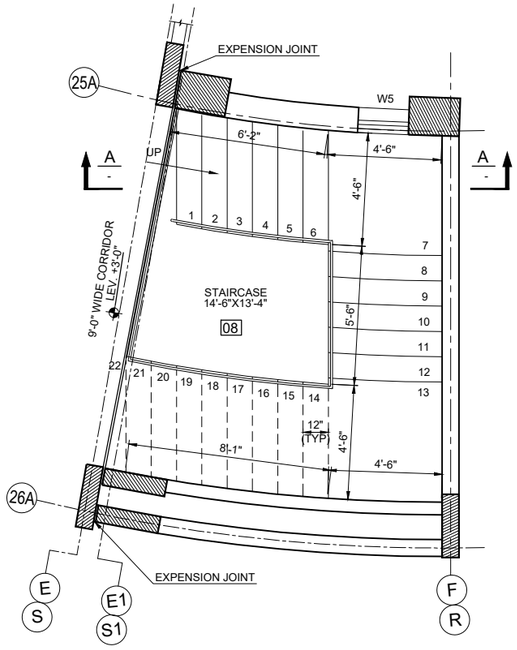
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

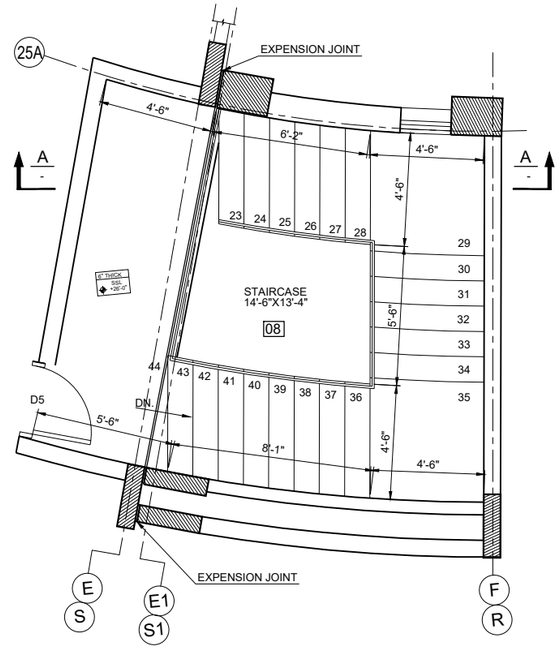
TITLE
TOILER BLOCK PART PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

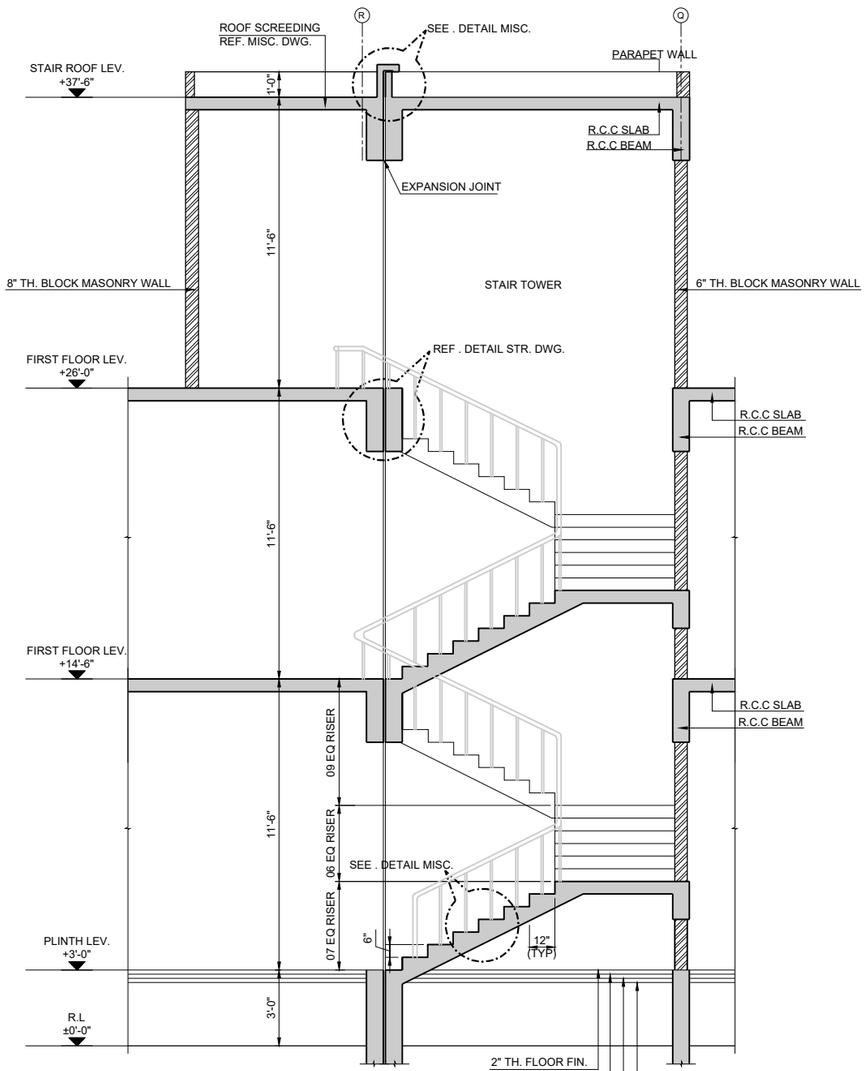
DRG. NO.
TACE-NED-PPE-AR-11



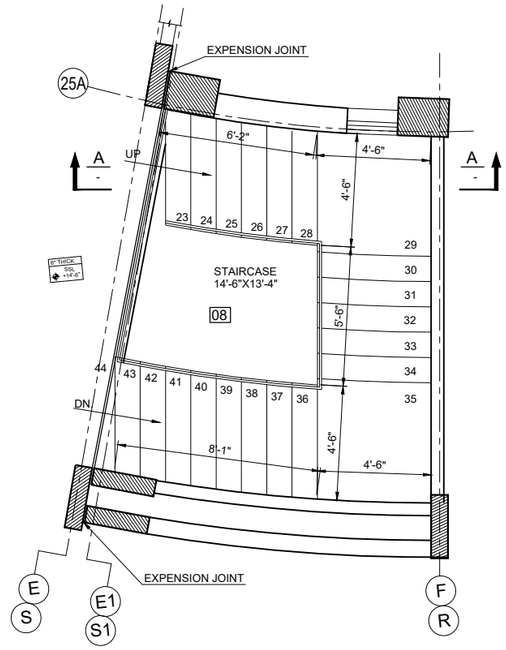
TYP. DETAIL PLAN OF STAIRCASE
GROUND FLOOR
SCALE 1/4"



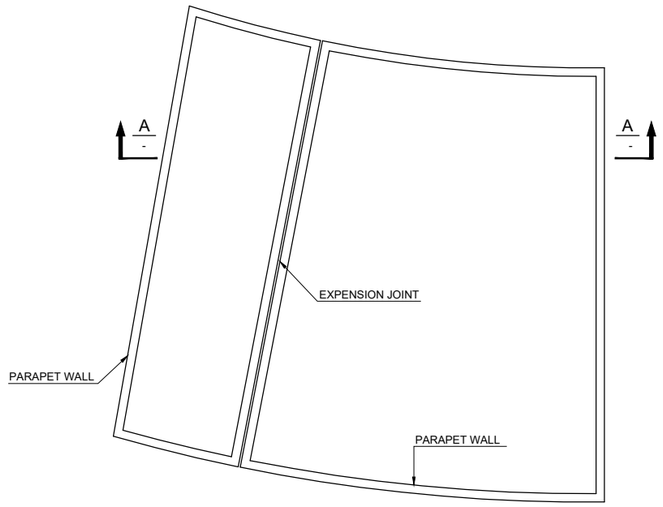
TYP. DETAIL PLAN OF STAIRCASE ROOF
SCALE 1/4"



SECTION AT A-A



TYP. DETAIL PLAN OF STAIRCASE
FIRST FLOOR
SCALE 1/4"



TYP. DETAIL PLAN OF STAIRCASE TOWER ROOF
SCALE 1/2"

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

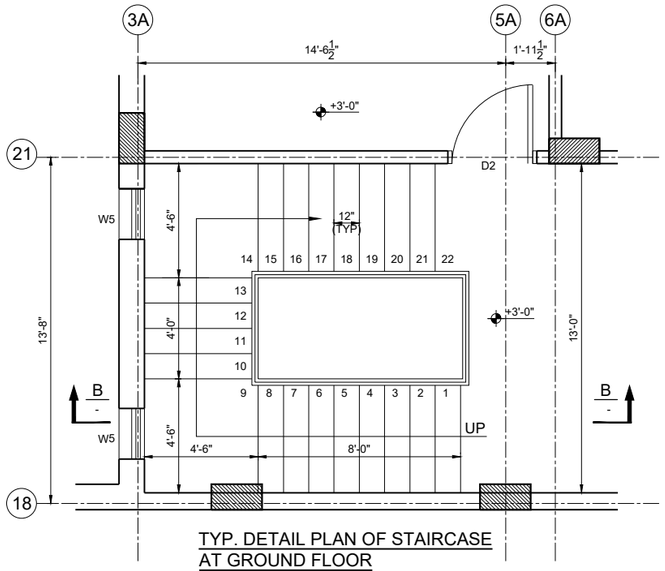
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
STAIR PLAN & DETAILS

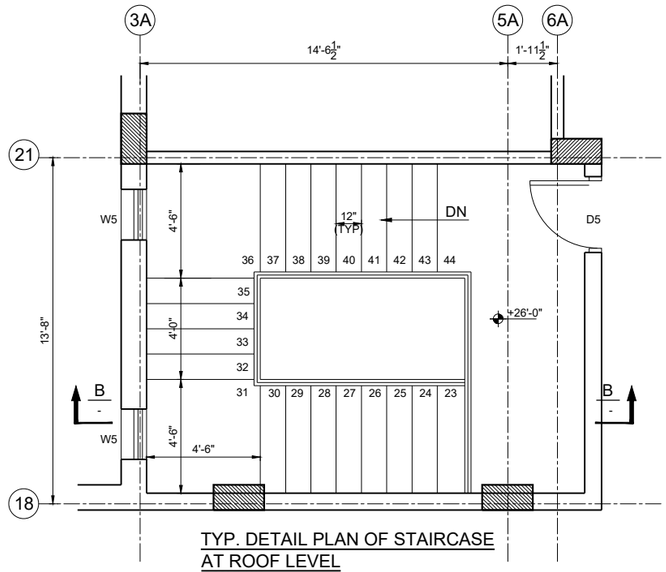
SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-AR-12



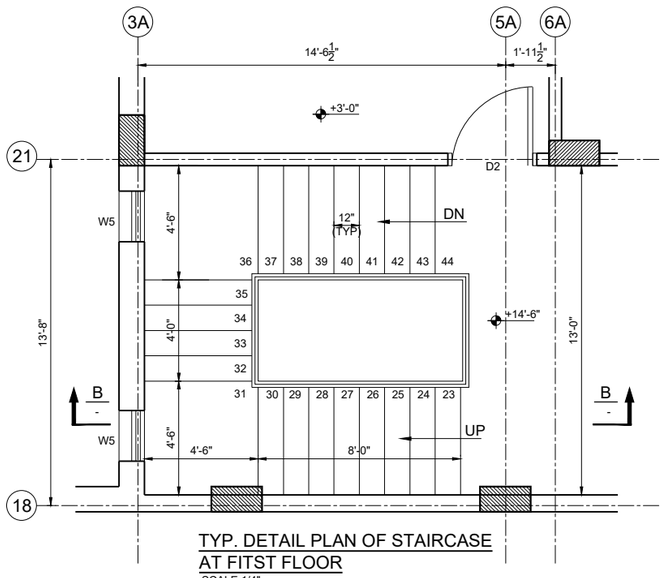
TYP. DETAIL PLAN OF STAIRCASE AT GROUND FLOOR

SCALE 1/4"



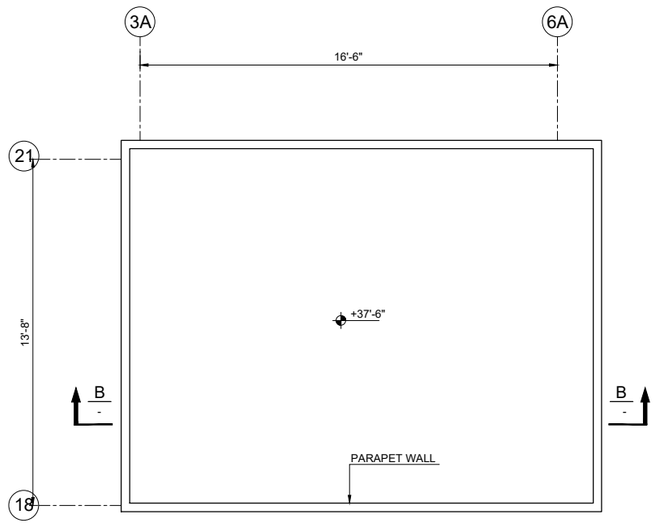
TYP. DETAIL PLAN OF STAIRCASE AT ROOF LEVEL

SCALE 1/4"



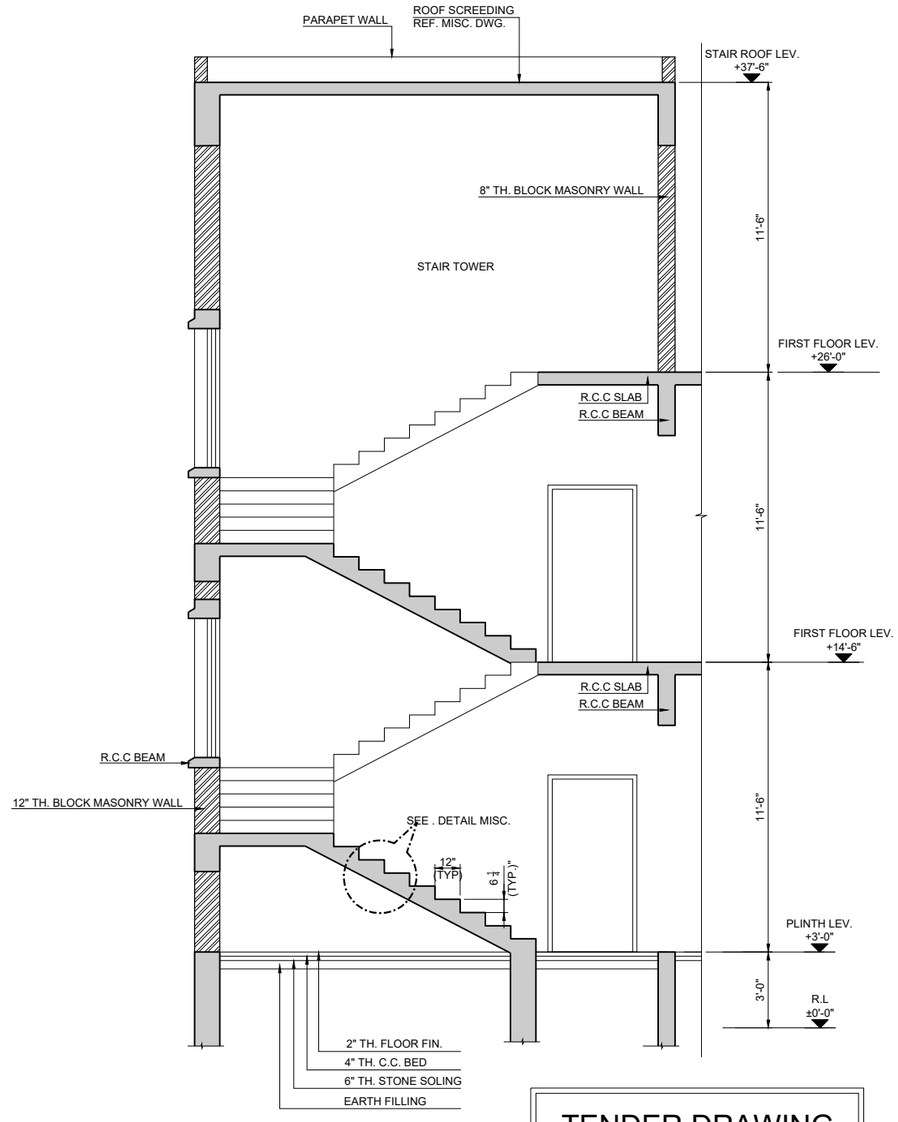
TYP. DETAIL PLAN OF STAIRCASE AT FITST FLOOR

SCALE 1/4"



TYP. DETAIL PLAN OF STAIRCASE AT TOWER ROOF

SCALE 1/4"



SECTION AT B-B

TENDER DRAWING

CLIENT

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

CONSULTANT

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PROJECT

CONSTRUCTION OF ACADEMIC BLOCK AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

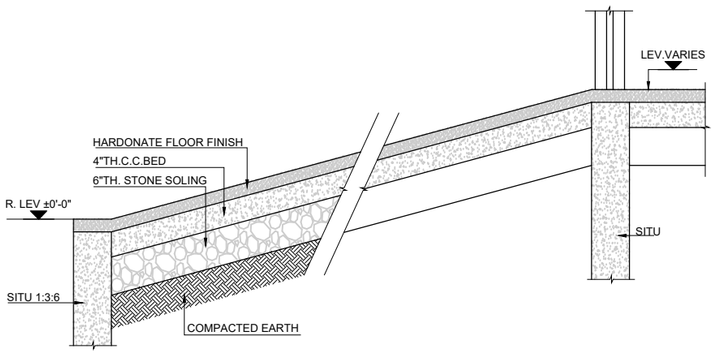
TITLE

STAIR PLAN & DETAILS

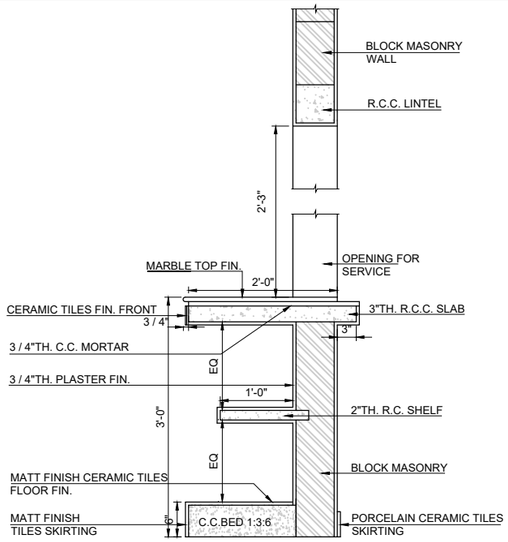
SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	ZAHEER	ZAHEER	TANVEER	OCT' 2025

DRG. NO.

TACE-NED-PPE-AR-13

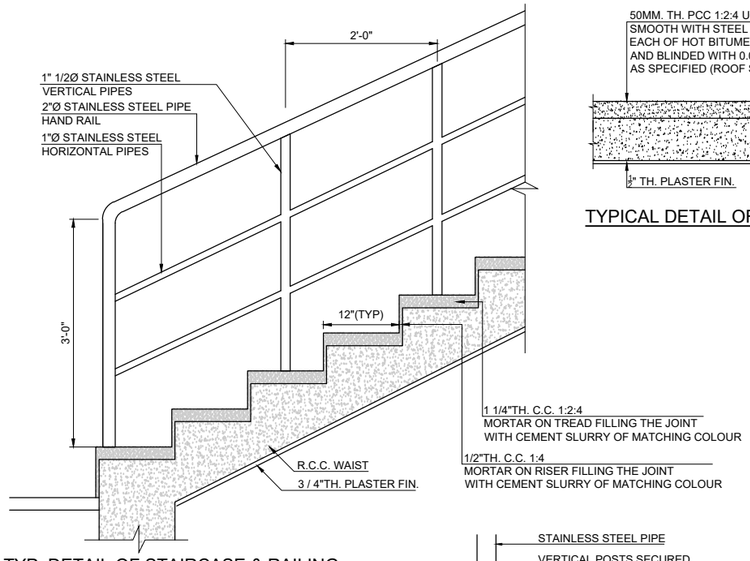


TYP.DET.OF RAMP

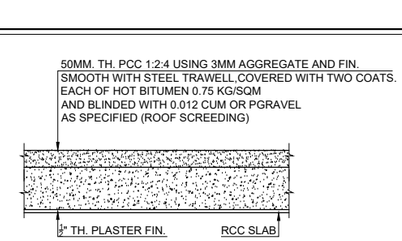


TYP.DET. OF SERVICES & COUNTER (KITCHEN & CASH COUNTER)

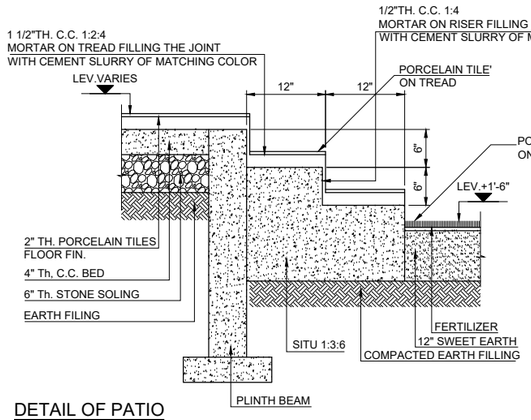
SCALE 1"



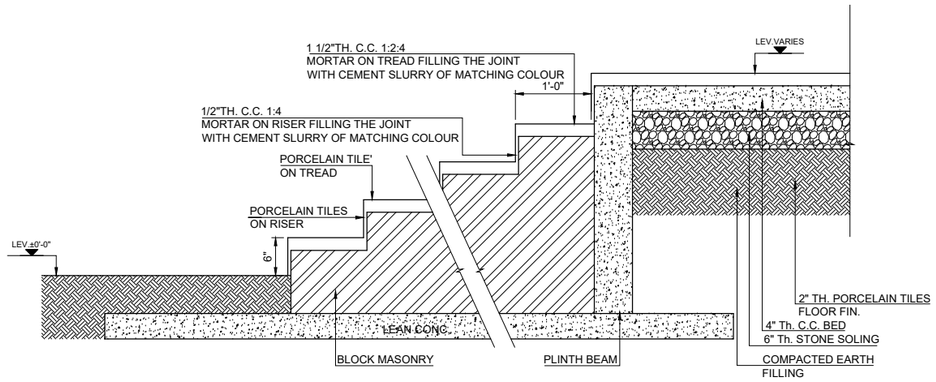
TYP. DETAIL OF STAIRCASE & RAILING



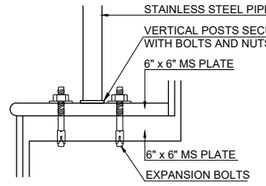
TYPICAL DETAIL OF ROOF FINISHES



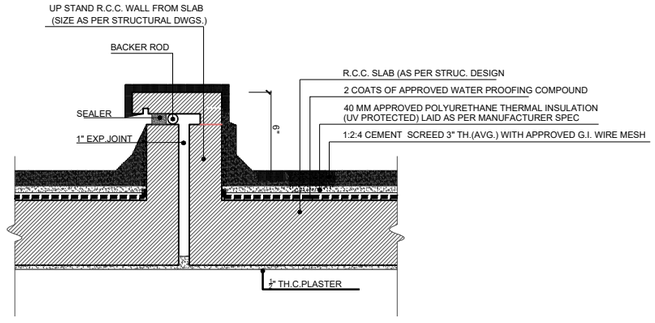
DETAIL OF PATIO



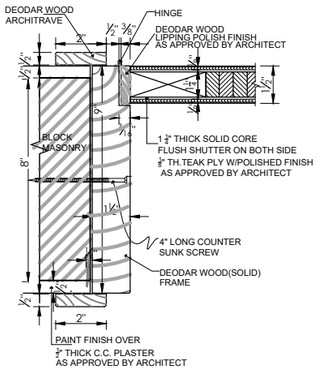
TYP. DETAIL OF STEPS



DETAIL Z

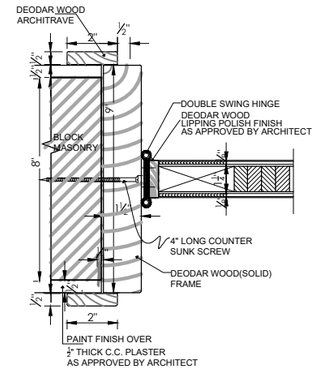


EXPANSION JOINT DETAIL (HORIZONTAL) AT ROOF LEV.



JAMB DETAIL OF WOODEN DOOR

SCALE :3" = 1'-0"



JAMB DETAIL OF DOUBLE SWING DOOR

SCALE :3" = 1'-0"

TENDER DRAWING

CLIENT

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

CONSULTANT

TACE

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Telephone : +92 21 34964622

PROJECT

CONSTRUCTION OF ACADEMIC BLOCK AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

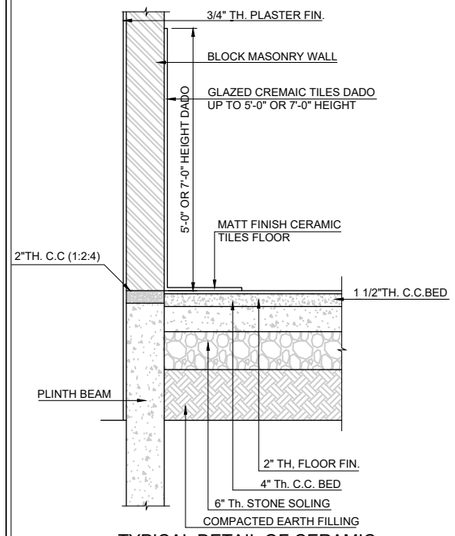
TITLE

MISCELLANEOUS DETAILS (SHEET-1)

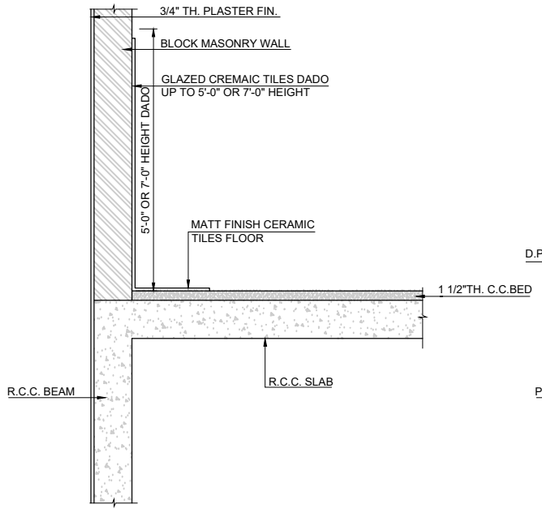
SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

DRG. NO.

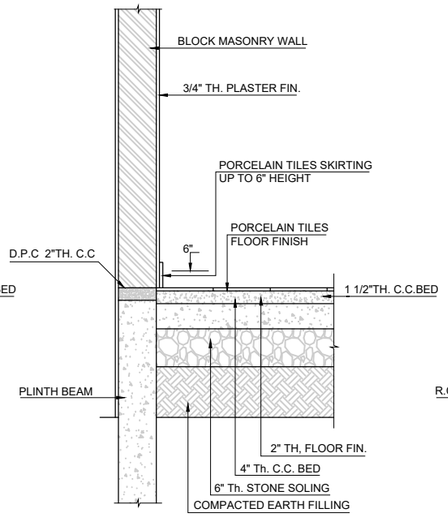
TACE-NED-PPE-AR-14



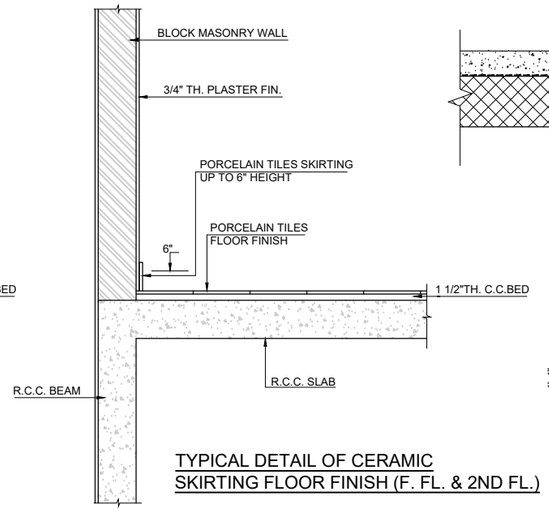
TYPICAL DETAIL OF CERAMIC
TILES FLOOR & DADO (G. FLOOR)



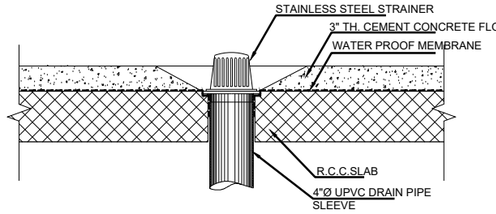
TYPICAL DETAIL OF CERAMIC
TILES FLOOR & DADO (F. FL. & 2ND FL.)



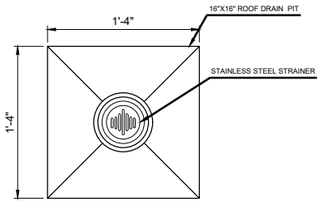
TYPICAL DETAIL OF PORCELAIN TILES
SKIRTING FINISH (G. FLOOR)



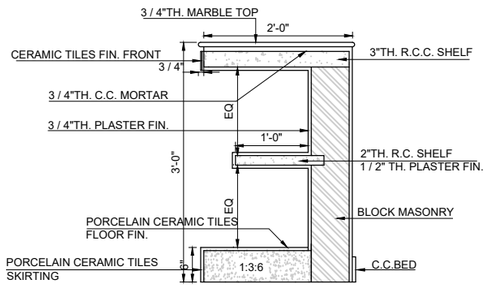
TYPICAL DETAIL OF CERAMIC
SKIRTING FLOOR FINISH (F. FL. & 2ND FL.)



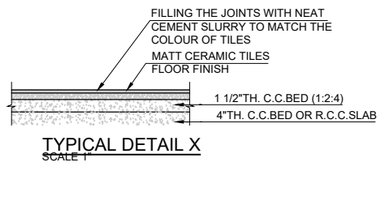
SECTIONAL ELEVATION
SCALE : N.T.S.



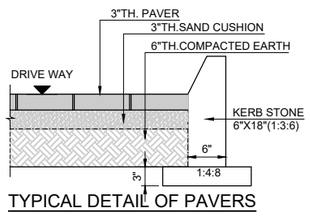
PLAN OF KHURRA OR
(SUMP PIT)
SCALE : N.T.S.



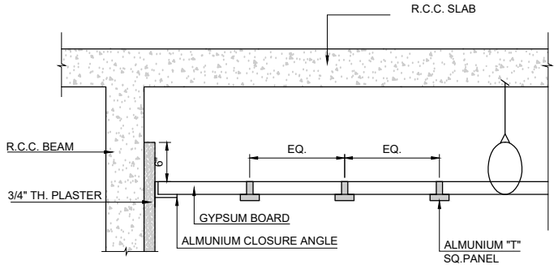
TYP.DET. OF RECEPTION & SERVICE COUNTER



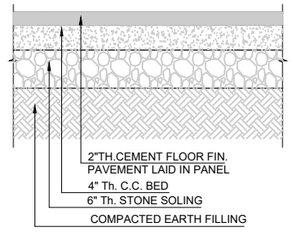
TYPICAL DETAIL X
SCALE 1



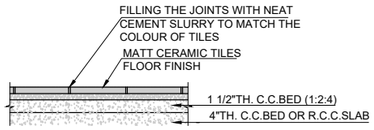
TYPICAL DETAIL OF PAVERS



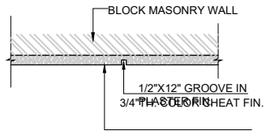
TYPICAL DETAIL OF FALSE CEILING



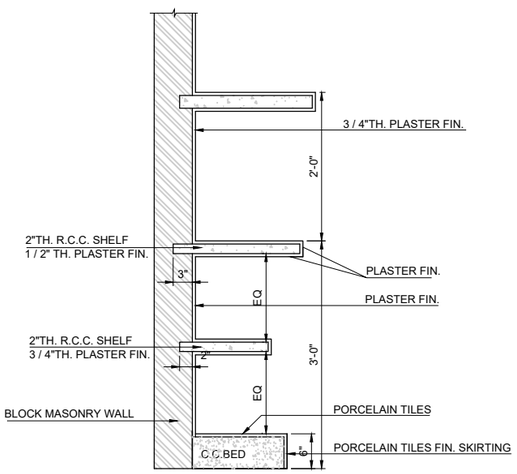
DETAIL OF PAVEMENT (CEMENTED)
SCALE 1"



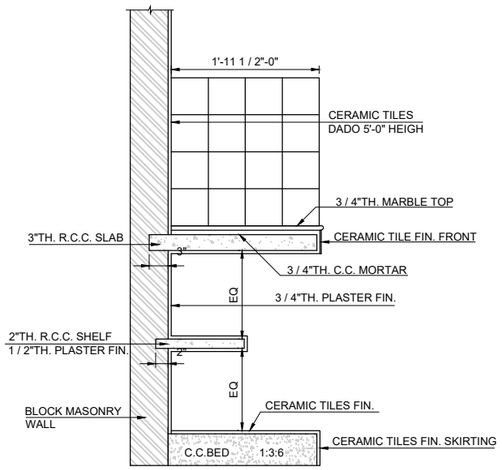
TYPICAL DETAIL Y



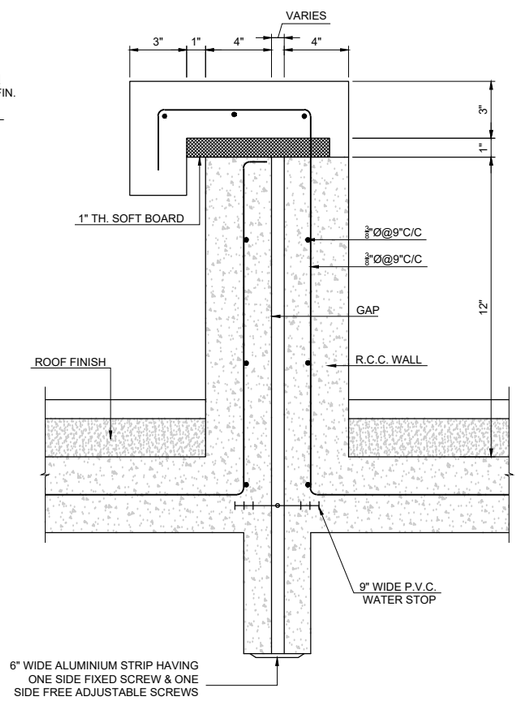
DETAIL OF GROOVE



DETAIL R.C.C. SHELF
USE IN ALL STORES



TYP.DET. OF KITCHEN & PANTRY COUNTRY



DETAIL OF EXPANSION JOINT IN ROOF SLABS

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING &
TECHNOLOGY

CONSULTANT
TACE
TANVEER AHSAN CONSULTING ENGINEERS
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
MISCELLANEOUS DETAILS
(SHEET-1)

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-AR-15

(TENDER DRAWINGS)

VOLUME IV:-

CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

SCHEME:-

ENHANCEMENT OF ACADEMIC FACILITIES
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

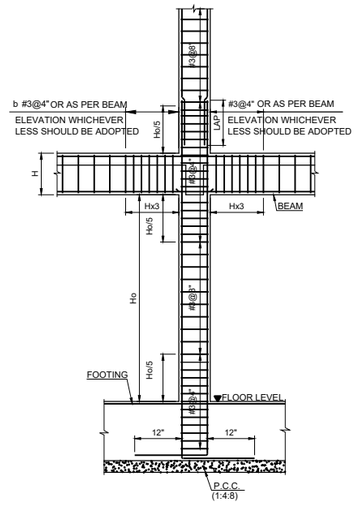
(STRUCTURAL DRAWINGS)

CONSULTANT :

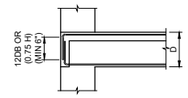
TA CE
TANVEER AHSAN CONSULTING ENGINEERS
Architect, Planners & Project Managers
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Gulshan-e-Iqbal, Karachi-75300 Pakistan
Telephone : +92 21 34964622

GENERAL NOTES

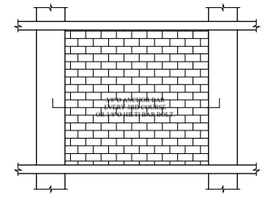
1. DESIGN IS IN ACCORDANCE WITH ACI-318-08 CODE.
2. ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE JOB SPECIFICATIONS.
3. BEAM AND SLAB REINFORCED CONCRETE WILL BE OF 3000 PSI CYLINDER STRENGTH AND COLUMN, FOUNDATION REINFORCED CONCRETE WILL BE OF 4000 PSI CYLINDER STRENGTH WITH MINIMUM CEMENT CONTENT 380 KG/M
4. DESIGN OF SPECIFIED CONCRETE MIX SHALL BE SUBMITTED BY THE CONCTRACTOR AND SHALL BE GOT APPROVED FORM THE ENGINEER WELL BEFORE CONCRETING OF RELEVENT STURCTURES ALONGWITH RESULT OF TEST CYLINDERS TESTED AS PER ASTM C 39. TEST SPECIMENS SHALL BE MADE AND CURED IN ACCORDANCE WITH ASTM C 31.
5. ALL REINFORCING STEEL IS DEFORMED 60,GRADE 60000 PSI MIN. YIELD STRENGTH AND MIN. ULTIMATE STRENGTH OF 90000 PSI AS PER ASTM A-615 SPECIFICATIONS.
6. ORDINARY PORTLAND CEMENT, CONFORMING TO BS-12 / PS-232 SHALL BE USED IN ALL R.C.C. WORK EXCEPT WHERE IT IS SPECIFICALLY MENTIONED IN THE GEOTECHNICAL REPORT.
7. CEMENT FROM DIFFERENT SOURCES SHALL NOT BE MIXED FOR THE STRUCTURE.
8. COARSE SAND FROM APPROVED QUARRIES / SOURCES SHALL BE USED.
9. WELL GRADED CRUSHED STONE FROM APPROVED QUARRIES / SOURCES SHALL BE USED AS COARSE AGGREGATE. MAXIMUM NOMINAL SIZE OF THE COARSE AGGREGATE SHALL BE 20 MM FOR ALL R.C.C. WORK. AGGREGATE SHALL COMPLY ASTM C33
10. POTABLE WATER SHALL BE USED FOR CONCRETE AND SHALL BE FREE OF ORGANIC AND OTHER IMPURITIES.
11. 60 X 60 MM PRECAST CONCRETE BLOCKS HAVING COMPRESSIVE STRENGTH OF 6000 PSI. AND SPACED NOT MORE THAN 1 M C/C SHALL BE USED FOR PROVISION OF REQUIRED COVER TO MAIN REINFORCEMENT. THICKNESS OF THESE BLOCKS SHALL BE EQUAL TO THE REQUIRED COVER.
12. ALL DIMENSIONS ARE GIVEN IN FEET-INCHES . WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
13. UNLESS OTHERWISE SHOWN ON THE PLANS, CONCRETE COVER PROVIDED FOR REINFORCEMENT SHALL BE AS FOLLOWS;
    FOOTINGS ON 1:4:8
    BOTTOM 1.5"
    SIDES 1.5"
    SLABS 0.75"
    BEAMS & COLUMNS 1.5"
14. CONSTRUCTION DRAWINGS ALONG WITH BAR BENDING SCHEDULE SHALL BE SUBMITTED BY THE CONTRACTOR FOR ENGINEER'S APPROVAL WELL BEFORE PROCEEDING ANY WORK.
15. ALL LAYOUT, CONFIGURATION, DIMENSIONS AND LEVELS SHALL BE VERIFIED BEFORE PROCEEDING WITH THE WORK.
16. ALL REINFORCING BARS SHALL BE HELD FIRMLY IN PLACE BEFORE AND DURING THE POURING OF CONCRETE BY MEANS OF ADEQUATE NUMBER OF WIRES AND SUPPORTS TO PREVENT DISLOCATION DURING THE COURSE OF CONSTRUCTION.
17. CONSTRUCTION JOINT NOT SHOWN ON THE DRAWING SHALL BE PROPERLY PLANED AND SO MADE AND LOCATED AS TO LEAST IMPAIR THE STRENGTH OF STRUCTURE AND SHALL NEED PRIOR APPROVAL OF THE ENGINEER. IN GENERAL THEY SHALL BE LOCATED NEAR THE MIDDLE OF THE SPAN OF SLAB AND BEAMS.
    JOINTS SHALL BE PERPENDICULAR TO MAIN REINFORCEMENT. ALL REINFORCING STEEL SHALL BE CONTINUED PROPERLY ACROSS THE JOINTS.
18. DURING CONSTRUCTION, SAFETY AND STABILITY OF THE STRUCTURE AND ALL TEMPORARY WORKS SHALL BE GIVEN PRIME IMPORTANCE. UTMOST CARE AND PRECAUTION SHALL BE EXERCISED BY THE CONTRACTOR DURING THE WORK AGAINST ANY MISHAP OR ACCIDENT.
19. BARS IN BEAMS SHALL BE JOGGLED IN VERTICAL PLANE FOR LAPS AND SHALL BE STAGGERED.
20. ALL LAPS ARE 54 TIMES BAR DIAMETER.
21. BARS IN COLUMN SHALL BE JOGGLED FOR LAPS WITH STARTER BARS.
22. POSITION OF BARS IN BEAMS SHALL BE ADJUSTED KEEPING IN VIEW THE POSITION OF VERTICAL BARS OF THE COLUMNS.
23. STIRRUPS SHALL BE PLACED IN SUCH A WAY THAT THEIR HOOKS SHALL BE STAGGERED AND LOCATED IN COMPRESSION FACE.
24. CONCRETE TEST CYLINDER SHALL BE CURED WITH THE SAME METHOD AND UNDER SAME CONDITIONS AS THOSE FOR THE CONCRETE WORK THEY REPRESENT.
23. STIRRUPS SHALL BE PLACED IN SUCH A WAY THAT THEIR HOOKS SHALL BE STAGGERED AND LOCATED IN COMPRESSION FACE.
24. CONCRETE TEST CYLINDER SHALL BE CURED WITH THE SAME METHOD AND UNDER SAME CONDITIONS AS THOSE FOR THE CONCRETE WORK THEY REPRESENT.
25. NO CONCRETE SHALL BE POURED UNTIL ITS FORM WORK AND REINFORCEMENT HAS BEEN INSPECTED AND APPROVED BY THE ENGINEER.
26. SEQUENCE OF REMOVAL OF FORM WORK SHALL BE AS APPROVED BY THE ENGINEER.
27. ALL STRUCTURAL DRAWINGS SHALL BE READ & CHECKED IN CONJUNCTION WITH THE ARCHITECTURAL DRAWINGS & ELO FOR LAYOUT AND LEVELS OF DIFFERENT MEMBERS.
28. EXISTING UNDERGROUND SERVICES IF ANY, REQUIRED TO BE LEFT IN POSITION, SHALL BE CAREFULLY PROTECTED DURING EXCAVATION.
29. EXCAVATION ADJACENT TO EXISTING STRUCTURES AND/OR UNDER-GROUND SERVICES SHALL BE MADE BY HAND AND PROPERLY PROTECTED.
30. ADEQUATE SHORING AND SUPPORT TO THE SIDES OF ALL EXCAVATION SHALL BE SUPPLIED AND ERECTED WHERE REQUIRED TO SAFE GUARD WORKMEN AND PROTECT ANY ADJACENT STRUCTURES.
31. FOUNDATIONS HAVE BEEN DESIGNED FOR BEARING CAPACITY OF ----- FOR RAFT FOUNDATION AT LEVEL ---- FROM EXISTING GROUND LEVEL. IN CASE OF ANY ADVERSE VARIETY OF SOIL OR BEARING CAPACITY FOUND DURING CONSTRUCTION, IT SHALL BE IMMEDIATELY BROUGHT TO THE NOTICE OF ENGINEER IN CHARGE FOR FURTHER INSTRUCTIONS.
    LOSE POCKET WHEREVER ENCOUNTERED SHALL BE REMOVE AND REPLACED WITH GOOD SOIL AND COMPACTED TO ARCHIVE DESIRE BEARING CAPACITY.
32. WHILE BACK FILLING OF EXCAVATION FOR FOOTINGS COMPACTION SHALL BE DONE IN LAYERS.
33. ALL CONDUITS AND PIPES TO BE LAID IN CONCRETE SHALL BE LOCATED ABOVE MAIN REINFORCEMENT OF SLABS AND BEAMS AND WITH THE APPROVAL OF THE ENGINEER.
34. PREFORMED EXPANSION JOINT FILLER (NON EXTRUDING AND RESILIENT TYPE) WHERE USED SHALL CONFORM TO ASTM 1751 (AASHTO M 213) SPECIFICATION.
35. EXCAVATION INCLUDING DEWATERING, BRACING OF EXCAVATION TO SAFEGUARD THE ADJOINING PROPERTY AND LIFE AND DEWATERING PITS IN CASE OF RAIN IS CONTRACTOR'S RESPONSIBILITY. FOR THAT MATTER, A QUALIFIED GEO-TECHNICAL ENGINEER CAN BE APPOINTED ON HIS ROLE.
36. MAXIMUM WATER CEMENT RATIO =0.5 FOR UNDERGROUND CONCRETE
    MAXIMUM WATER CEMENT RATIO =0.45 FOR ABOVE GROUND CONCRETE
37. HEAVY DUTY POLYTHENE SHEET, 0.20MM THK SHALL BE PLACED BELOW THE LEAN CONCRETE FOR ALL GROUND SLABS.
38. WATER PROOFING SHALL BE BITUTHENE 3000 OR PROOFEX 12X OR EQUIVALENT.
39. CRYSTALLINE WATER PROOFING WHERE SPECIFIED SHALL BE PENETRON OR XYPEX OR ACQUAFIN-IC OF SCHAUMBURG OR EQUIVALENT.
40. BLOCKWORK MUST NOT BE BUILT ON CONCRETE SLABS OR BEAMS UNTIL FORMWORK SUPPORTING SAME HAS BEEN REMOVED.
41. MINIMUM CAMBER IN ALL BEAMS AND SLABS SHALL BE ATLEAST SPAN/240 AND SPAN/180 FOR CANTILEVER BEAMS AND SLABS. UNLESS SHOWN OTHERWISE.
42. TOP OF BLINDING SHALL BE 1.4 mm MULTI-LAYER COMPOSITE HIGH DENSITY POLYETHYLENE MEMBRANE WITH PRESSURE SENSITIVE ADHESIVE COATING.
43. ALL FACES OF CONCRETE SHALL BE PROTECTED WITH 1.5 mm THICK SELF ADHESIVE RUBBER/BITUMEN POLYETHYLENE LAMINATED WATER PROOFING MEMBERANE FOR MAIN STRUCTURES.
44. CONTRACTOR SHALL PREPARE AT LEAST 6 CUBES/CYLINDRICAL FOR EACH POUR AND SHALL SUBMIT THE TEST REPORTS TO ARCHITECT/ STRUCTURE ENGINEER, 2 EACH FOR 7 & 28 DAYS CRUSHING STRENGTH.
45. THE TERMITE CONTROL TREATMENT SHALL BE APPLIED AFTER EXCAVATION OF FOUNDATIONS ON BEDS AND SIDE SLOPES BEFORE CONCRETING OPERATION.
46. THE BACK FILLING / EARTH FILLING WILL BE DONE IN LAYERS (6" TO 8" THICK) COMPACTED UPTO 95% AASHTO STANDARDS
47. CONTRACTOR / SITE ENGINEER SHOULD PREPARE BAR BENDING SCHEDULE AND GET APPROVAL FROM THE DESIGNER
48. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE DESIGN, CONSTRUCTION AND SAFETY OF THE FORM WORK.



SEISMIC BEAM/COLUMN JOINT DETAIL

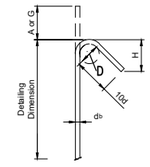


BAR BENDING DETAIL AT BEAM END



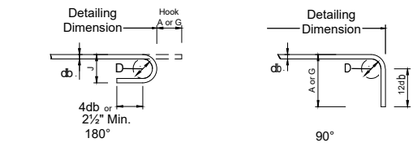
COLUMN/WALL ANCHOR DETAIL
FOR EXTERNAL BLOCK WALL ONLY

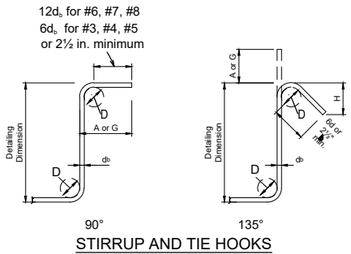
Bar Size	D (in.)	Stirrups and tie hook dimensions, in.			135 deg Stirrup-tie hook dimensions, in.	
		90-deg hooks	135-deg hooks		135-deg hooks	
		A or G,	A or G,	H approx	A or G, in.	H approx
#3	1½	4	4	2½	5	3½
#4	2	4½	4½	3	6½	4½
#6	4½	12	7 3/4	4½	10 3/4	6½



135-DEG SEISMIC STIRRUP/TIE HOOKS

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	11 3/4	19
#10	10 3/4	17	13¼	20
#11	12	19	14 3/4	24
#14	18¼	27	21 3/4	31
#18	24	36	28½	41





STIRRUP AND TIE HOOKS

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

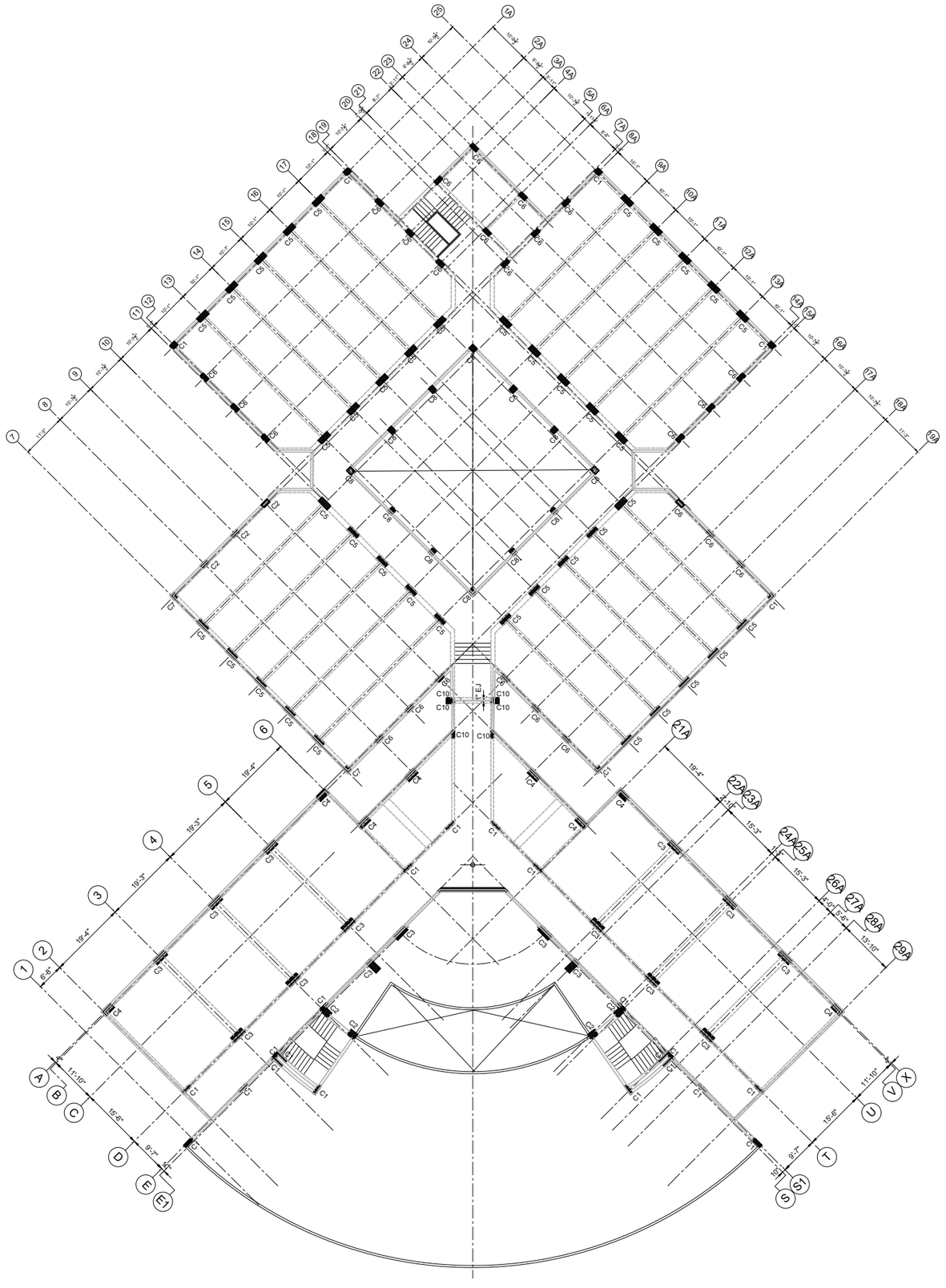
CONSULTANT
TA CE
TANVEER AHSAN CONSULTING ENGINEERS
Architect, Planners & Project Managers
R–210 Abid Town, Block–2
Gulshan–e–Iqbal, Karachi–75300 Pakistan
Telephone : +92 21 34964622

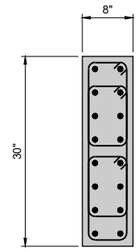
PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
GENERAL NOTES

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

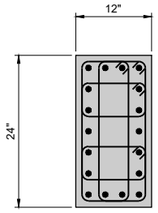
DRG. NO.
TACE-NED-PPE-GN-00





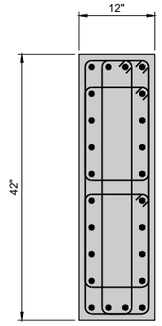
MAIN BARS 16#5
RINGS #3@4"/8" c/c

COLUMN-C1
SCALE 3/4"



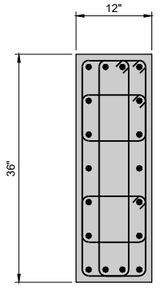
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RINGS #3@4"/8" c/c

COLUMN-C2
SCALE 3/4"



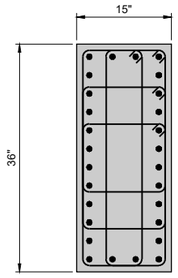
MAIN BARS 24#5
RINGS #3@4"/8" c/c

COLUMN-C3
SCALE 3/4"



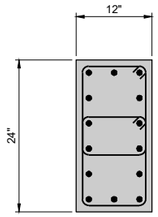
MAIN BARS 18#5
RINGS #3@4"/8" c/c

COLUMN-C4
SCALE 3/4"



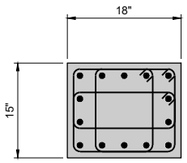
MAIN BARS 28#5
RINGS #3@4"/8" c/c

COLUMN-C5
SCALE 3/4"



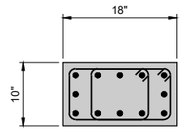
MAIN BARS 14#5
RINGS #3@4"/8" c/c

COLUMN-C6
SCALE 3/4"



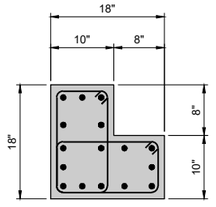
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RINGS #3@4"/8" c/c

COLUMN-C7
SCALE 3/4"



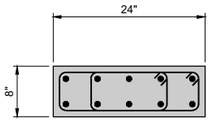
MAIN BARS 12#5
RINGS #3@4"/8" c/c

COLUMN-C8
SCALE 3/4"



MAIN BARS 16#5
RINGS #3@4"/8" c/c

COLUMN-C9
SCALE 3/4"



MAIN BARS 10#5
RINGS #3@4"/8" c/c

COLUMN-C10
SCALE 3/4"

TENDER DRAWING

CLIENT
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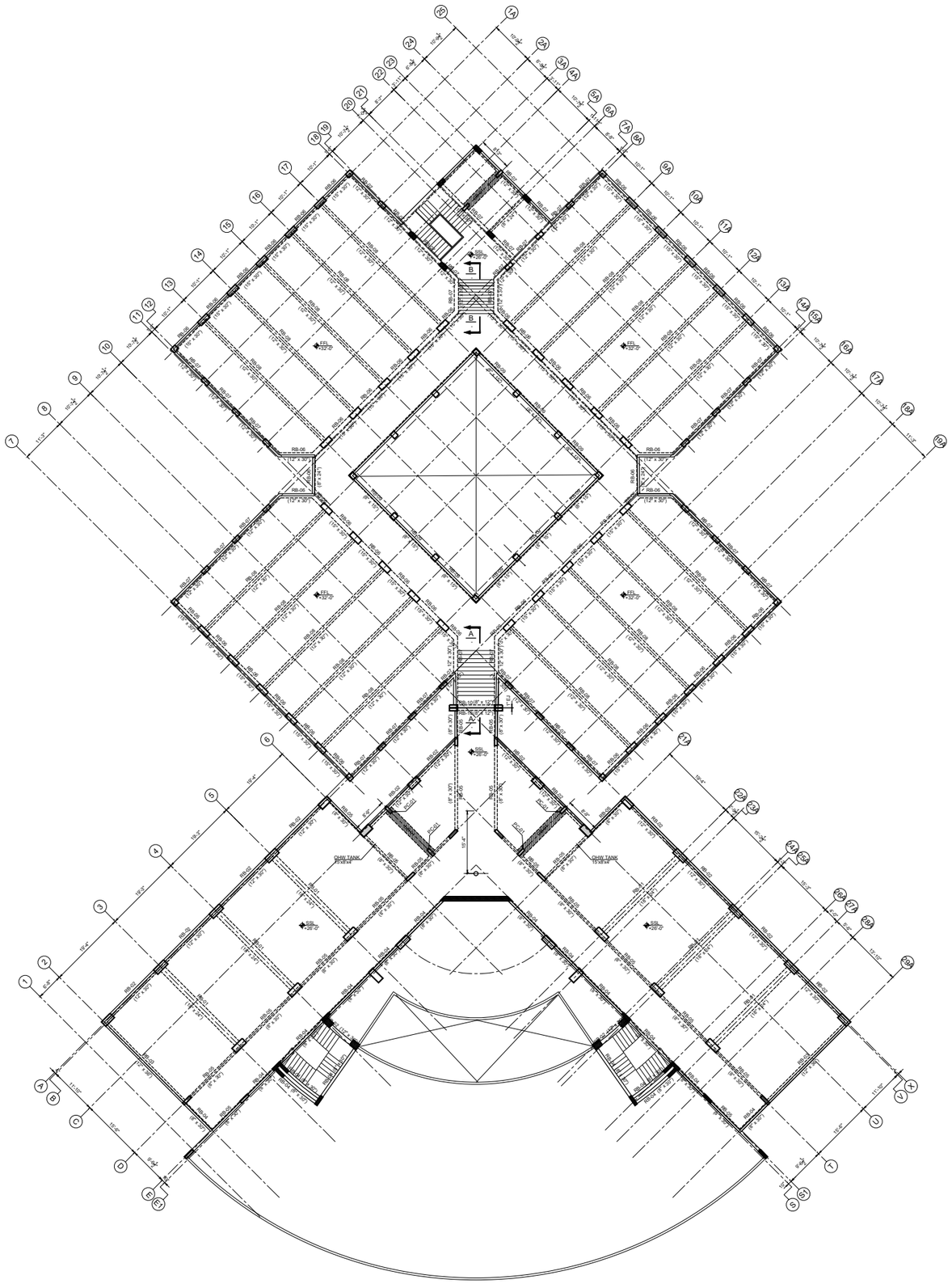
CONSULTANT
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TANVEER AHSAN CONSULTING ENGINEERS
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
FIRST FLOOR FRAMING PLAN (EXISTING)
COLUMN LAYOUT PLAN & DETAILS

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-ST-01



ROOF FRAMING PLAN
SCALE 1/16"

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

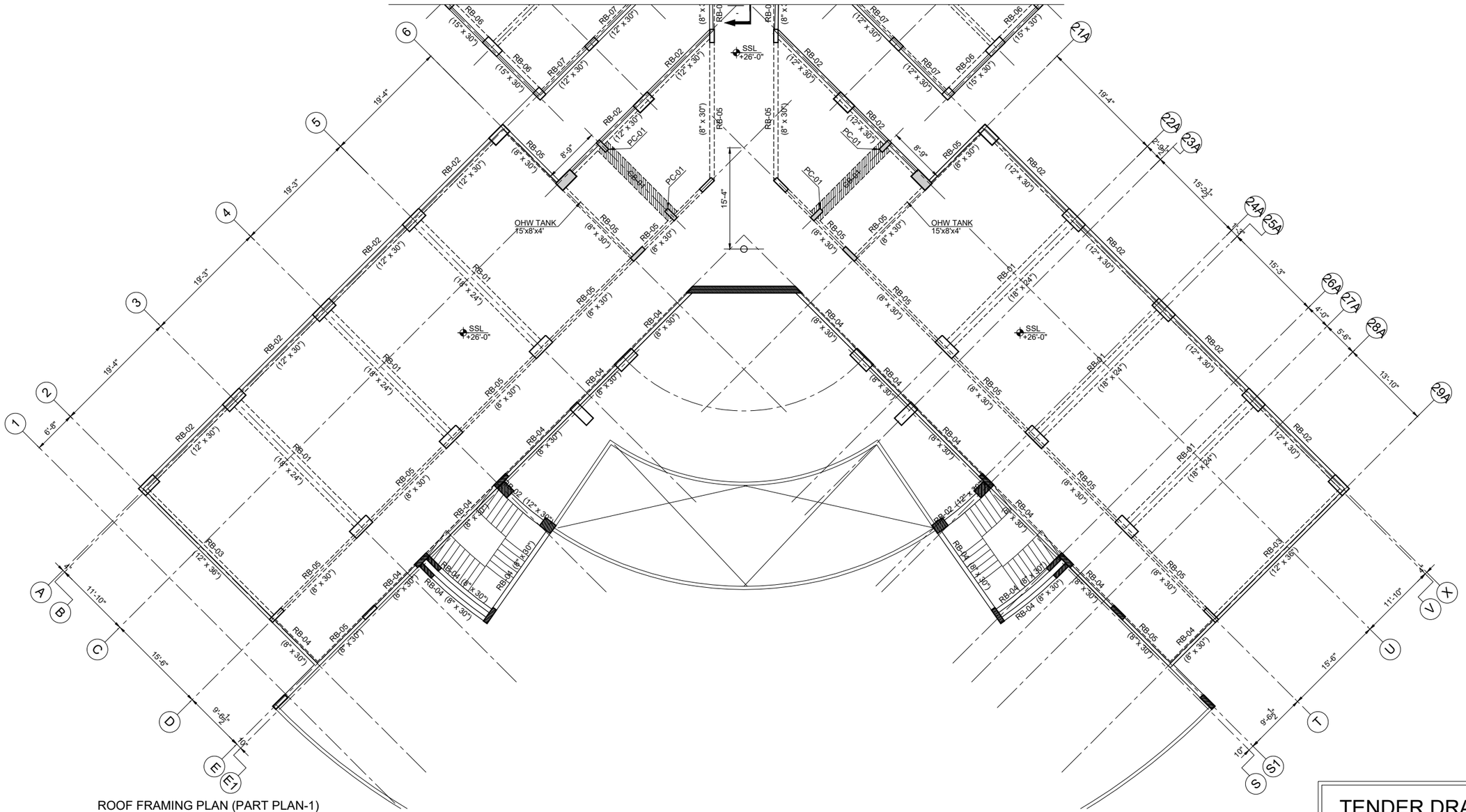
CONSULTANT
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
ROOF FRAMING PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

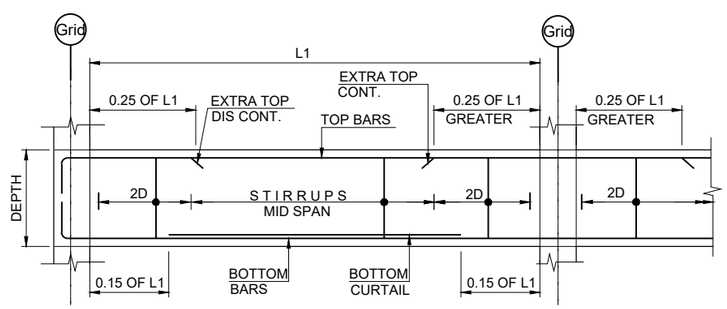
DRG. NO.
TACE-NED-PPE-ST-02



ROOF FRAMING PLAN (PART PLAN-1)
SCALE 3/32"

SCHEDULE OF FIRST FLOOR BEAMS

MARKS	WIDTH	DEPTH	REINFORCEMENT					STIRRUPS		REMARKS
			BOTTOM BARS	BOTT CURTAIL BARS	TOP BARS	EXTRA TOP CONT:	EXTRA TOP DISCONT:	UP TO L/4 FROM SUPPORT	MIDDLE OF L/2	
RB-01	18"	24"	6 H5	2#5	6#5	-	2#5	#3@5" c/c	#3@9" c/c	-
RB-02	12"	30"	4 H6	-	4#6	-	-	#3@5" c/c	#3@9" c/c	-
RB-03	12"	36"	4 H6	2#5	4#6	-	-	#3@5" c/c	#3@9" c/c	-
RB-04	8"	30"	4 H5	-	4#5	-	-	#3@5" c/c	#3@9" c/c	-
RB-05	8"	30"	4 H5	2#5	4#5	-	-	#3@5" c/c	#3@9" c/c	-
RB-06	15"	30"	6 H5	-	5#5	2#5	2#5	#3@5" c/c	#3@9" c/c	-
RB-07	12"	30"	4 H5	-	3#5	2#5	2#5	#3@5" c/c	#3@9" c/c	-
RB-08	12"	30"	8 H8	4#8	4#8	4#8	4#8	#3@5" c/c	#3@9" c/c	2+2#4 (SIDE BARS)
RB-09	8"	15"	4 H5	-	2#5	2#5	2#5	#3@5" c/c	#3@9" c/c	-
RB-10	8"	12"	4 H5	-	2#5	2#5	2#5	#3@5" c/c	#3@9" c/c	-



TYPICAL ELEVATION OF BEAM

TENDER DRAWING

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NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

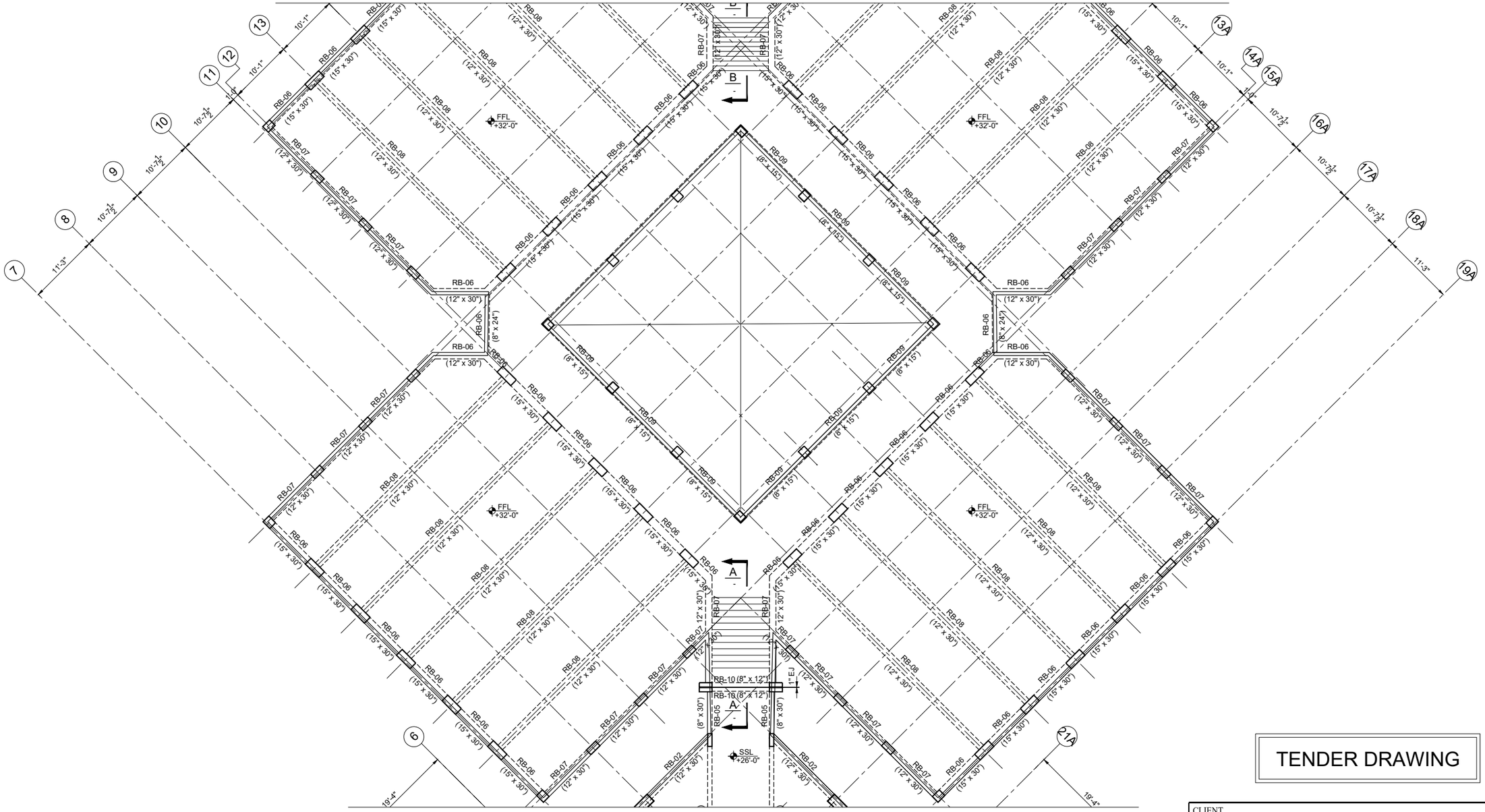
CONSULTANT
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

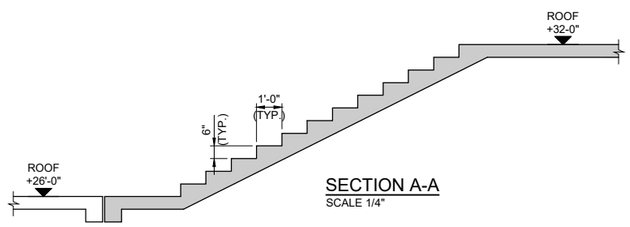
TITLE
ROOF FRAMING PLAN (PART PLAN-1)

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-ST-03



ROOF FRAMING PLAN (PART PLAN-2)
SCALE 3/32"



SECTION A-A
SCALE 1/4"

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

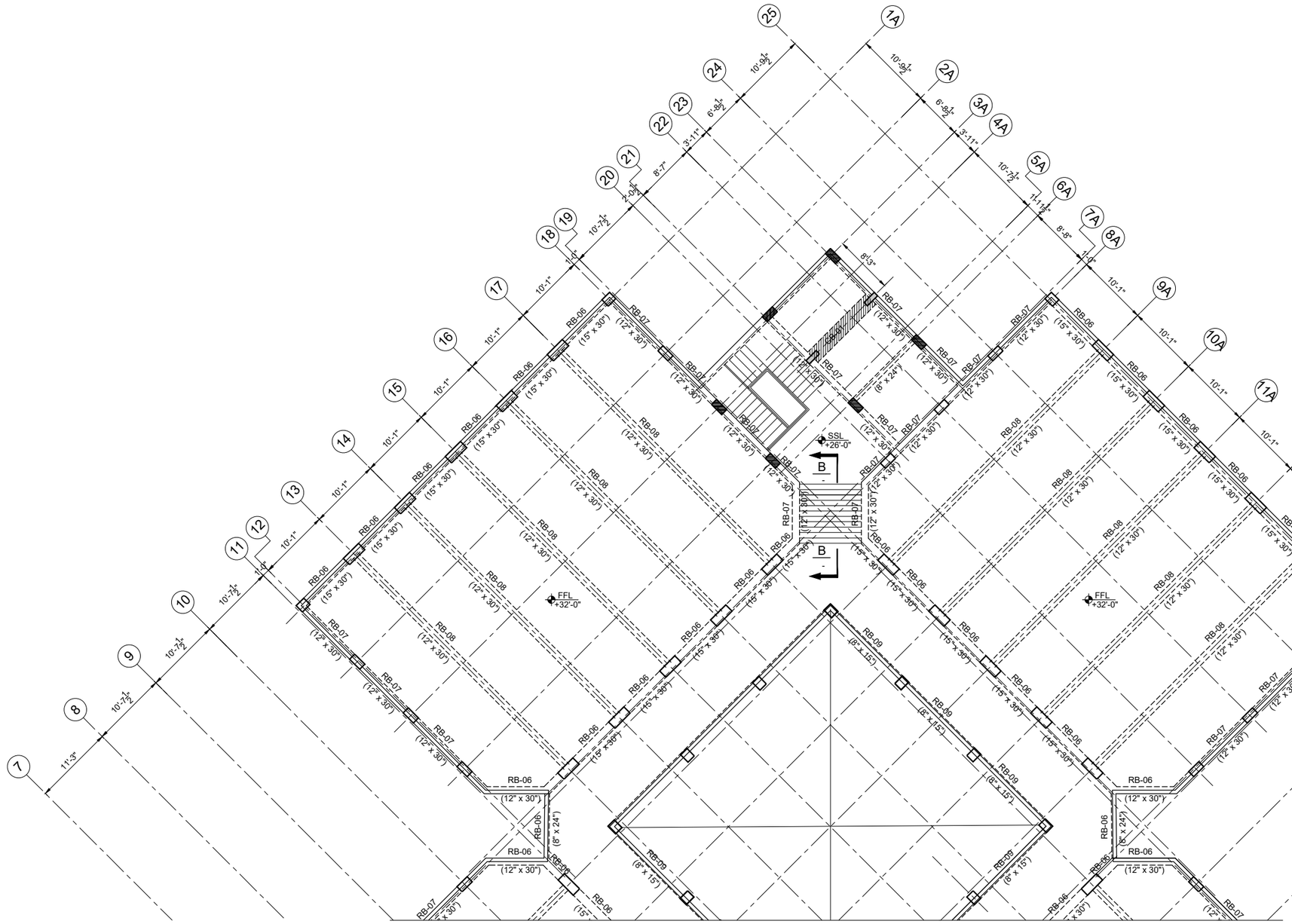
CONSULTANT
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Gulshan-e-Iqbal, Karachi-75300 Pakistan
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

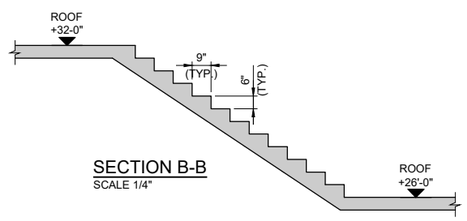
TITLE
ROOF FRAMING PLAN (PART PLAN-2)

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-ST-04



ROOF FRAMING PLAN (PART PLAN-3)
SCALE 3/32"



SECTION B-B
SCALE 1/4"

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

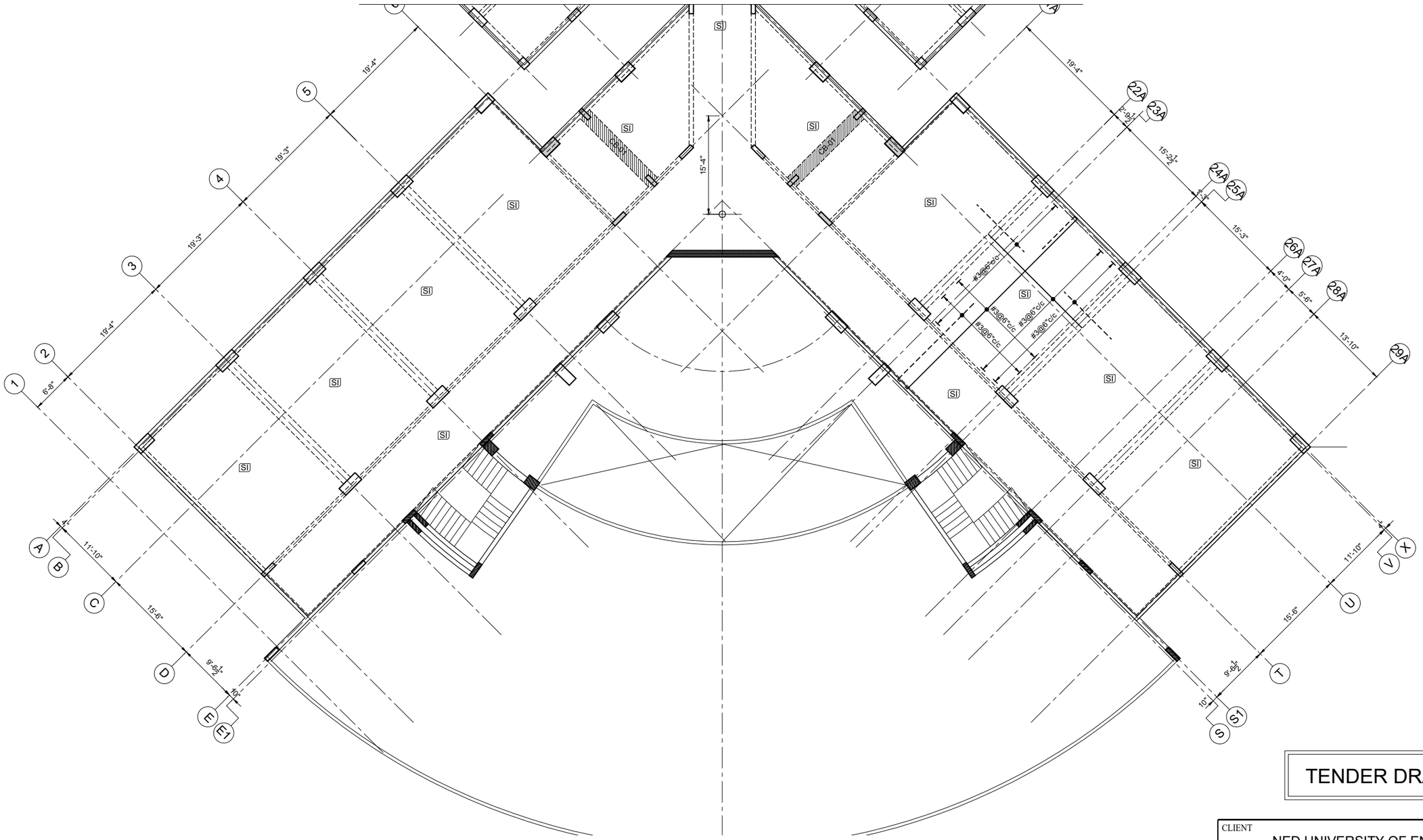
CONSULTANT
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
ROOF FRAMING PLAN (PART PLAN-3)

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-ST-05



ROOF REINFORCEMENT PLAN (PART PLAN-1)
SCALE 3/32"

TENDER DRAWING

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NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

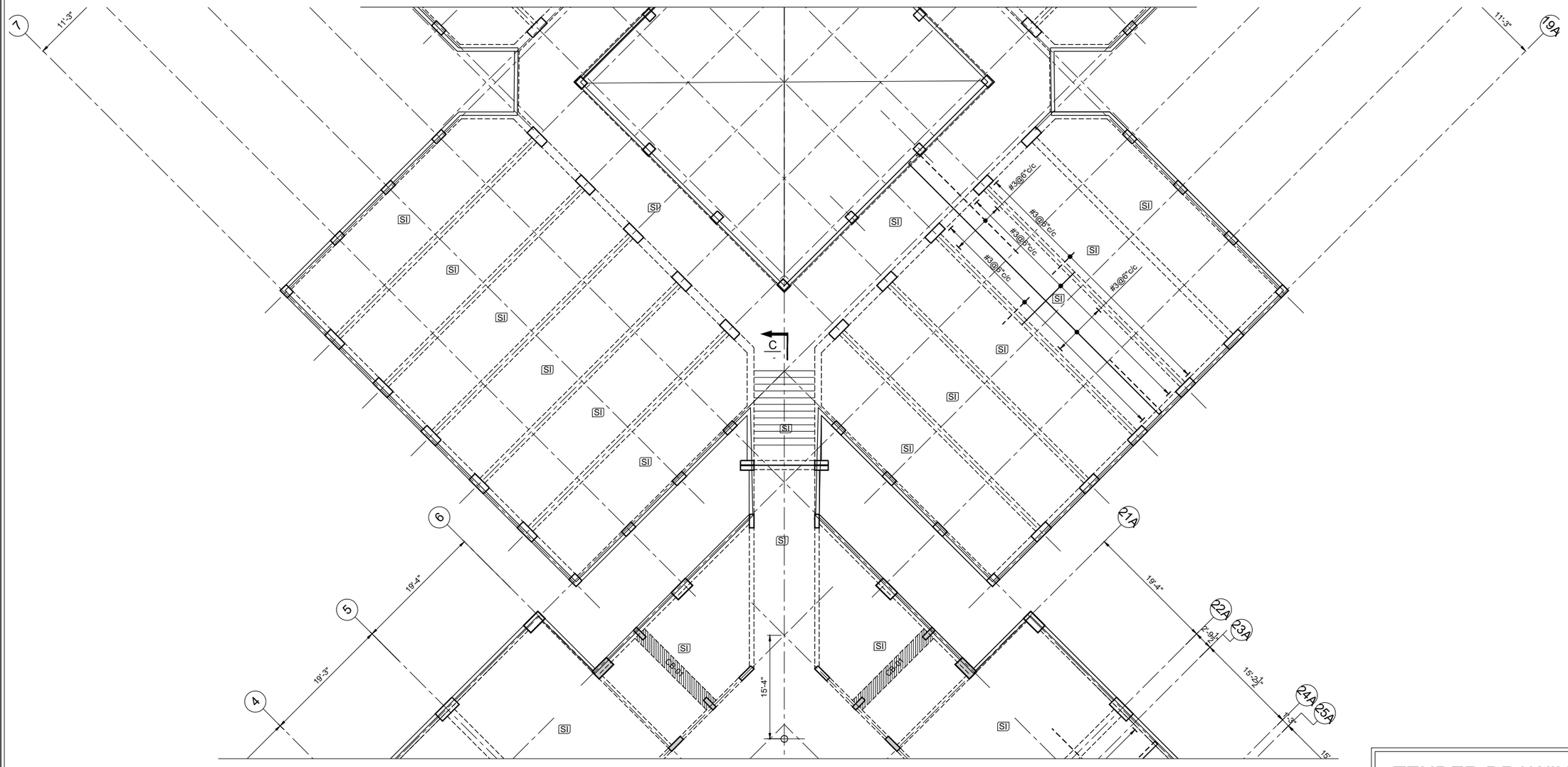
CONSULTANT
TA CE
TANVEER AHSAN CONSULTING ENGINEERS
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
ROOF REINFORCEMENT PLAN (PART PLAN-1)

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-ST-06



ROOF REINFORCEMENT PLAN (PART PLAN-2)
SCALE 3/32"

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

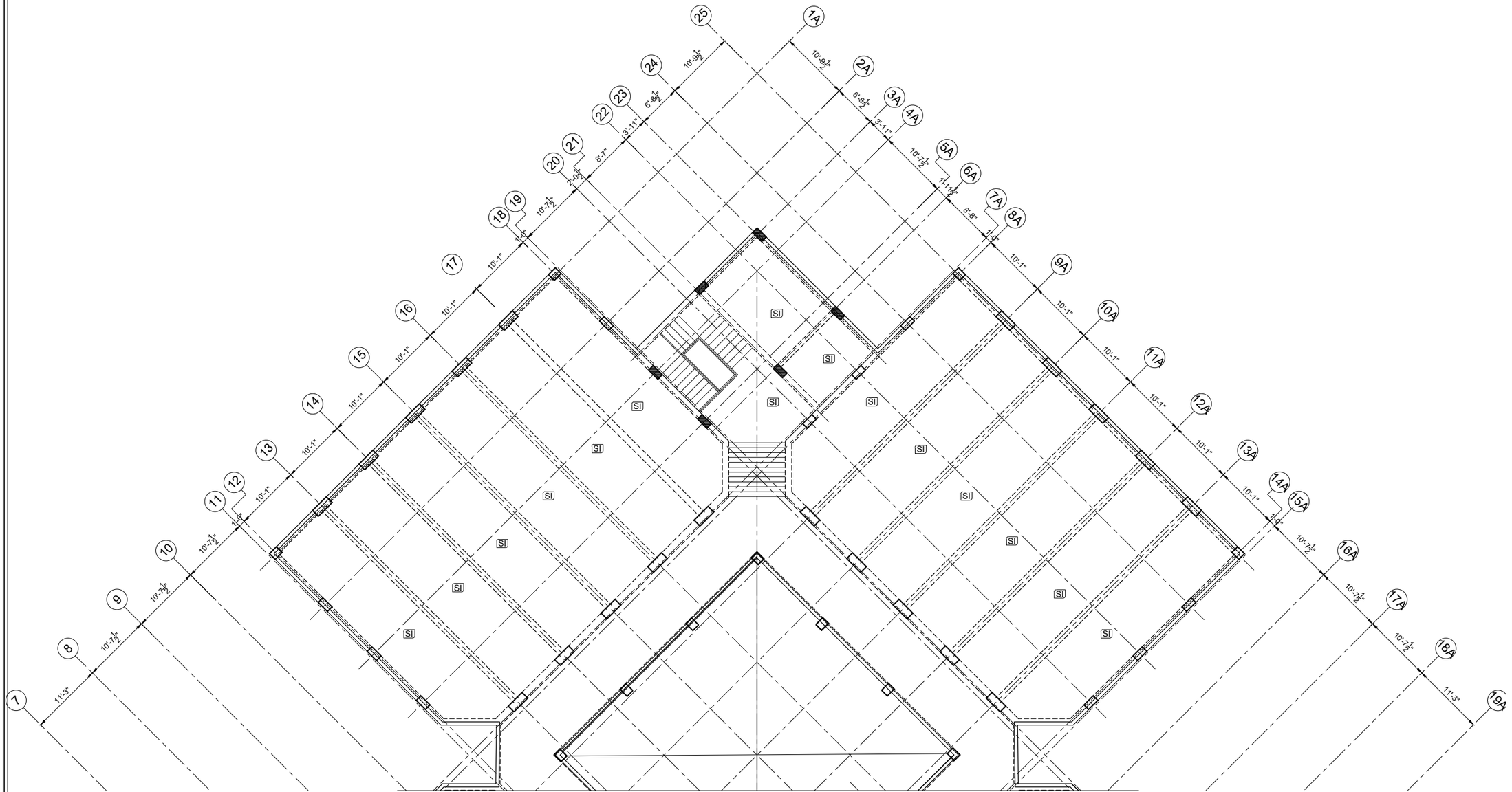
CONSULTANT
TANVEER AHSAN CONSULTING ENGINEERS
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Telephone : +92 21 34964622

PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
ROOF REINFORCEMENT PLAN (PART PLAN-2)

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-ST-07



ROOF REINFORCEMENT PLAN (PART PLAN-3)
SCALE 3/32"

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

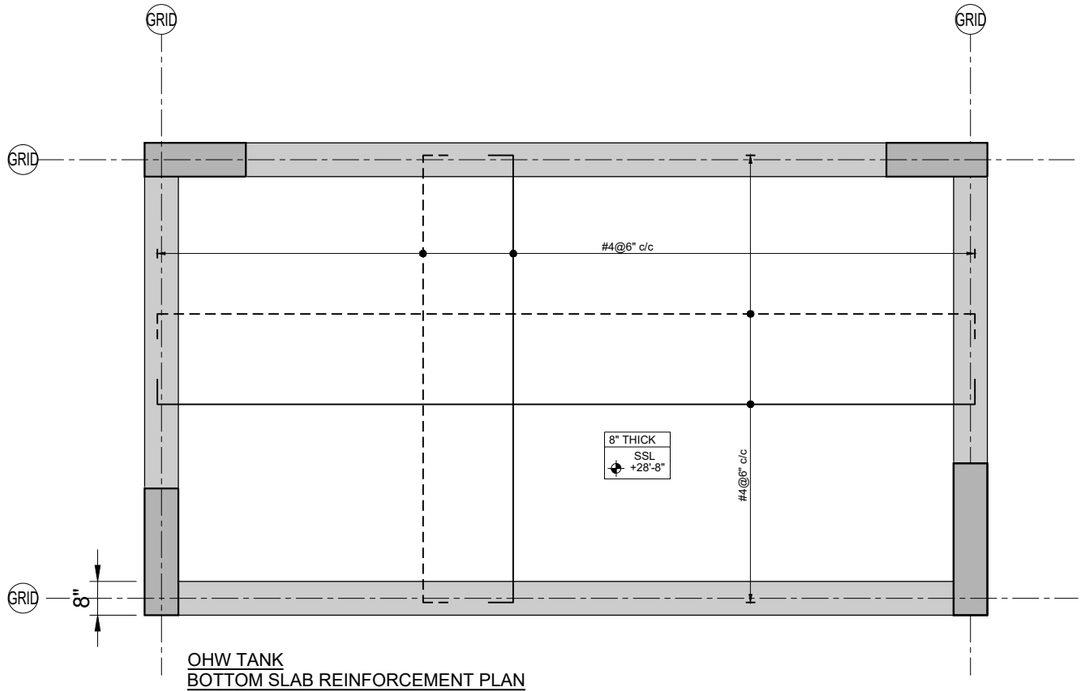
CONSULTANT
TANVEER AHSAN CONSULTING ENGINEERS
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Gulshan–e–Iqbal, Karachi–75300 Pakistan
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

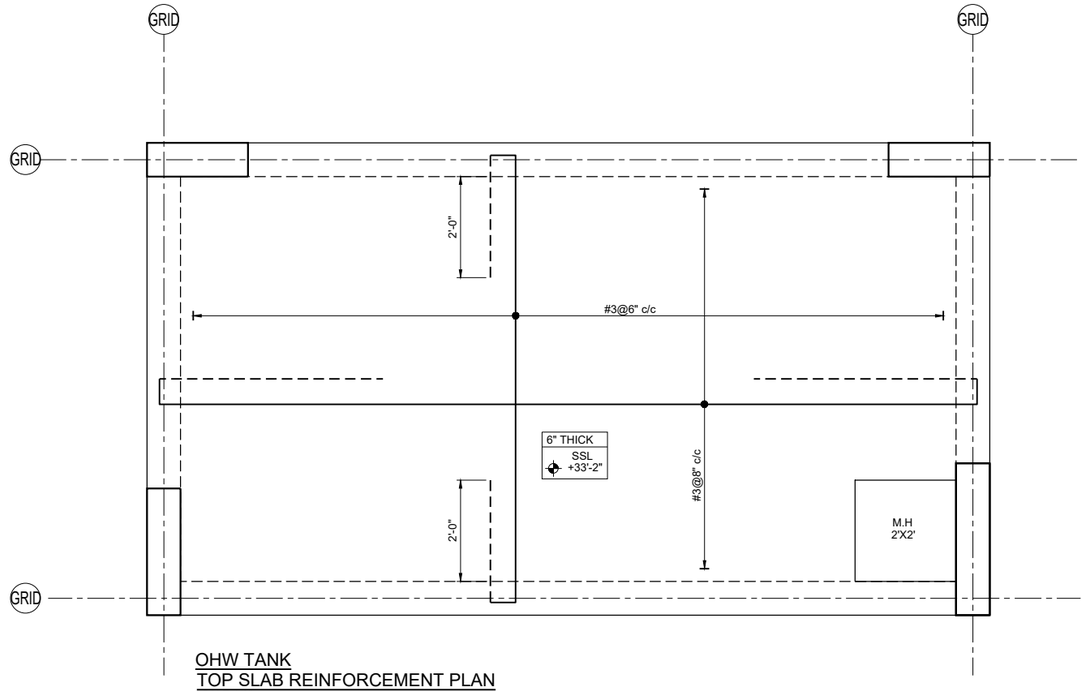
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ROOF REINFORCEMENT PLAN (PART PLAN-3)

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

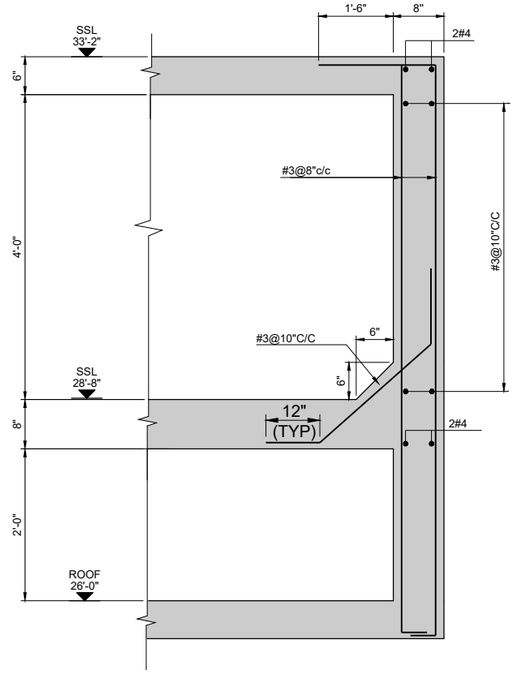
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TACE-NED-PPE-ST-08



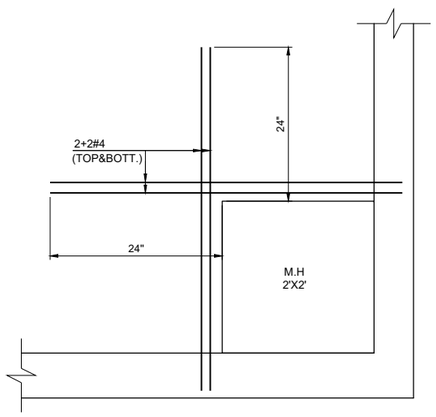
OHW TANK
BOTTOM SLAB REINFORCEMENT PLAN
SCALE 1/2"



OHW TANK
TOP SLAB REINFORCEMENT PLAN
SCALE 1/2"



TYPICAL O.H.W TANK DETAIL
SCALE 1/2"



DETAIL OF MAN HOLE

TENDER DRAWING

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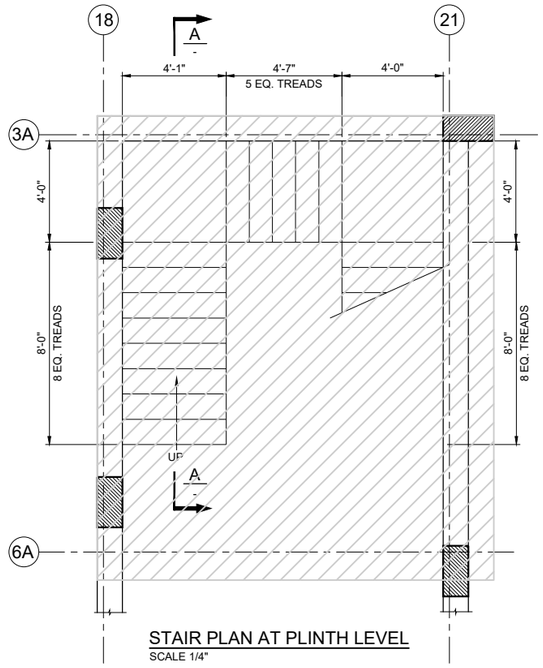
CONSULTANT
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

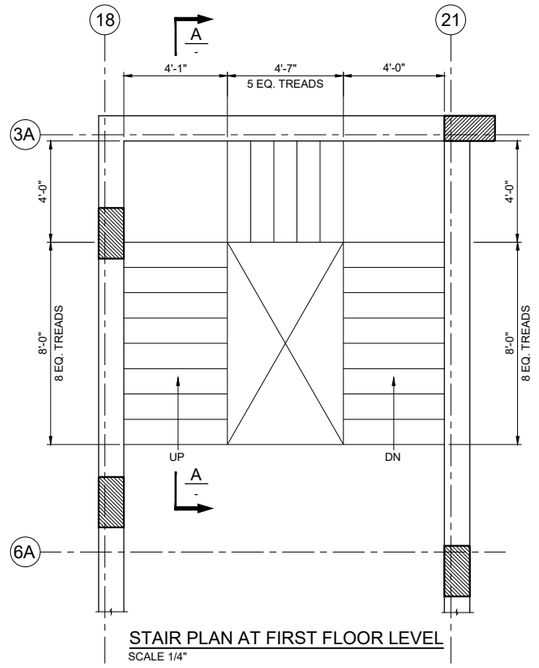
TITLE
OHW TANK REINFORCEMENT PLAN & DETAIL

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

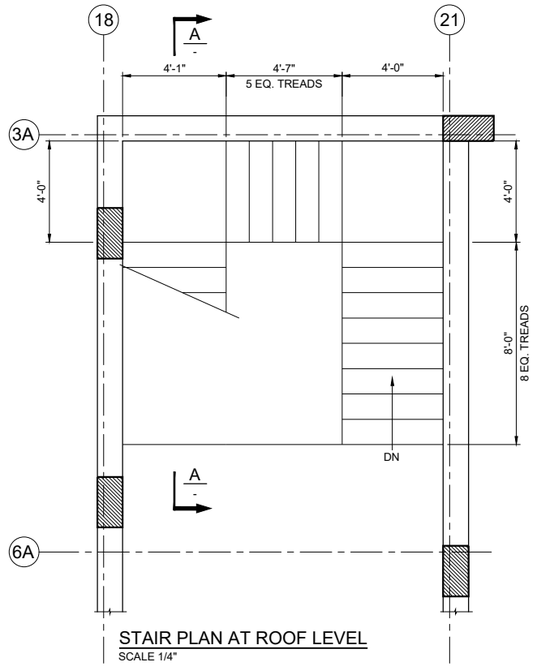
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TACE-NED-PPE-ST-09



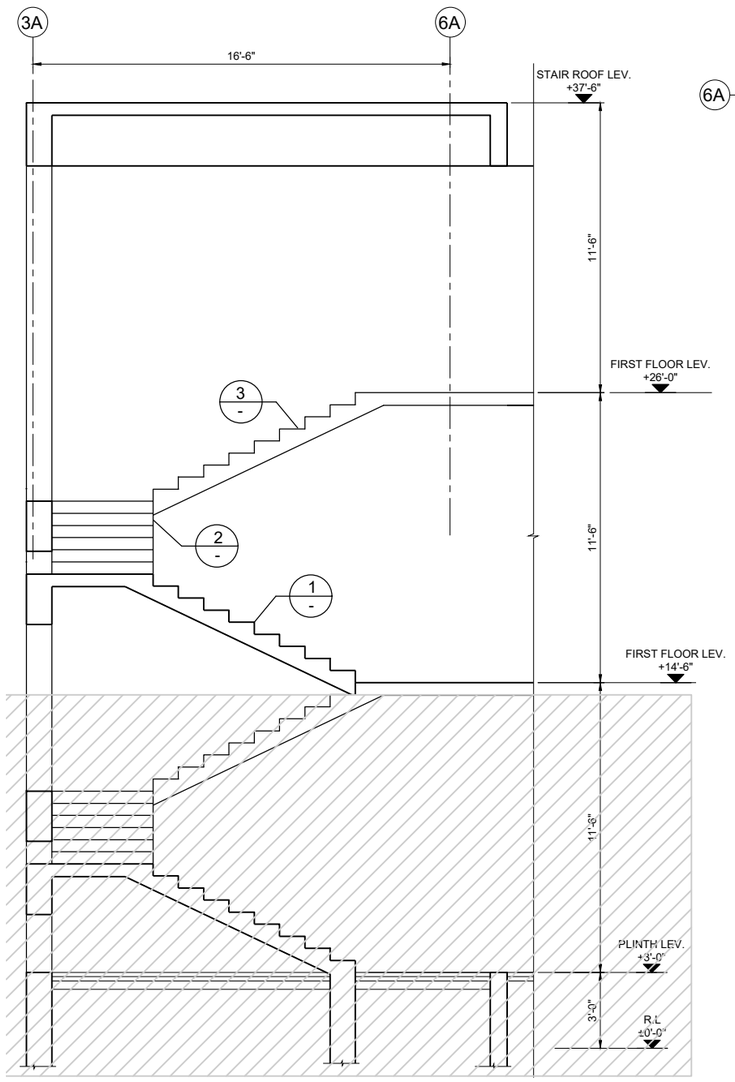
STAIR PLAN AT PLINTH LEVEL
SCALE 1/4"



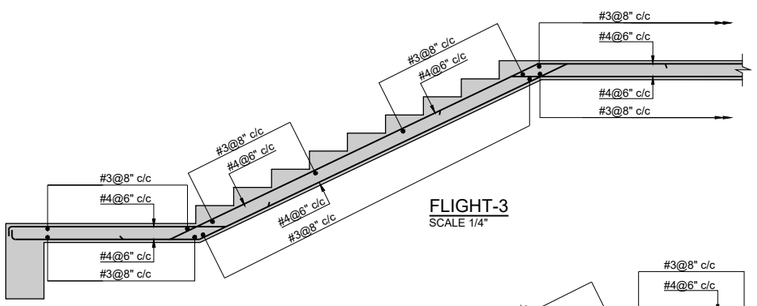
STAIR PLAN AT FIRST FLOOR LEVEL
SCALE 1/4"



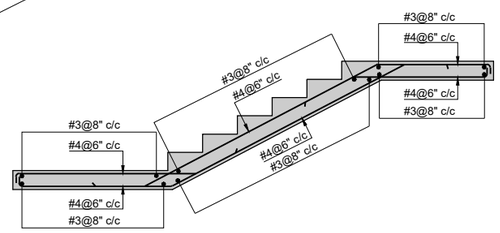
STAIR PLAN AT ROOF LEVEL
SCALE 1/4"



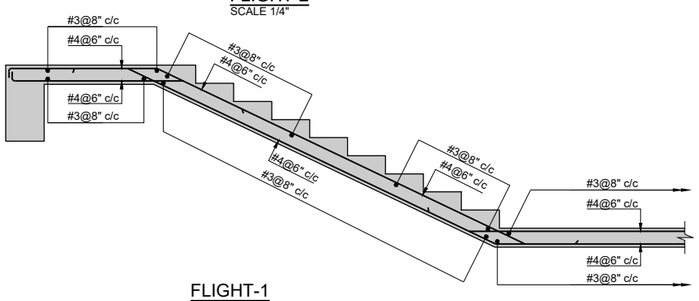
SECTION A-A
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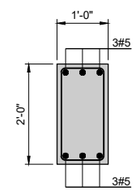
FLIGHT-3
SCALE 1/4"



FLIGHT-2
SCALE 1/4"



FLIGHT-1
SCALE 1/4"



TYPICAL SECTION OF LANDING BEAM
SCALE 1/2"

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

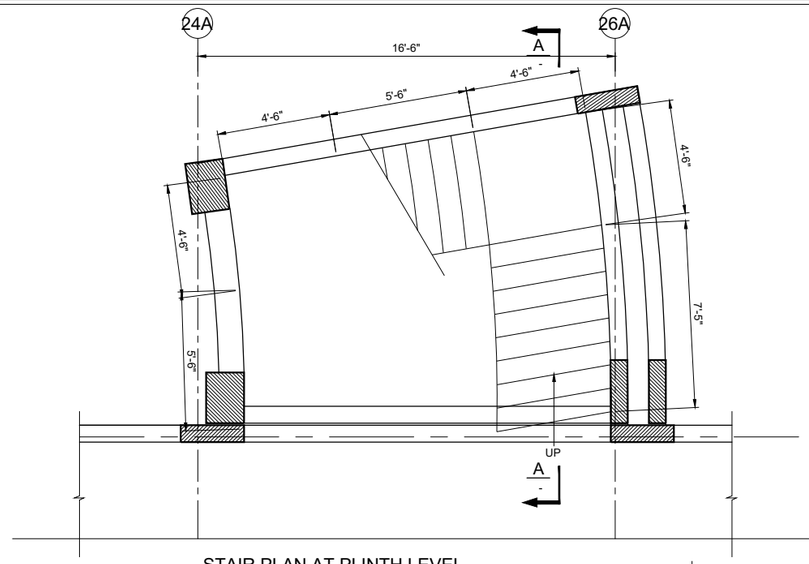
CONSULTANT
TA CE
TANVEER AHSAN CONSULTING ENGINEERS
Architect, Planners & Project Managers
R-210 Abid Town, Block-2
Gulshan-e-Iqbal, Karachi-75300 Pakistan
Telephone : +92 21 34964622

PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

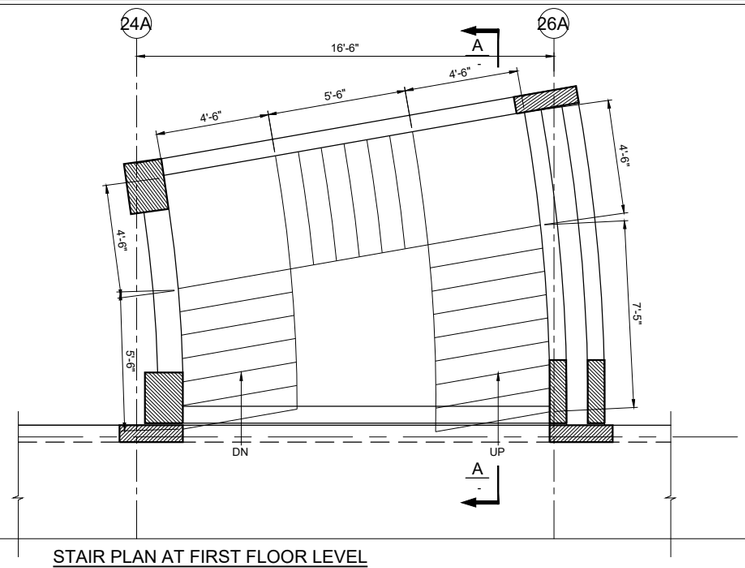
TITLE
STAIR PLAN, SECTION & DETAILS

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

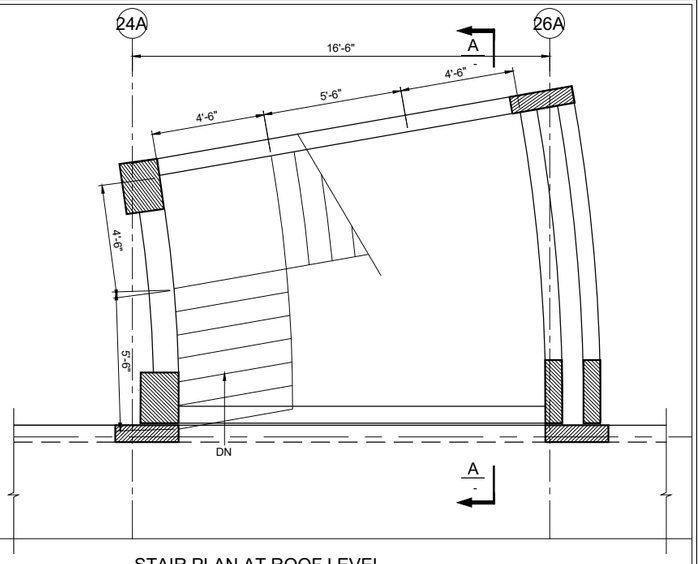
DRG. NO.
TACE-NED-PPE-ST-10



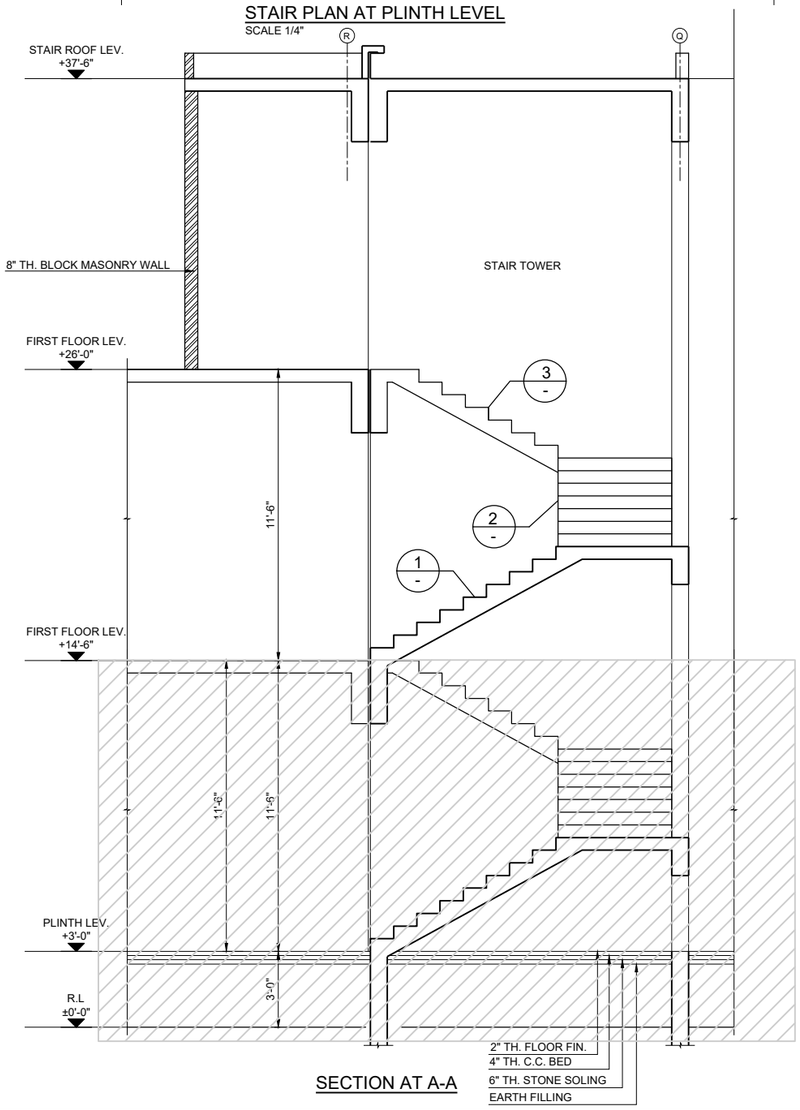
STAIR PLAN AT PLINTH LEVEL
SCALE 1/4"



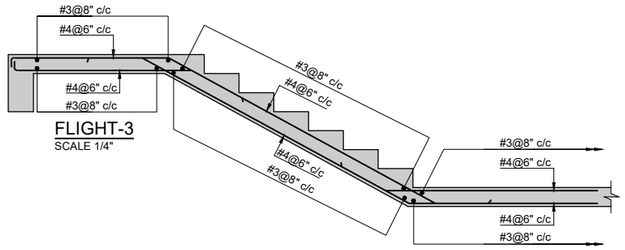
STAIR PLAN AT FIRST FLOOR LEVEL
SCALE 1/4"



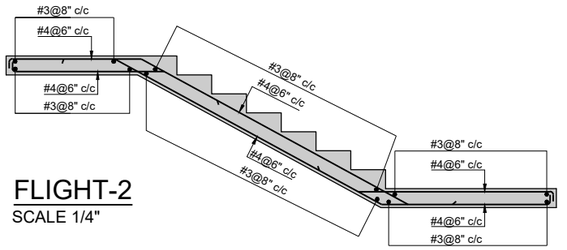
STAIR PLAN AT ROOF LEVEL
SCALE 1/4"



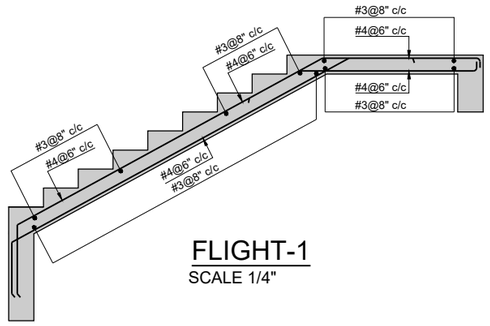
SECTION AT A-A



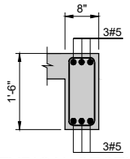
FLIGHT-3
SCALE 1/4"



FLIGHT-2
SCALE 1/4"



FLIGHT-1
SCALE 1/4"



TYPICAL SECTION OF LANDING BEAM
SCALE 1/2"

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

CONSULTANT
TACE
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
STAIR PLAN, SECTION & DETAILS

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	FURQAN	YAHYA	TANVEER	OCT' 2025

DRG. NO.
TACE-NED-PPE-ST-11

(TENDER DRAWINGS)

VOLUME IV:-

CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

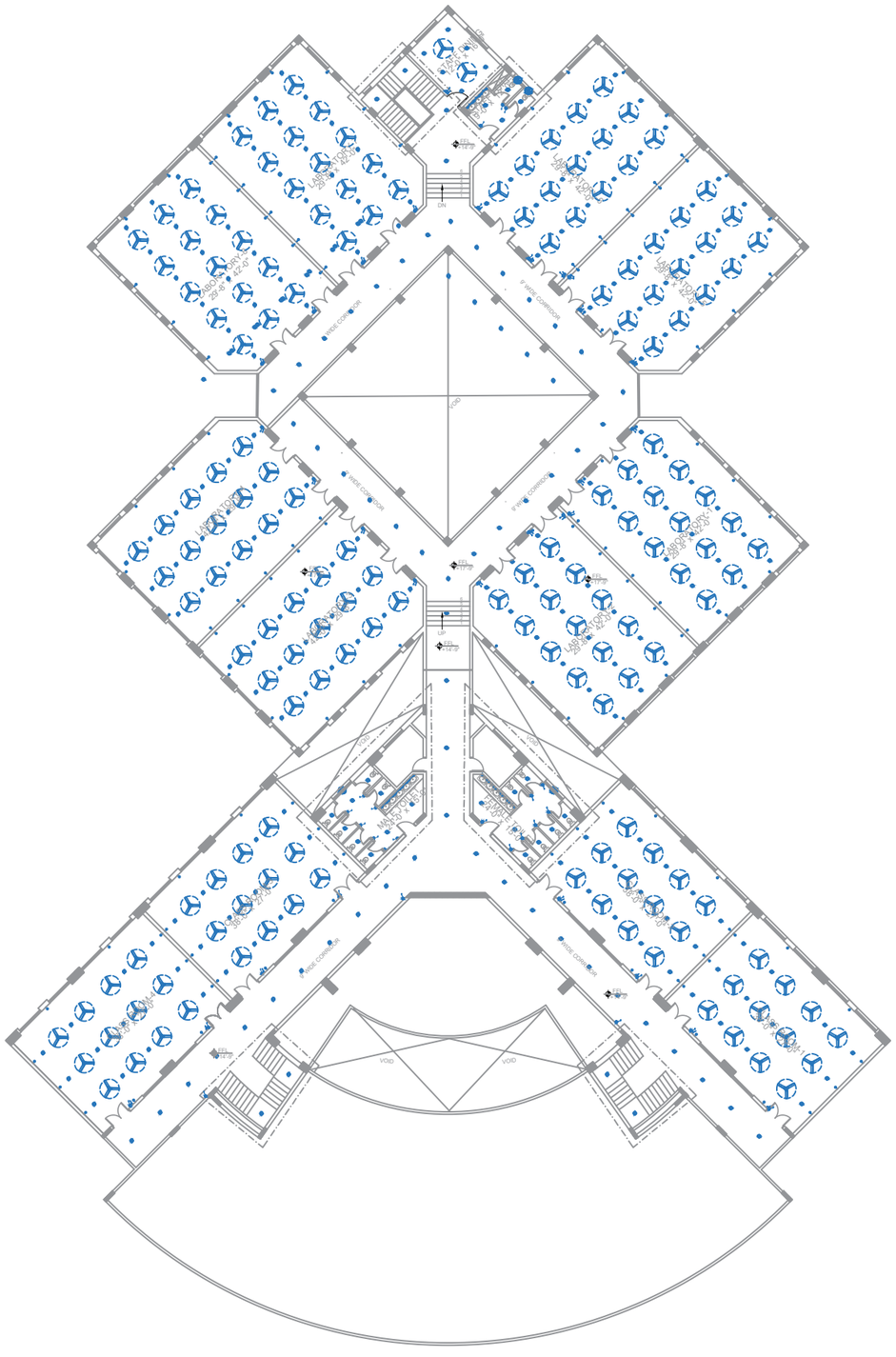
SCHEME:-

ENHANCEMENT OF ACADEMIC FACILITIES
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

(MEP DRAWINGS)

CONSULTANT :

TA CE
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Telephone : +92 21 34964622



FIRST FLOOR PLAN
SCALE 3/32"

SYMBOLS	DESCRIPTION
	MAIN DISTRIBUTION BOARD
	10 A. ONE WAY SWITCH
	10 A. TWO WAY SWITCH
	CEILING MOUNTED LIGHT FIXTURE (18 W. LED LAMP)
	CEILING MOUNTED LIGHT FIXTURE(24 W. LED LAMP)
	RECESSED DOWN LIGHT MCOB (18 W. LED LAMP)
	WALL MOUNTED LED BULB 12&18W
	RECESSED DOWN LIGHT MCOB (18 W. LED LAMP)
	GATE LIGHT FIXTURE (24 W. LED LAMP)
	MIRROR LIGHT (18 W. LED LAMP)
	STEP LIGHT FIXTURE (18 W. LED LAMP)
	CHANDILIER
	HANGING LIGHT FIXTURE (20 W. LED LAMP)
	SWEEP CEILING FAN(48 & 56")
	FAN DIMMER
	WALL BRACKET FAN 24"
	STAIRS LED LIGHT STRIP
	EXHAUST FAN PLASTIC BODY
	EXHAUST FAN METALLIC BODY

TENDER DRAWING

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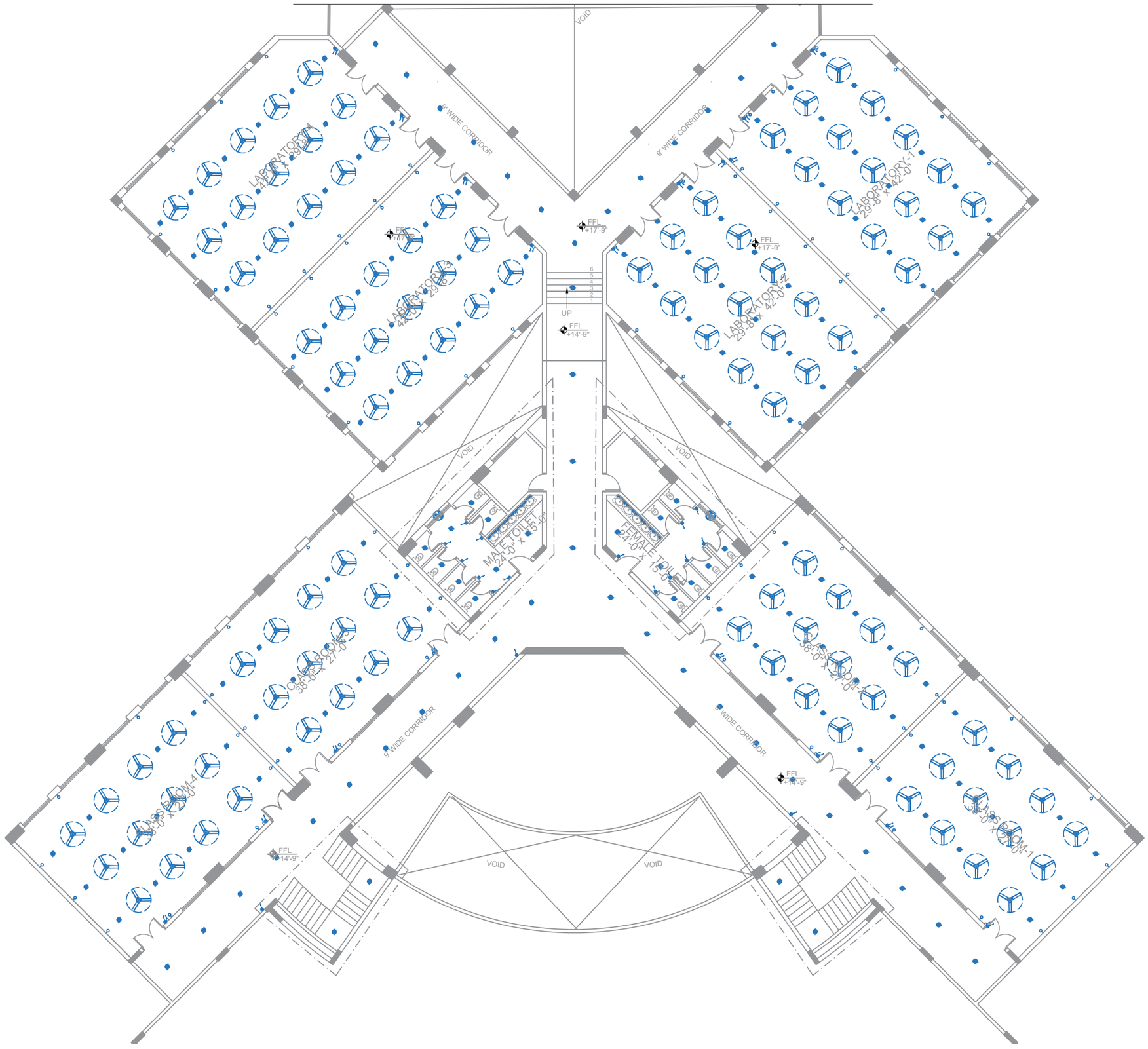
CONSULTANT
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Gulshan-e-Iqbal, Karachi-75300 Pakistan
Telephone : +92 21 34964622

PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
FIRST FLOOR ELECTRICAL PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	MOIN	ZAHEER	TANVEER	MAY' 2025

DRG. NO.
TACE-NED-PPE-EL-01



TENDER DRAWING

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NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

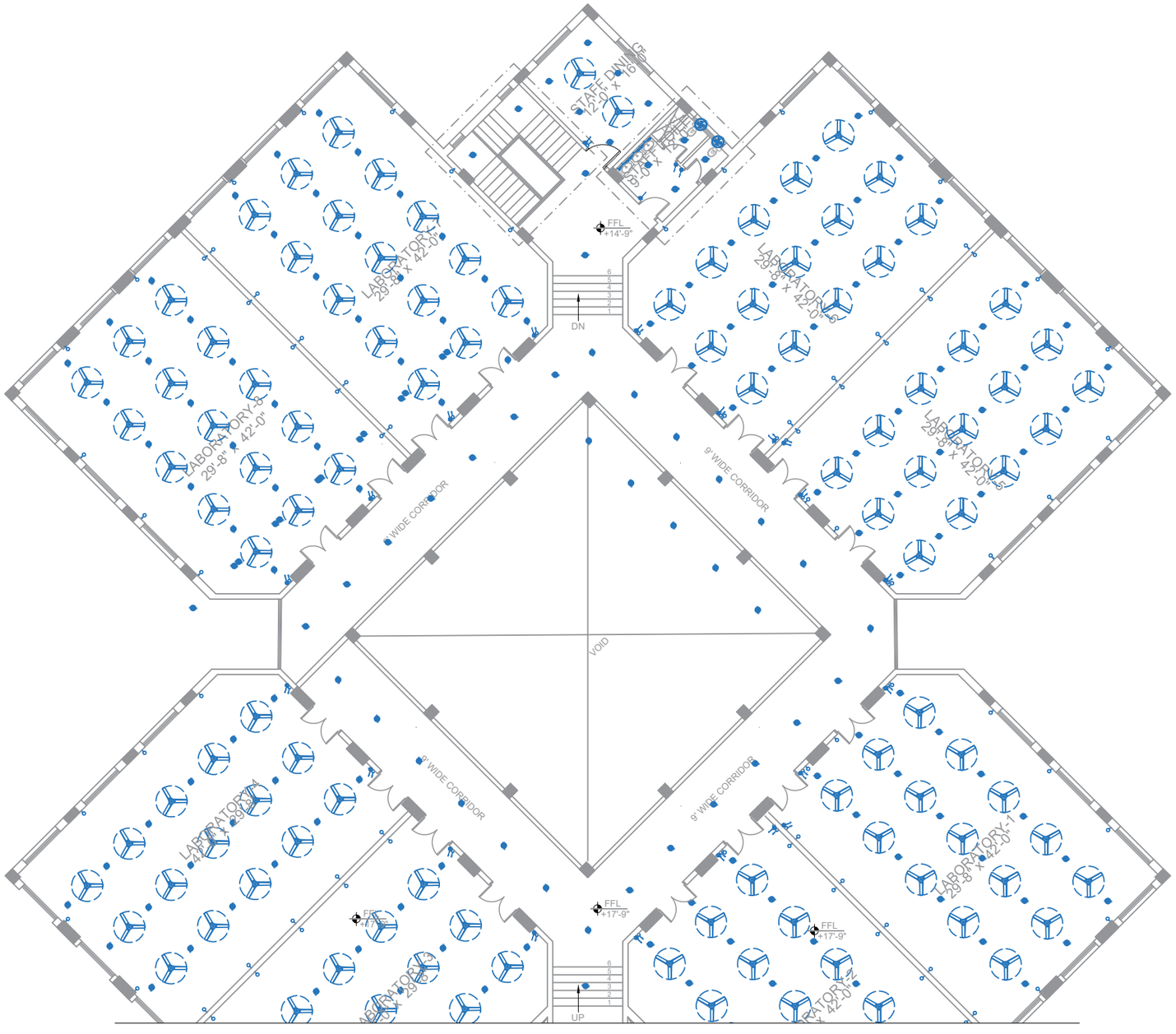
CONSULTANT
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Architect, Planners & Project Managers
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Gulshan–e–Iqbal, Karachi–75300 Pakistan
Telephone : +92 21 34964622

PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
FIRST FLOOR ELECTRICAL PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	MOIN	ZAHEER	TANVEER	MAY' 2025

DRG. NO.
TACE-NED-PPE-EL-02



TENDER DRAWING

CLIENT

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

CONSULTANT

TA CE

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PROJECT

CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

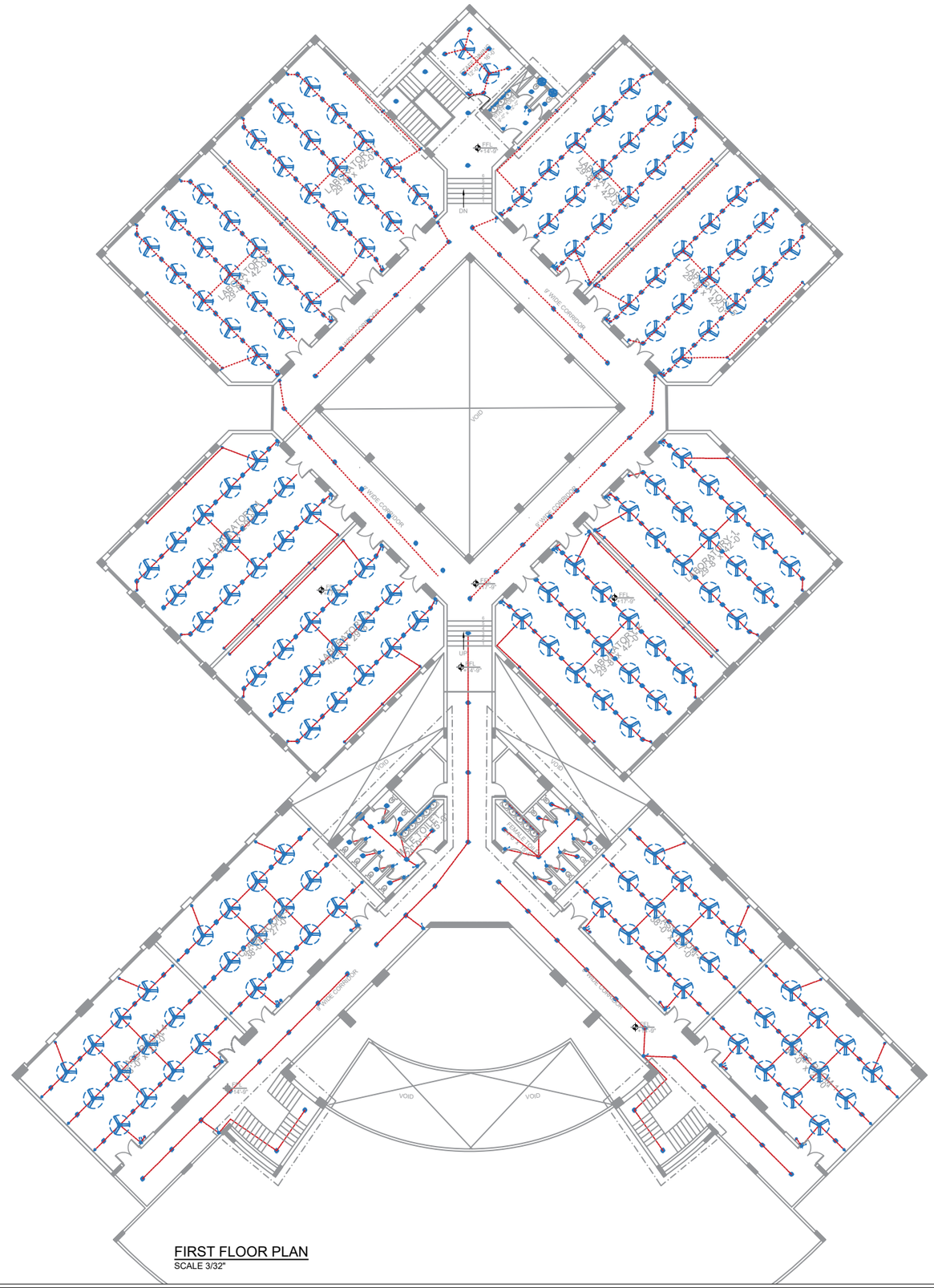
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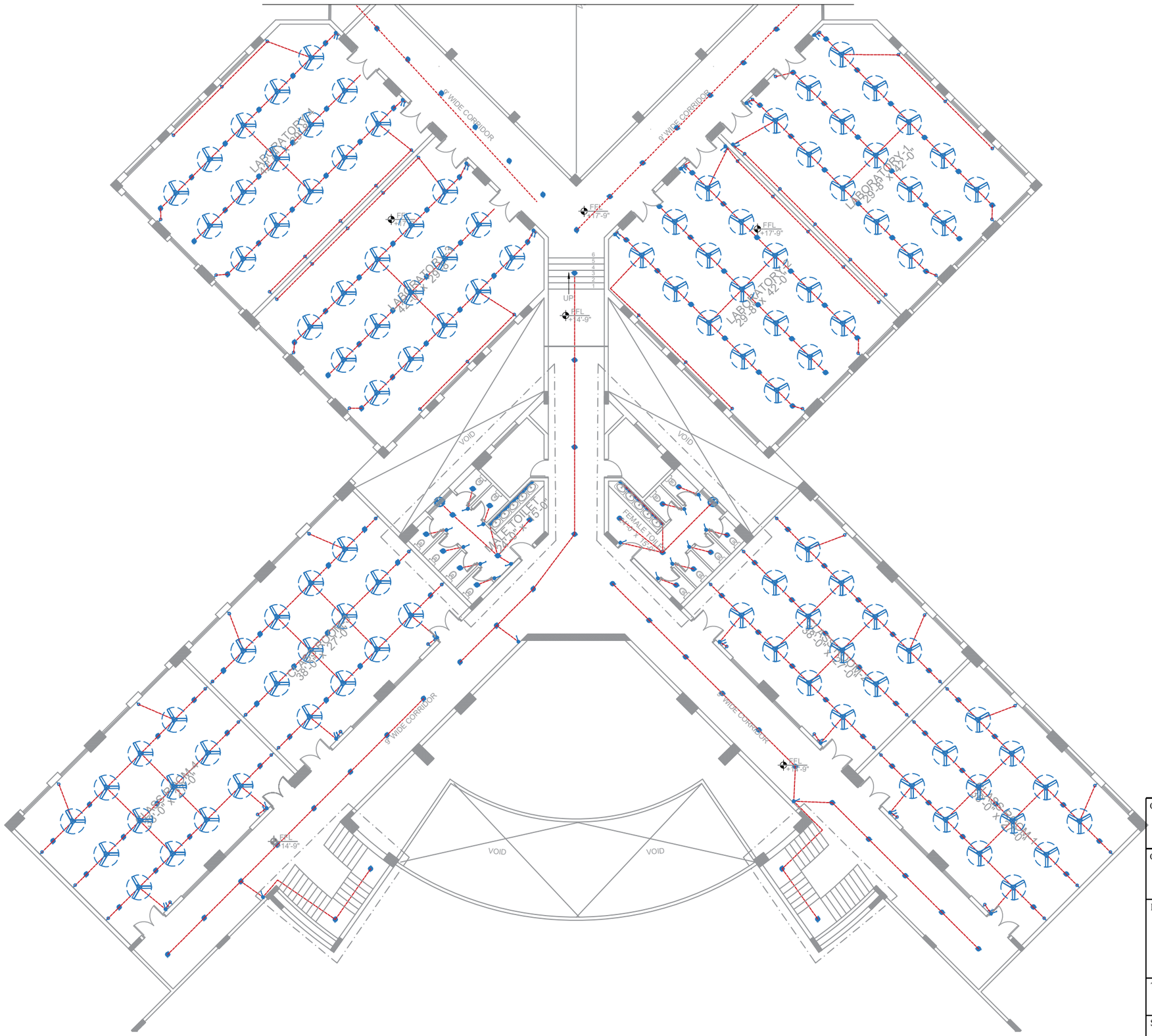
FIRST FLOOR ELECTRICAL PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	MOIN	ZAHEER	TANVEER	MAY' 2025

DRG. NO.

TACE-NED-PPE-EL-03


LABORATORY 2130 SQ.FT
LABORATORY 2130 SQ.FT
LABORATORY 2130 SQ.FT



TENDER DRAWING

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CONSULTANT

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PROJECT

CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

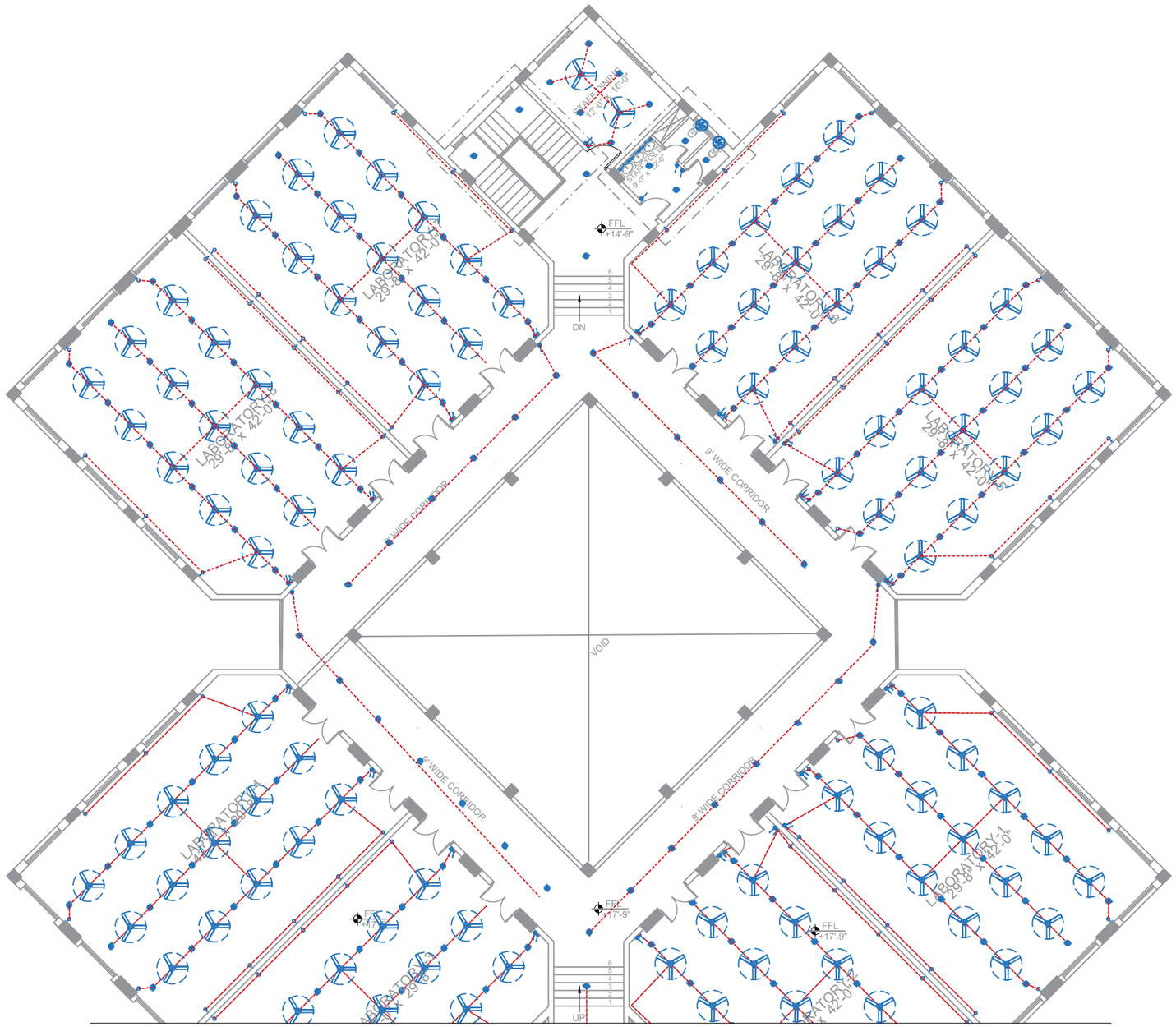
TITLE

FIRST FLOOR ELECTRICAL PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	MOIN	ZAHEER	TANVEER	MAY' 2025

DRG. NO.

TACE-NED-PPE-EL-05



TENDER DRAWING

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PROJECT

CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

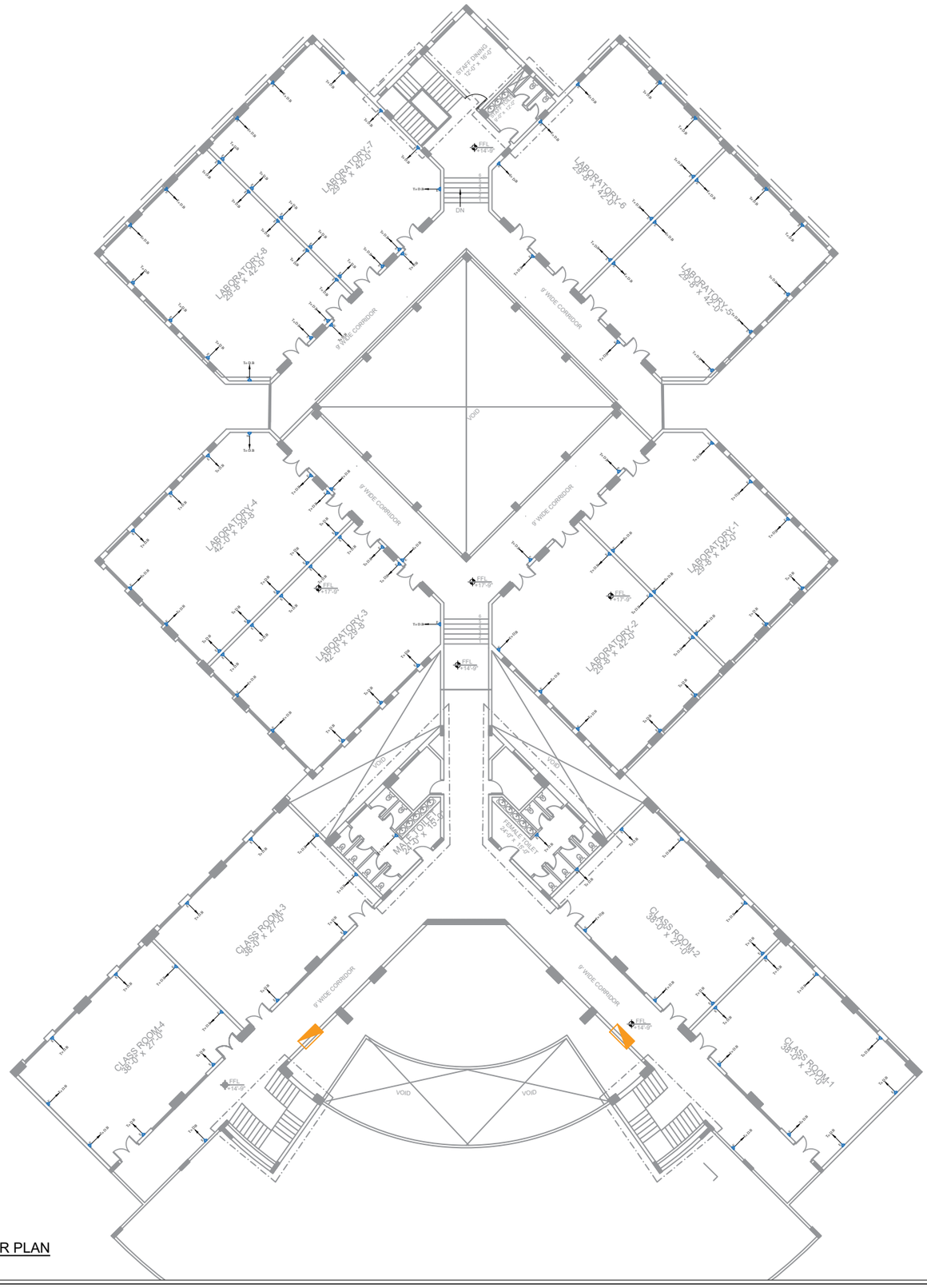
TITLE

FIRST FLOOR ELECTRICAL PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	MOIN	ZAHEER	TANVEER	MAY' 2025

DRG. NO.

TACE-NED-PPE-EL-06



FIRST FLOOR PLAN
SCALE 3/32"

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

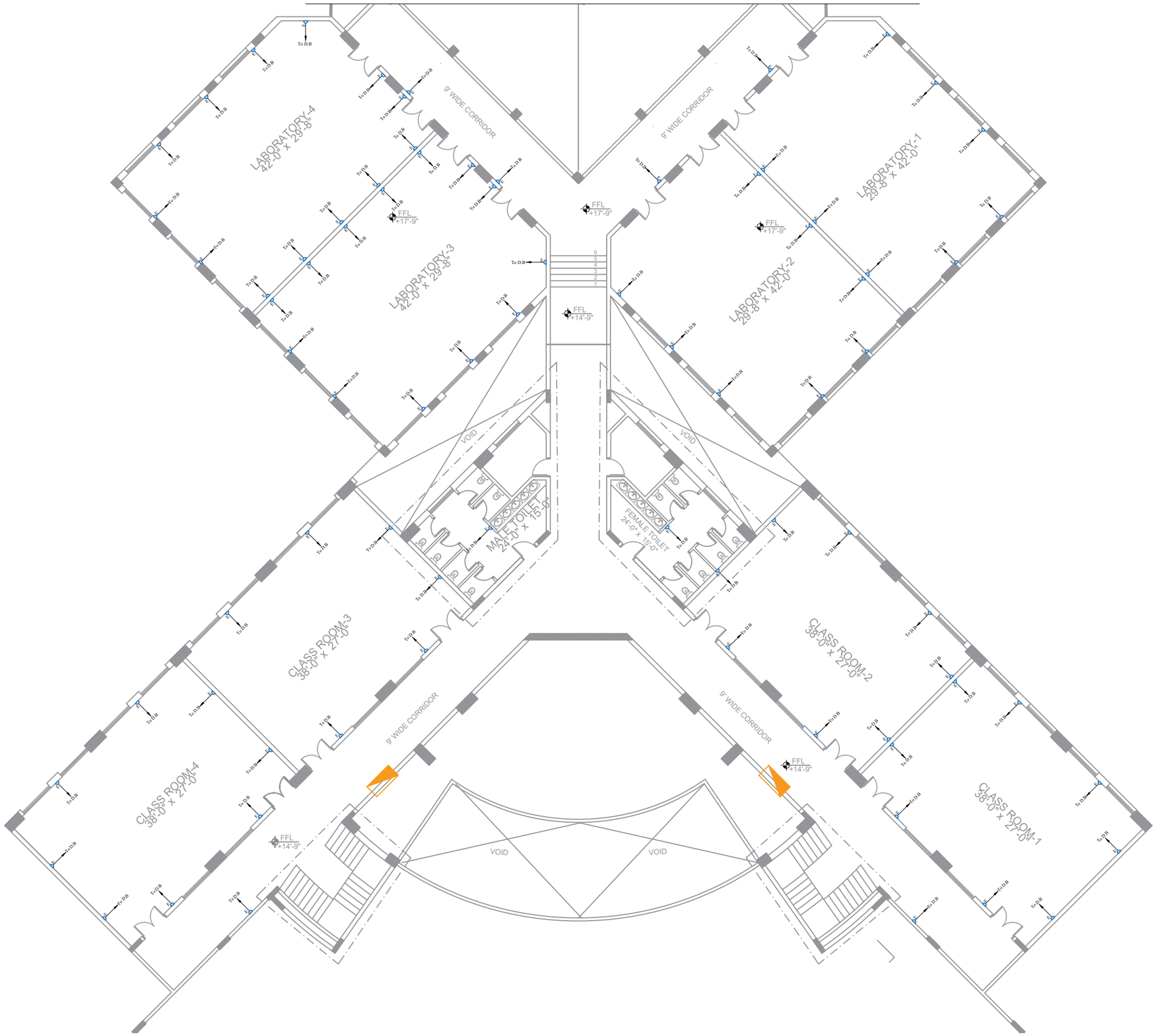
CONSULTANT
TA CE
TANVEER AHSAN CONSULTING ENGINEERS
Architect, Planners & Project Managers
R–210 Abid Town, Block–2
Gulshan–e–Iqbal, Karachi–75300 Pakistan
Telephone : +92 21 34964622

PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
FIRST FLOOR ELECTRIC POWER SOCKETS PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	MOIN	ZAHEER	TANVEER	MAY' 2025

DRG. NO.
TACE-NED-PPE-EL-07



TENDER DRAWING

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NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

CONSULTANT

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Telephone : +92 21 34964622

PROJECT

CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

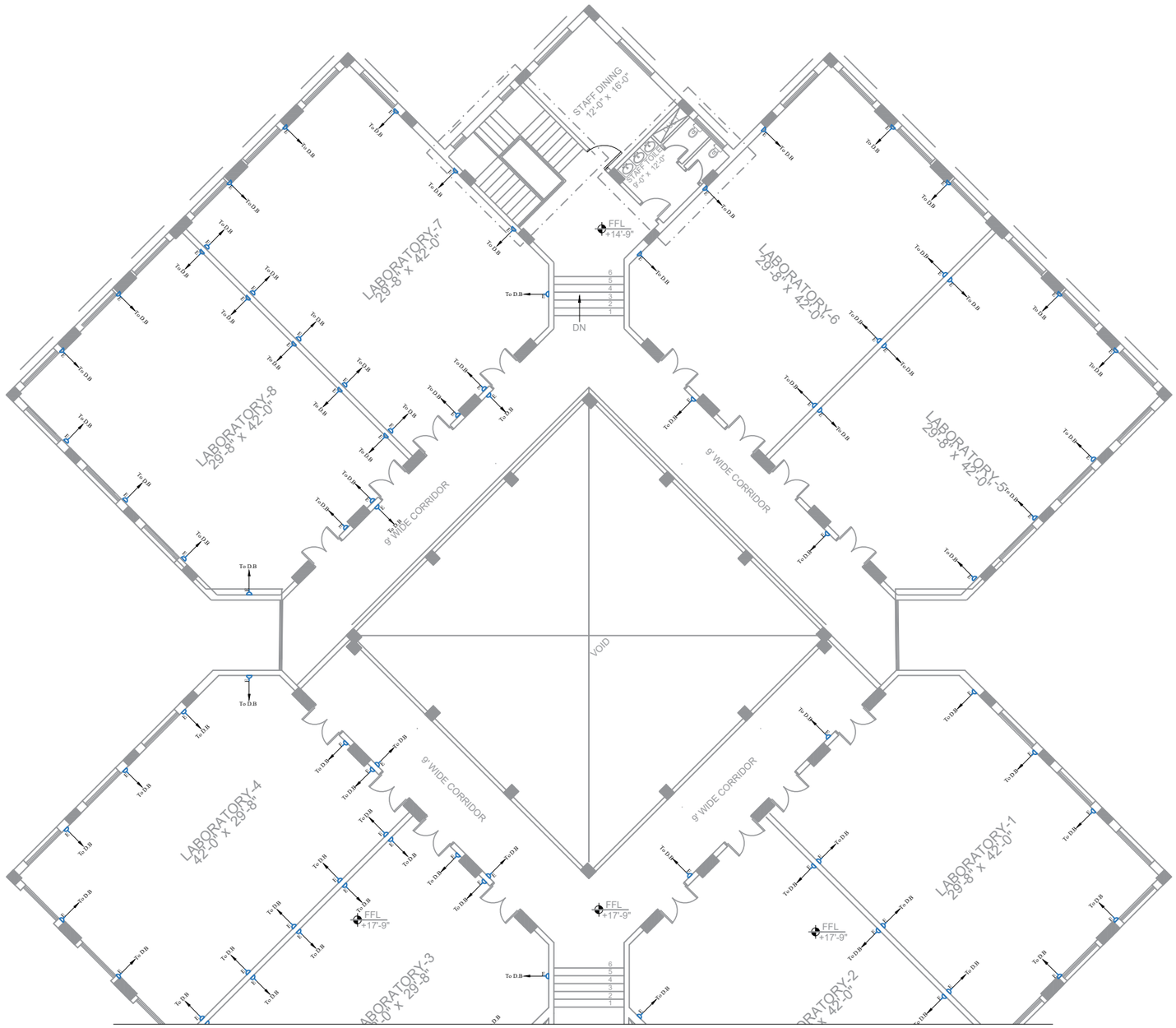
TITLE

FIRST FLOOR ELECTRICAL PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	MOIN	ZAHEER	TANVEER	MAY' 2025

DRG. NO.

TACE-NED-PPE-EL-08



TENDER DRAWING

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Telephone : +92 21 34964622

PROJECT

CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

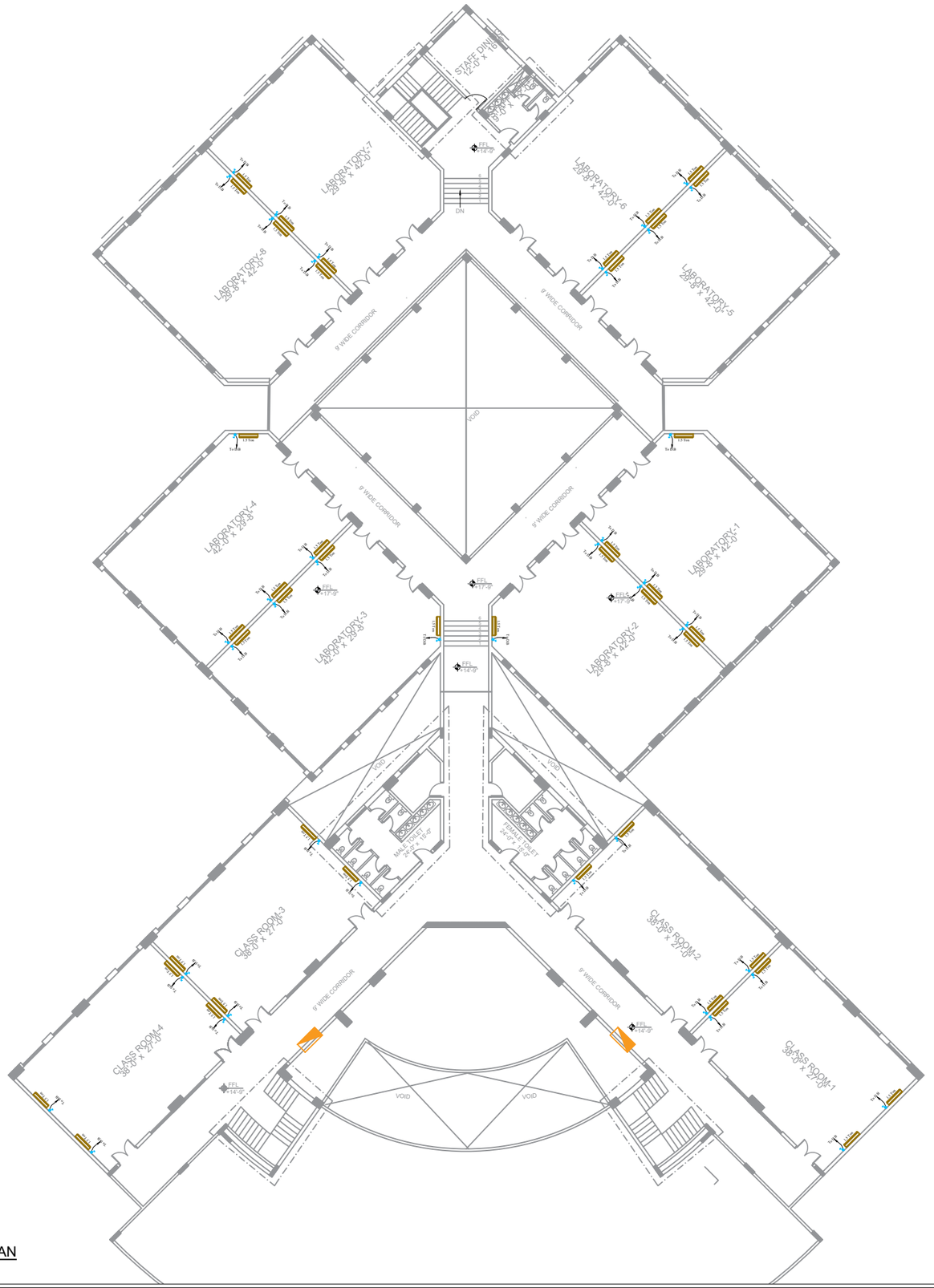
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FIRST FLOOR ELECTRICAL PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	MOIN	ZAHEER	TANVEER	MAY' 2025

DRG. NO.

TACE-NED-PPE-EL-09



FIRST FLOOR PLAN
SCALE 3/32"

TENDER DRAWING

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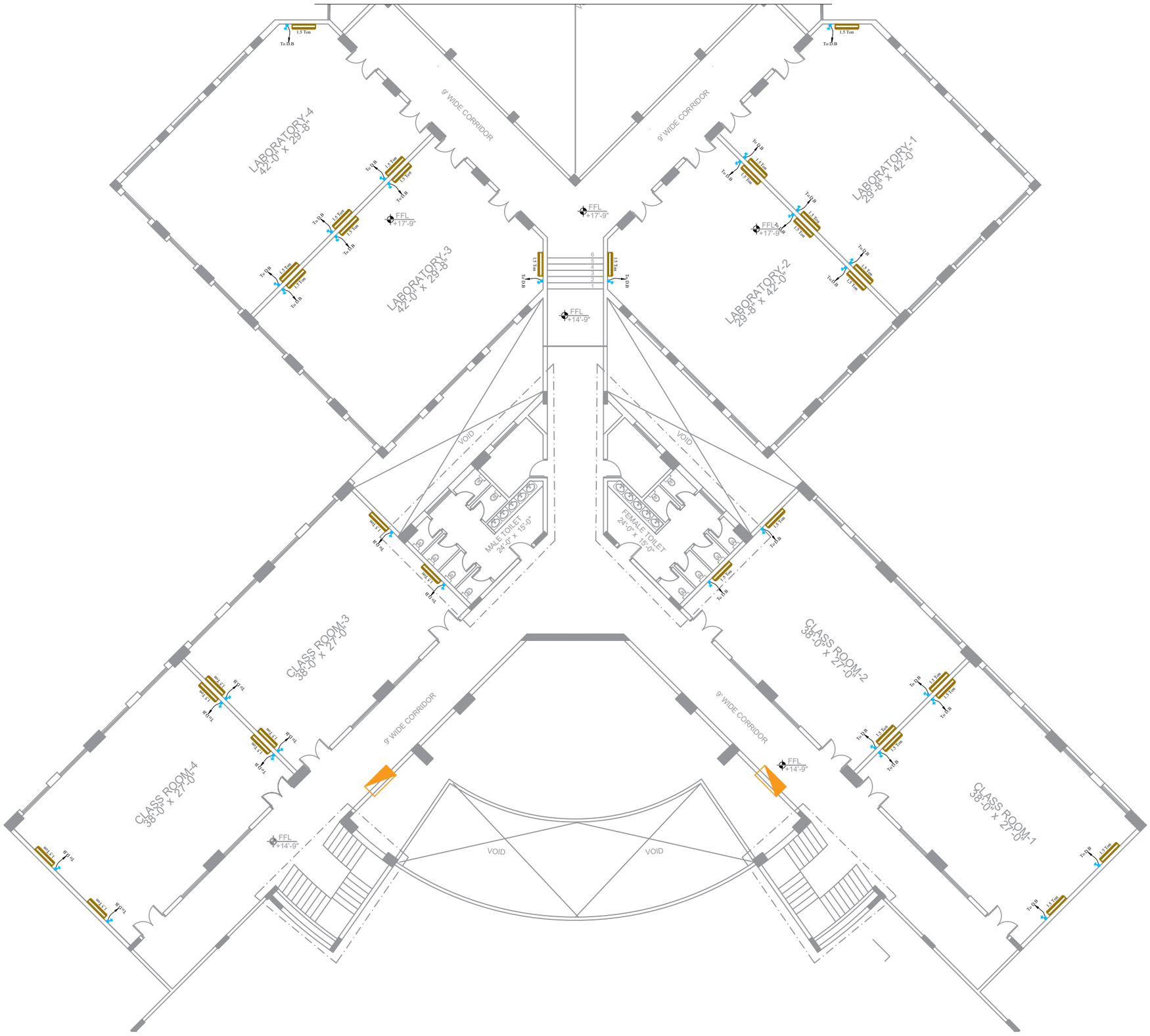
CONSULTANT
TA CE
TANVEER AHSAN CONSULTING ENGINEERS
Architect, Planners & Project Managers
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Telephone : +92 21 34964622

PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
FIRST FLOOR SPLIT A/C PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	MOIN	ZAHEER	TANVEER	MAY' 2025

DRG. NO.
TACE-NED-PPE-EL-10



TENDER DRAWING

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CONSULTANT

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Telephone : +92 21 34964622

PROJECT

CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

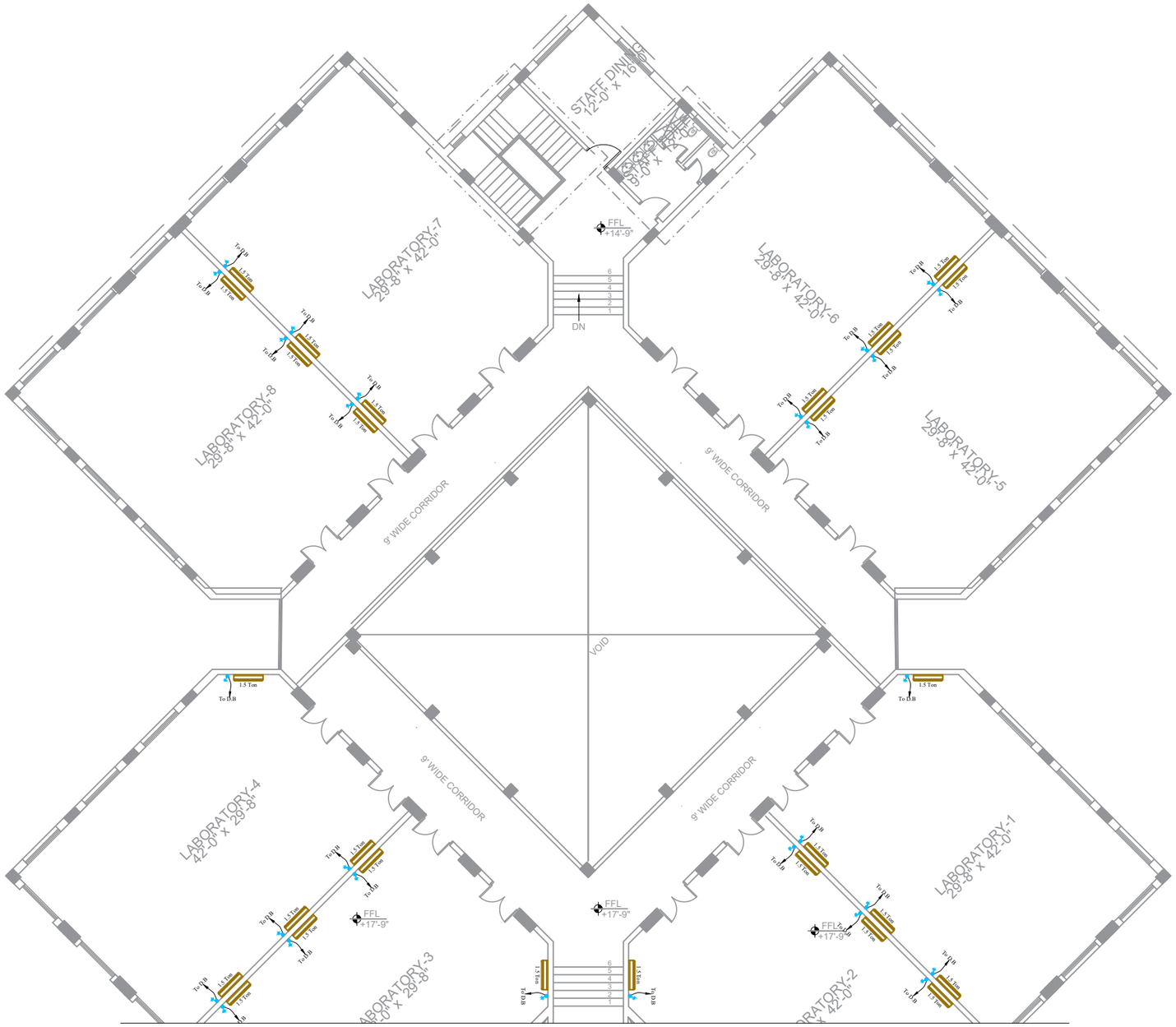
TITLE

FIRST FLOOR ELECTRICAL PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	MOIN	ZAHEER	TANVEER	MAY' 2025

DRG. NO.

TACE-NED-PPE-EL-11



TENDER DRAWING

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CONSULTANT

TACE

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PROJECT

CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

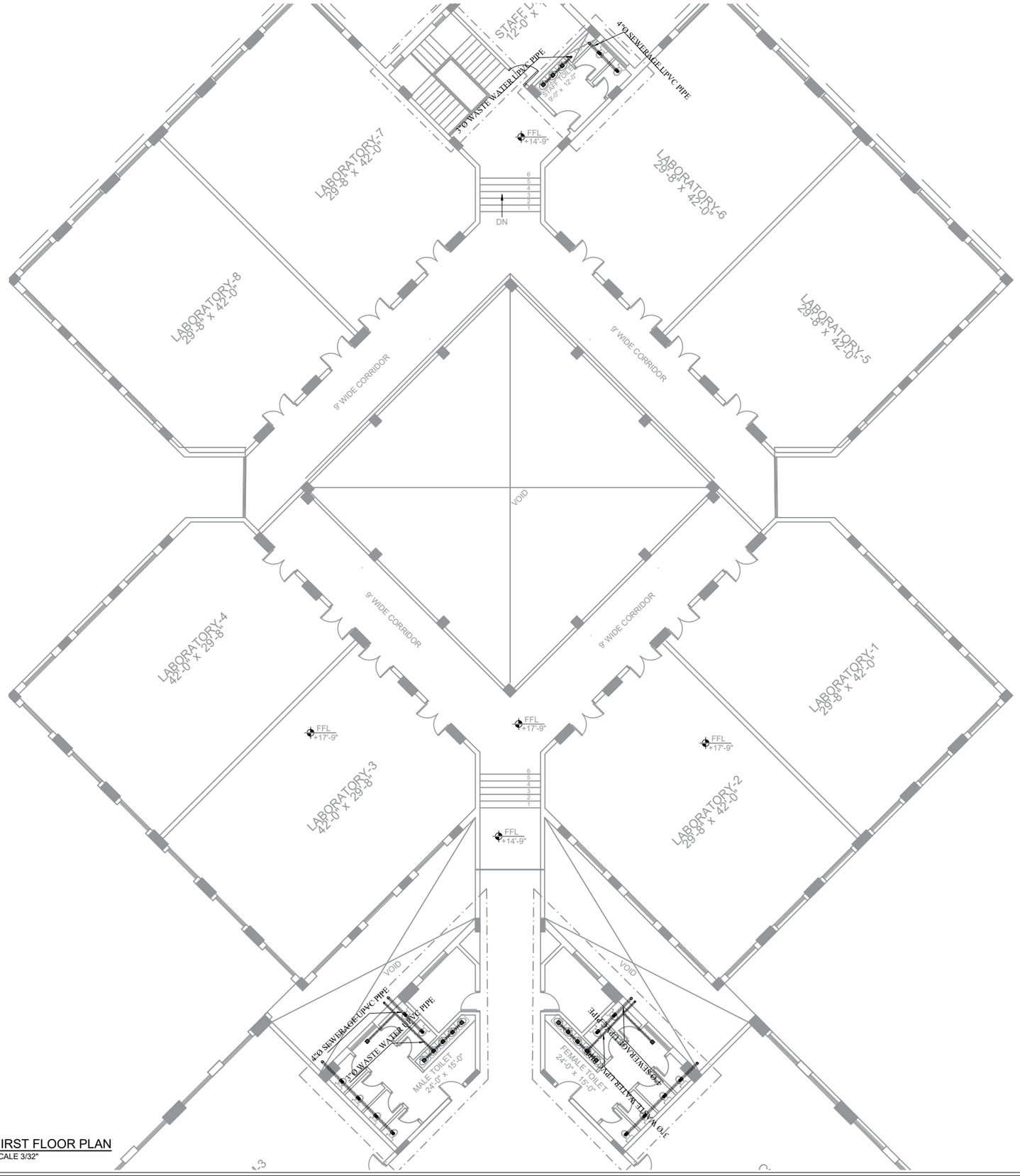
TITLE

FIRST FLOOR ELECTRICAL PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	MOIN	ZAHEER	TANVEER	MAY' 2025

DRG. NO.

TACE-NED-PPE-EL-12



FIRST FLOOR PLAN
SCALE 3/32"

SYMBOLS	DESCRIPTION
	FLOOR DRAIN WITH 3" Ø OUTLET
	ROOF DRAIN
	COMMODE
	WASH BASIN (VANITY)
	HOT WATER TAP 1" SIZE
	COLD WATER TAP 1" SIZE
	HOT WATER LINE 1"Ø
	COLD WATER LINE 1"Ø
M.H	SEWERAGE MAIN HOLE
	GULLY TRAP
	P TRAP 4" SIZE FOR COMMODE
	WASTE WATER DRAIN PIPE UPVC 3"
	WASTE SEWERAGE PIPE UPVC 4"
	MAIN SEWERAGE PIPE UPVC 6"

TENDER DRAWING

CLIENT
NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

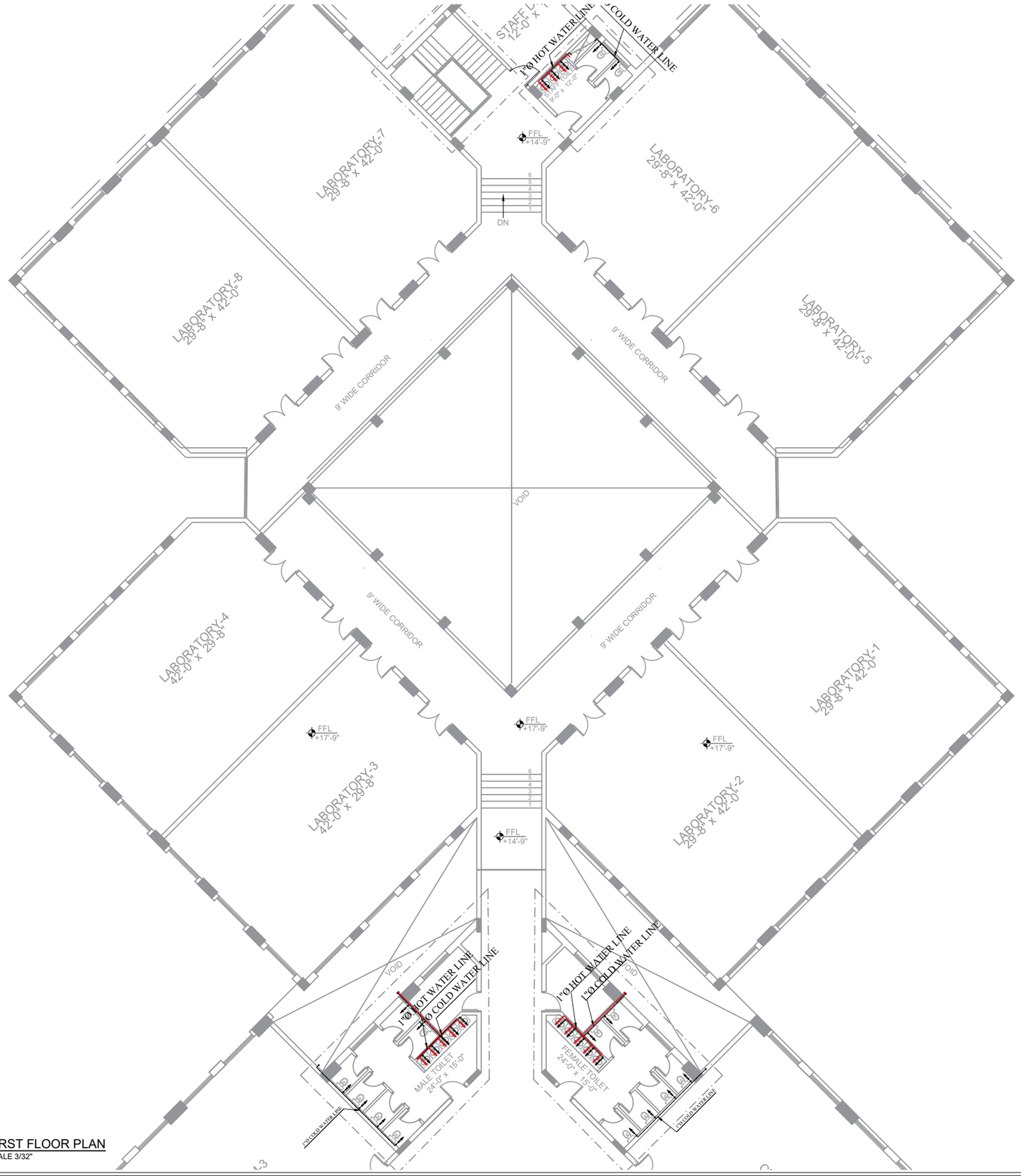
CONSULTANT
TA CE
TANVEER AHSAN CONSULTING ENGINEERS
Architect, Planners & Project Managers
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Gulshan–e–Iqbal, Karachi–75300 Pakistan
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
FIRST FLOOR SEWERAGE PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	MOIN	ZAHEER	TANVEER	MAY' 2025

DRG. NO.
TACE-NED-PPE-PS-01



FIRST FLOOR PLAN
SCALE 3/32"

TENDER DRAWING

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CONSULTANT
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Architect, Planners & Project Managers
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Gulshan-e-Iqbal, Karachi-75300 Pakistan
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PROJECT
CONSTRUCTION OF ACADEMIC BLOCK
AT NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

TITLE
FIRST FLOOR PLUMBING PLAN

SCALE	DRAWN	DESIGNED	CHECKED	DATE
AS SHOWN	MOIN	ZAHEER	TANVEER	MAY' 2025

DRG. NO.
TACE-NED-PPE-PS-02

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

No. DR (Estab)/(1003)/615 Dated: 28/01/2025

NOTIFICATION

In supersession of this University Officer Order No. DR(Estab)/(1003)/1990 dated: 12.02.2016, it is for information of all concerned that following the retirement of Engr. Khurshid Akhtar, former Director of Works and Services, effective from 24.01.2025, the University Administration has reconstituted the Procurement Committee for procurement of "Works" comprising of the Officers as follows:

1.	Prof. Dr. Abdul Jabbar Sangi Professor and Chairman Department of Civil Engineering	Convener
2.	Engr. Sadia Jabeen Asim Senior Civil Engineer (HEJ) University of Karachi	Member
3.	Engr. Azhar Iqbal Deputy Director Works & Services and Ag. Director Works & Services	Member / Secretary

The Terms of Reference (TORs), functions, and responsibilities of the aforementioned Committee shall be in accordance with the Rule 8 of the Sindh Public Procurement Rules 2010 (as amended). Additionally, the Committee will address all procurement matters initiated prior to the retirement of Engr. Khurshid Akhtar that are currently under evaluation.

Hussain

REGISTRAR

To:

The Convener and all Members

Copy for information to:

1. Dean (ECE)
2. Director Finance
3. Director, Planning &Development
4. Director Procurement
5. Ag. Resident Auditor

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY

No. DR (Estab)/(1003)/5730 Dated: 27/05/ 2016

OFFICE ORDER

In supersession of this office order No. DR (Estab)/(1003)/11418 dated 02-11-2015, the University Administration has constituted the Complaint Redressal Standing Committee comprising of the following officers to address complaints regarding all procurement issues in the University in pursuance of Clause 31(1) of the SPPRA rules:

1.	**Prof. Dr. Saad Ahmed Qazi** Dean (ECE)	Convener
2.	**Independent Professional from the relevant field**	Member
3.	**Nominee of Accountant General Sindh**	Member

27/5/2016

Ag. REGISTRAR

To:

The Convener & all members

Copy for information to:

1 Dean (ECE)
2 Director Planning & Projects
3 Director Finance
4 Director, Procurement Cell
5 Ag. Resident Auditor

DAWN: 01.01.2026

NED UNIVERSITY
OF ENGINEERING & TECHNOLOGY

Director
Procurement

PROCUREMENT CELL

University Road, Karachi-75270

Tel: 9926 1261 - 68 (Ext: 2471 & 2220) Fax: 9926 1255
Email: dp@neduet.edu.pk Website: http://www.neduet.edu.pk

No. PC/NED/MIV/191597/ 8529/ 963 Date: Dec 31, 2025

SAY NO TO CORRUPTION

CORRIGENDUM

Tender No. PC/NED/MIV/Construction 8529/2025

Construction of Academic Block at NEDUET.

With reference to above NIT published in **Newspapers on 30.12.2025**, all concerned are **informed** that following **corrections** shall be read and considered as integral part of the bidding documents and NIT:

Instead of
Eligibility in the NIT and Bidding Data (i) Valid Registration with Pakistan Engineering Council (PEC) in Category C-5 or above and Specialization Codes CE-10, CE-11(ix), EE-02, EE-04, EE-11 or EE-11(vi) and ME-01.
Should be
Eligibility in the NIT and Bidding Data (i) Valid Registration with Pakistan Engineering Council (PEC) in Category C-4 or above and Specialization Codes CE-10 and EE-11 or EE-11(vi)

However, all other terms & conditions of the tender will remain the same.

Director Procurement

JANG: 01.01.2026

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No. PC/NED/MIV/191597/ 8529/ 963 Date: Dec 31, 2025

SAY NO TO CORRUPTION

ٹینڈر نوٹس - توسیع

Tender No. PC/NED/MIV/Construction 8529/2025

Construction of Academic Block at NEDUET.

مورخہ 30.12.2025 کو اخبارات میں شائع شدہ مذکورہ این آئی ٹی کے حوالے سے، تمام متعلقہ افراد کو مطلع کیا جاتا ہے کہ درج ذیل اصلاحات کو بولی کے دستاویزات اور این آئی ٹی کا لازمی حصہ سمجھا جائے اور اسی کے مطابق پڑھا اور زیرِ غور لایا جائے۔

Instead of
Eligibility in the NIT and Bidding Data (i) Valid Registration with Pakistan Engineering Council (PEC) in Category C-5 or above and Specialization Codes CE-10, CE-11(ix), EE-02, EE-04, EE-11 or EE-11(vi) and ME-01.
Should be
Eligibility in the NIT and Bidding Data (i) Valid Registration with Pakistan Engineering Council (PEC) in Category C-4 or above and Specialization Codes CE-10 and EE-11 or EE-11(vi)

ٹینڈر کی دیگر شرائط وضوابط میں کوئی تبدیلی نہیں ہے۔

ڈائریکٹر پروکیورمنٹ

ABC
CERTIFIED
عوامي حقن جي ترجمان، ڪمپيوٽر تي پهرين مڪمل اخبار
ڪراچي، حيدرآباد ۽ سکر مان هڪ ئي وقت شايع ٿيندڙ
Daily AWAMI AWAZ
روزاني
عوامي آواز

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No. PC/NED/MIV/191597/ 8529/ 963 Date: Dec 31, 2025

SAY NO TO CORRUPTION

ٹينڈر نوٽيس - توسيع

Tender No. PC/NED/MIV/Construction 8529/2025

Construction of Academic Block at NEDUET.

تاريخ **30.12.2025** تي اخبارن ۾ شايع شده ذڪر ڪيل اين آءِ ٽي جي حوالي سان، مڙني لاڳاپيل فردن کي آگاهه ٿو ڪجي ته هيٺ ڏنل اصلاحات کي واڪ جي دستاويزن ۽ اين آءِ ٽي جو لازمي حصو سمجهيو وڃي ۽ انهيءَ جي مطابق پڙهيو ۽ غور هيٺ آندو وڃي.

Instead of
Eligibility in the NIT and Bidding Data (i) Valid Registration with Pakistan Engineering Council (PEC) in Category C-5 or above and Specialization Codes CE-10, CE-11(ix), EE-02, EE-04, EE-11 or EE-11(vi) and ME-01.
Should be
Eligibility in the NIT and Bidding Data (i) Valid Registration with Pakistan Engineering Council (PEC) in Category C-4 or above and Specialization Codes CE-10 and EE-11 or EE-11(vi)

ٽينڈر جي ٻين شرط ۽ ضابطن ۾ ڪا به تبديلي نه آهي.

ڊائريڪٽر پروڪيورمينٽ

FOUNDED BY QUAID-I-AZAM MOHAMMAD ALI JINNAH

DAWN

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Email: dp@neduet.edu.pk Website: http://www.neduet.edu.pk

Ref: DP/M-IV/1915/97/8529/955 Date: 29 December 2025

SAY NO TO CORRUPTION

NOTICE INVITING TENDER
[EPADS]

NEDUET invites Sealed Bids on Single Stage One Envelope procedure from Reputable and Well Experienced Firms to carry out the following work:

Construction of Academic Block at NEDUET.

Tender No. PC/NED/MIV/Construction /8529/2025

Estimated Cost (Rs in million)	Bid Security	Time of Completion	Tender Fee
149.202	2% of Bid Cost	12 Months	5,000/-

ELIGIBILITY CRITERIA:

(i) (Valid Registration with Pakistan Engineering Council (PEC) in Category C-5 or above and Specialization Codes CE-10, CE-11(ix), EE-02, EE-04, EE-11 or EE-11(vi) and ME-01.

(ii) Valid Registered License from Electrical Inspector for Electrical Works issued from Government of Sindh.

(iii) Registered with Sindh Revenue Board and FBR and must have active status.

(iv) Last 3 years Audited Financial Statements along-with last 3 years online Annual Returns submitted to FBR.

(v) List of similar assignment along-with cost undertaken over past 5 years; evidence must be attached.

(vi) Affidavit on (non-judicial stamp paper) of no litigation history, non-blacklisting, never indulge in any corrupt, fraudulent and collusive practices, also undertaking that the information and documents provided with are correct. The date of issuance of said stamp paper and bidder signature on it should be later than the date of publication of this NIT.

(vii) Contractors working with NED University must submit a certificate from Project In charge that the work progress and quality of work executed are satisfactory.

BIDDING / TENDER DOCUMENTS

Tender Fee of Rs 5,000/- and Bid Security @ 2% of the bid cost in the shape Pay Order should be in favour of Director Finance, NEDUET. Bidding Documents can be obtained and shall be submitted in EPADS as per following schedule:

(i)	**Issuance:**	Documents will be issued from 01.01.2026 to 19.01.2026
(ii)	**Submission:**	Last Date of Submission of Bids is 20.01.2026 at 10:00 A.M.
(iii)	**Opening:**	Bids will be opened on 20.01.2026 at 10:30 A.M.
(iv)	**Place Address:**	Office of DDP, Procurement Cell, NED University, Main Campus, Tel: 021-99261261-68 (Ext. 2220)

FUNDING POSITION

Funds are available under HEC approved Development Project.

TERMS AND CONDITIONS:

a) **Under the following conditions, Bid can be rejected:**

(i) Bidders are advised that before filling the Bidding Document all papers of Bidding Documents should carefully be rechecked. If any page(s) / Paper(s) of Bidding Documents are missing, that can be downloaded from the Official website of the University and SPPRA. Bid(s) with incomplete Bidding Document will be rejected.

(ii) Incomplete, Conditional and Telegraphic Bids.

(iii) Bids not accompanied by Bid Security of required amount & form.

(iv) Bids received after Specified Date and Time.

(v) Black Listed Firms /Companies.

a) Bid Validity Period: 90 days

b) Bidders are requested to give their best and final price as "No Negotiations" is permitted. Bidding documents containing detailed terms and conditions are available at websites https://www.neduet.edu.pk and https://www.portalsindh.eprocure.gov.pk. The Procuring Agency reserves the right to reject all or any Bid subject to the relevant provisions of Sindh Public Procurement Rules 2010 amended up to date.

Director Procurement


منگل 9 رجب المرجب 1447ھ 30 دسمبر 2025ء

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باقاعدہ تصدیق شدہ اشاعت ABC CERTIFIED پاکستان کے ہر روزنامہ کا نمائندہ

THE DAILY JANG KARACHI

روزنامہ جنگ کراچی

TUESDAY DECEMBER 30, 2025

بانی ۔۔۔ میر خلیل الرحمٰن

جلد 89 | منگل 9 رجب المرجب 1447ھ 30 دسمبر 2025ء | نمبر 358

NED UNIVERSITY
OF ENGINEERING & TECHNOLOGY

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Email: dp@neduet.edu.pk Website: http://www.neduet.edu.pk

Ref: DP/M-IV/191597/8529/955 Date: 29 December 2025

SAY NO TO CORRUPTION

نوٹس برائے طلبی ٹینڈر
(EPADS)

NEDUET درج ذیل کام کو انجام دینے کیلئے معروف اور اچھی تجربہ کار فرموں سے سنگل اسٹیج ایک لفافے کے طریقہ کار پر صوبندیلیوں کو مدعو کرتا ہے:

Construction of Academic Block at NEDUET.

Tender No. PC/NED/MIV/Construction /8529/2025

Estimated Cost (Rs in million)	Bid Security	Time of Completion	Tender Fee
149.202	2% of Bid Cost	12 Months	5,000/-

اہلیت کے معیار:

(i) پاکستان انجینئرنگ کونسل (PEC) کے ساتھ کیٹگری C-5 یا اس سے زائد میں اور اسٹیبلشمنٹ کوڈ EE-11، EE-04، EE-02، CE-11(ix)، CE-10 یا EE-11(vi) اور ME-01 میں درست رجسٹریشن۔

(ii) حکومت سندھ سے جاری کردہ الیکٹریکل ورکس کیلئے الیکٹریکل انسپکٹر کا درست رجسٹریشن سرٹیفکیٹ۔

(iii) سندھ ریونیو بورڈ اور ایف بی آر کے ساتھ رجسٹرڈ اور فعال حیثیت کا ہونا ضروری ہے۔

(iv) گزشتہ 3 سالوں کے آڈٹ شدہ مالیاتی گوشواروں کیساتھ ساتھ FBR کو جمع کرائے گئے پچھلے 3 سال کے آمدنی سالانہ ریٹرنز۔

(v) گزشتہ 5 سال کے دوران انجام دی گئی اسی نوعیت کی اسائنمنٹس کی فہرست بمعہ لاگت، مدت شکمل ہونا لازمی ہے۔

(vi) (تین جوڈیشل اسٹامپ پیپر) پر حلف نامہ جس میں کوئی قانونی چارہ جوئی کی تاریخ نہ ہو، بلیک لسٹ نہ ہو، کبھی بھی کسی بھی عدالتی دعوہ کہ دیوانی و فوجداری نگلٹ کے عمل میں ملوث نہ ہوں، یہ بھی واضح کرتا ہو کہ فراہم کردہ معلومات اور دستاویزات درست ہیں۔ مذکورہ اسٹامپ پیپر کے اجراء کی تاریخ اور اس پر بولی دہندہ کے دستخط اس NIT اشاعت کی تاریخ کے بعد کے ہونے چاہئیں۔

(vii) NED یونیورسٹی کے ساتھ کام کرنے والے کنٹریکٹروں کو پراجیکٹ انچارج کی طرف سے ایک سرٹیفکیٹ جمع کرانا ہوگا کہ کام کی پیشرفت اور کئے گئے کام کا معیار تسلی بخش ہے۔

بولی / ٹینڈر دستاویزات

ٹینڈر فیس 5,000/- روپے اور بولی کی سیکیورٹی بولی کی لاگت کے 2% کے برابر پے آرڈر کی صورت میں ڈائریکٹر فنانس، NEDUET کے نام جمع کروائی جائے گی۔ بولی دستاویزات حاصل کی جاسکتی ہیں اور درج ذیل شیڈول کے مطابق EPADS میں جمع کروائی جائیں گی:

(i)	اجراء:	دستاویزات 01.01.2026 سے 19.01.2026 تک جاری کی جائیں گی۔
(ii)	جمع کرانے کی تاریخ:	بولیوں کی جمع کرانے کی آخری تاریخ 20.01.2026 بوقت 10:00 بجے ہے۔
(iii)	کھولنے کا وقت:	بولیاں 20.01.2026 بوقت 10:30 بجے کھولی جائیں گی۔
(iv)	مقام / پتہ:	دفتر ڈائریکٹر پروکیورمنٹ، کمیٹی روم، این ای ڈی یونیورسٹی، مین کیمپس یونیورسٹی روڈ، کراچی۔ ٹیلیفون نمبر: 021-99261261-68 (ایکسٹینشن 2220)

نمٹنگ کی صورتحال

نکٹر ڈائریکٹر ای سی سے منظور شدہ وڈ فیزیبلٹی پروجیکٹ کے تحت دستیاب ہیں۔

شرائط و ضوابط

a) درج ذیل صورتوں میں بولی مسترد کی جاسکتی ہے:

i) بولی دہندگان کو ہدایت کی جاتی ہے کہ بولی دستاویزات پر کرنے سے قبل تمام صفحات / کاغذات بغور چیک کرلیں۔ اگر بولی دستاویزات کا کوئی صفحہ / کاغذ موجود نہ ہو تو ویب نوٹس اور SPPRA کی آفیشل ویب سائٹ سے ڈاؤن لوڈ کیا جاسکتا ہے۔ نامکمل بولی دستاویزات کے ساتھ جمع کرائی گئی بولیاں مسترد کردی جائیں گی۔

ii) نامکمل، مشروط اور لیٹی گرانگ بولیاں۔

iii) بولیاں جن کے ساتھ مطلوبہ رقم اور مقررہ فارم میں بولی سیکیورٹی منسلک نہ ہو۔

iv) مقررہ تاریخ اور وقت کے بعد موصول ہونے والی بولیاں۔

v) بلیک لسٹ شدہ فرمیں / کمپنیاں۔

b) بولی کی معیاد 90 دن

c) بولی دہندگان سے گزارش ہے کہ اپنی بہترین اور حتمی قیمت درج کریں کیونکہ "کسی قسم کی مذاکرات کی اجازت نہیں ہوگی"۔ تفصیلی شرائط و ضوابط پر مشتمل بولی دستاویزات ویب سائٹس https://www.neduet.edu.pk اور https://www.portalsindh.eprocure.gov.pk پر دستیاب ہیں۔ پروکیورمنٹ اجنسی شدہ پبلک پروکیورمنٹ رولز 2010 (تا حال ترمیم شدہ) کی متعلقہ دفعات کے تحت کسی بھی یا تمام بولیوں کو مسترد کرنے کا حق محفوظ رکھتی ہے۔

ڈائریکٹر پروکیورمنٹ

ABC CERTIFIED

عوامي حقن جي ترجمان، ڪمپيوٽر تي پهرين مڪمل اخبار

ڪراچي، حيدرآباد ۽ سکر مان هڪ ئي وقت شايع ٿيندڙ

Daily AWAMI AWAZ

روزاني

عوامي آواز

سال 36_ شمارو 352 | سومر 29 ڊسمبر 2025ع 08 رجب المرجب 1447ھ | صفحا_08_قيمت 40 روپيا

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Ref: DP/M-IV/191597/8529/955 Date: 29 December 2025

SAY NO TO CORRUPTION

ٹينڈر گھرائڻ جو نوٽيس
(EPADS)

NEDUET هيٺ ڏنل ڪم کي انجام ڏيڻ جي لاءِ معروف ۽ بهتر تجربيڪار فرمن کان سنگل اسٽيج هڪ لفافي جي طريقيڪار تي مهربند واڪ طلب ڪري ٿو:

Construction of Academic Block at NEDUET.

Tender No. PC/NED/MIV/Construction /8529/2025

Estimated Cost (Rs in million)	Bid Security	Time of Completion	Tender Fee
149.202	2% of Bid Cost	12 Months	5,000/-

اهليت جا معيار:

(i) پاڪستان انجنيئرنگ ڪائونسل (PEC) وٽ ڪيٽيگري C_5 يا ان کان مٿي ۾ اسپيشلائيزيشن ڪوڊز CE_10، CE_11 (ix)، EE_، EE_02، EE_11.04 يا EE_11 (vi) ۽ ME_01 ۾ درست رجسٽريشن.

(ii) حڪومتِ سنڌ مان جاري ڪيل اليڪٽريڪل ورڪس جي لاءِ اليڪٽريڪل انسپيڪٽر جو درست رجسٽرڊ لائيسنس.

(iii) سنڌ ريونيو بورڊ ۽ ايف بي آر وٽ رجسٽرڊ ۽ فعال حيثيت جو هجڻ ضروري آهي.

(iv) گذريل 3 سالن جا آڊٽ شده مالياتي گوشوارن سان گڏو گڏ FBR وٽ جمع ڪرايل گذريل 3 سال جا آن لائين ساليانا ريٽرنز.

(v) گذريل 5 سال جي دوران انجام ڏنل ساڳي نوعيت جي اسائنمينٽس جي فهرست سان لاڳت، ثبوت شامل هجڻ لازمي آهي.

(vi) (ٽان جوڊيشل استامپ پيپر) تي حلف نامو جنهن ۾ ڪنهن قانوني چاره جوئي جي تاريخ نه هجي، بليڪ لسٽ نه هجي، ڪڏهن به ڪنهن بدعنواڻي، ڏوڪيبازي ۽ ملي پگهٽ جي عمل ۾ ملوث نه هجڻ. اهو پڻ واضح ڪندو هجي ته فراهم ڪيل معلومات ۽ دستاويز درست آهن. ڏکر ڪيل استامپ پيپر جي اجراء جي تاريخ ۽ ان ٽي واڪ ٽينڈرز جا دستخط هن NIT اشاعت جي تاريخ کان بعد جا هجڻ گهرجن.

(vii) NED يونيورسٽي سان گڏ ڪم ڪندڙ ٺيڪيدارن کي پراجيڪٽ انچارج وٽان هڪ سرٽيفڪيٽ جمع ڪرائڻو هوندو ته ڪم جي پيشرفت ۽ ڪيل ڪم جو معيار تسلي بخش آهي.

واڪ/ٽينڈر دستاويز:

ٽينڈر فيس 5,000/- روپيا ۽ واڪ سيڪيورٽي واڪ جي لاڳت جي 2٪ جي برابر پي آرڊر جي صورت ۾ ڊائريڪٽر فنانس، NEDUET جي نالي جمع ڪرايا ويندا. واڪ دستاويز حاصل ڪري سگهجن ٿا ۽ هيٺ ڏنل شيڊيول جي مطابق EPADS تي جمع ڪرايا ويندا:

(i)	اجراء:	دستاويز 01.01.2026 کان 19.01.2026 تائين جاري ڪيا ويندا
(ii)	جمع ڪرائڻ جي تاريخ:	واڪ جمع ڪرائڻ جي آخري تاريخ 20.01.2026 صبح 10:00 وڳي آهي
(iii)	کولڻ جو وقت:	واڪ 20.01.2026 صبح 10:30 وڳي کوليا ويندا.
(iv)	هنڌ/پتو:	دفتر ڊي ڊي پي، پروڪيورمينٽ سيل، اين اي ڊي يونيورسٽي، مين ڪئمپس ٽيليفون:_021 99261261_68 (ايڪسٽينشن 2220)

فنڊنگ جي صورتحال:

فنڊز ايڇ اي سي وٽان منظور شده ڊيولپمينٽ پراجيڪٽ جي تحت دستياب آهن.

شرط ۽ ضابطا:

a) هيٺين صورتن ۾ واڪ رد ڪيا ويندا:

i) واڪ ٽينڈرن کي هدايت ٽي ڪجي ته واڪ دستاويز پرن کان پهريان سموريا صفحا/ڪاغذن کي غور سان چيڪ ڪن. جيڪڏهن واڪ دستاويزن جو ڪو صفحو/ڪاغذ موجود نه هوندو ته يونيورسٽي ۽ SPPRA جي آفيشل ويب سائيٽ تان ڊائون لوڊ ڪري سگهجي ٿي. اڻپورن واڪ دستاويزن سان گڏ جمع ڪرايل واڪ رد ڪيا ويندا.

ii) اڻپورا، مشروط ۽ ٽيليگرافڪ واڪ

iii) اهڙا واڪ جن سان گڏ گهربل رقم ۽ مقرر فارم ۾ بڊ سيڪيورٽي شامل نه هجي.

iv) مقرر ڪيل تاريخ ۽ وقت کانپوءِ وصول ٿيندڙ واڪ.

v) بليڪ لسٽ شده فرمون/ڪمپنيون

b) واڪ جو مدو: 90 ڏينهن

c) واڪ ٽينڈرن کي درخواست ٽي ڪجي ٿي انهنجي بهترين ۽ حتمي قيمت درج ڪن چو "ڪنهن به قسم جي مذاڪرات جي اجازت نه هوندي". تفصيلي شرط ۽ ضابطن ٽي مشتمل واڪ دستاويز ويب سائيٽس

https://www.neduet.edu.pk ۽

https://www.portalsindh.eprocure.gov.pk تي دستياب آهن. پروڪيورنگ ايجنسي سنڌ پبلڪ پروڪيورمينٽ رولز 2010 (تاحال ترميم شده) جي لاڳاپيل دفعات جي تحت ڪنهن به يا مڙني واڪن کي مسترد ڪرڻ جو حق محفوظ رکي ٿي.

ڊائريڪٽر پروڪيورمينٽ