



HIGHER EDUCATION COMMISSION

Establishment of University of Turbat

Turbat Town (South-West of Balochistan) in
District Kech



CONSTRUCTION OF BOUNDARY WALL AROUND GIRLS HOSTEL PHASE-II

PACKAGE-08

Tender Document

Volume-I (Conditions of Contract)

Volume-II (Technical Specifications)

Volume-III (Bill of Quantities)

Volume-IV (Drawings)



EA Consulting Pvt Ltd

(Formerly Engineering Associates)

Engineering, Architecture & Project Management

Head Office: AL-9, 15th Lane, Khayaban-e-Hilal,

Phase VII, D.H.A., Karachi-75500.,

Tel: UAN: 111-111-584, Fax: (021) 3584-1825

Web: www.eaworld.com

Sep 2024

BIDDING DOCUMENTS

- | | |
|--|---------------------|
| 1. CONDITIONS OF CONTRACT | (Volume - I) |
| 1.1 Instructions to bidders | |
| 1.2 Bidding data | |
| 1.3 Form of bid and appendices to bid | |
| 1.4 Forms | |
| 1.5 Part-I: General conditions of contract | |
| 1.6 Part-II: Particular conditions of contract | |
| 1.7 Part-III: Supplementary conditions of contract | |
| 2. SPECIFICATIONS - TECHNICAL PROVISIONS | (Volume II) |
| 3. APPENDIX D - BILL OF QUANTITIES
Special Provisions (Preliminaries) | (Volume III) |
| 4. DRAWINGS | (Volume IV) |

INVITATION FOR BIDS

Refer Notice published in News papers

TABLE OF CONTENTS

Description

1. INSTRUCTIONS TO BIDDERS

A. General

- IB.1 Scope of Bid
- IB.2 Source of Funds
- IB.3 Eligible Bidders
- IB.4 One Per Bidder
- IB.5 Cost of Bidding
- IB.6 Site Visit

B. Bidding Documents

- IB.7 Contents of Bidding Documents
- IB.8 Clarification of Bidding Documents
- IB.9 Amendment of Bidding Documents

C. Preparation of Bids

- IB.10. Language of Bid
- IB.11 Documents Accompanying the Bid
- IB.12 Bid Prices
- IB.13 Currencies of Bid and Payment
- IB.14 Bid Validity
- IB.15 Bid Security
- IB.16 Alternate Proposals by Bidder
- IB.17 Pre-Bid Meeting
- IB.18 Format and Signing of Bid

D. Submission of Bids

- IB.19 Sealing and Marking of Bids
- IB.20 Deadline for Submission of Bids
- IB.21 Late Bids
- IB.22 Modification, Substitution and Withdrawal of Bids

E. Bid Opening and Evaluation

- IB.23 Bid Opening
- IB.24 Process to be Confidential
- IB.25 Clarification of Bids
- IB.26 Examination of Bids and Determination of Responsiveness
- IB.27 Correction of Errors
- IB.28 Evaluation and Comparison of Bids

F. Award of Contract

- IB.29 Award
- IB.30 Employer's Right to Accept any and to Reject any or all Bids
- IB.31 Notification of Award
- IB.32 Performance Security
- IB.33 Signing of Contract Agreement

- IB.34 General Performance of the Bidders
- IB.35 Integrity Pact
- IB.36 Instructions Not Part of Contract

2. BIDDING DATA

3. FORM OF BID AND APPENDICES TO BID

FORM OF BID

- Appendix-A to Bid : Special Stipulations
- Appendix-B to Bid : Foreign Currency Requirements
- Appendix-C to Bid : Price Adjustment (Under Clause 70)
- Appendix-D to Bid : Bill of Quantities (Separate Volume III)
- Appendix-E to Bid : Proposed Construction Schedule
- Appendix-F to Bid : Method of Performing the Work
- Appendix-G to Bid : List of Major Equipment – Related Items
- Appendix-H to Bid : Construction Camp and Housing Facilities
- Appendix-I to Bid : List of Subcontractors
- Appendix-J to Bid : Estimated Progress Payments/ Cash Flow Diagram
- Appendix-K to Bid : Organization Chart of the Supervisory Staff and Labour
- Appendix-L to Bid : Integrity Pact

4. FORMS

- 4.1 BID SECURITY
- 4.2 PERFORMANCE SECURITY
- 4.3 CONTRACT AGREEMENT
- 4.4 MOBILIZATION ADVANCE GUARANTEE/BOND

5. PART-I: GENERAL CONDITIONS OF CONTRACT

6. PART-II: PARTICULAR CONDITIONS OF CONTRACT

7. PART-III: SUPPLEMENTARY CONDITION OF CONTRACT

- 8. SPECIFICATIONS - SPECIAL PROVISIONS (PRELIMINARIES) (Part of BOQ)**
- 9. SPECIFICATIONS - TECHNICAL PROVISIONS (Volume II)**
- 10. Appendix D - Bill of Quantities (Volume III)**
- 11. Drawings (Volume IV)**

INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

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

A. GENERAL

- a. For ease of reference certain information and Conditions of Particular Application to the Contract are set forth in Appendix-A to Bid and where these Conditions conflict with the provisions or requirement set forth elsewhere in the Contract Document, the Conditions as given in Appendix-A to Bid shall govern.
- b. The Bidder, whether or not he submits a Bid, shall treat the details of the documents as private and confidential.
- c. Bids containing any qualification e.g. material deviation from these Instructions to Bidders and the stated contractual terms, specifications and any addenda related thereto may be rejected.

d. Stamp Paper Requirements

The Bidder/Contractor shall submit at his own cost all bonds and the Agreement required as per the Provisions of the Contract, on **judicial** stamp papers in accordance with the Government prevailing regulations.

IB.1 Scope of Bid

- 1.1 The Employer as defined in the Bidding Data hereinafter called "the Employer" wishes to receive bids for the construction and completion of works as described in these Bidding Documents, and summarized in the Bidding Data hereinafter referred to as the "Works".
- 1.2 The successful Bidder shall be expected to complete the Works within the time stipulated in items 41 of Appendix-A to Bid.

IB.2 Source of Funds

- 2.1 The Employer has applied for/received a loan/credit from the source (s) indicated in the Bidding Data in various currencies towards the cost of the project specified in the Bidding Data and it is intended that part of the proceeds of this loan/credit will be applied to eligible payments under the Contract for which these Bidding Documents are issued.

IB.3 Eligible Bidders

- 3.1 This Invitation for Bids is open to all Bidders meeting the following requirements:
 - a. Duly licensed by the Pakistan Engineering Council (PEC) in the category relevant to the value of the Works.
 - b. Duly prequalified / enlisted with the Employer.

IB.4 One Bid per Bidder

- 4.1 Each Bidder shall submit only one bid either by himself, or as a partner in a joint venture. A Bidder who submits or participates in more than one bid (other than alternatives pursuant to Clause IB.16) will be disqualified.

IB.5 Cost of Bidding

- 5.1 The Bidders shall bear all costs associated with the preparation and submission of their respective bids and the Employer will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the Bidding process.

IB.6 Site Visit

- 6.1 The Bidders are advised to visit and examine the Site of Works and its surroundings and obtain for themselves on their own responsibility all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. All cost in this respect shall be at the Bidder's own expense.
- 6.2 The Bidders and any of their personnel or agents will be granted permission by the Employer to enter upon his premises and lands for the purpose of such inspection, but only upon the express condition that the Bidders, their personnel and agents, will release and indemnify the Employer, his personnel and agents from and against all liability in respect thereof and will be responsible for death or personal injury, loss of or damage to property and any other loss, damage, costs and expenses incurred as a result of such inspection.
- 6.3 The Bidder must enquire and satisfy himself as to the nature of the ground and its existing contours, the hydrological and climatic conditions, the form and nature of the Site, source of supply, the sufficiency and the means of obtaining and transporting all materials, labour, fuel, water, electrical current for light and power and other things required for or in connection with the Works and he must consider all other matters and possible contingencies affecting the execution, completion and maintenance of the Works e.g. local customs & cultural events affecting the Bid Price etc.
- 6.4 Any information obtained from or given by the Consultants in regard to the foregoing shall neither bind the Employer, nor absolve the Bidder of his liability/obligations or requirements to make his own enquiries and investigations. Any neglect or failure on the part of the Bidder to obtain reliable information on the spot or elsewhere upon the foregoing or any other matters affecting the execution, completion and maintenance of the Works and the Contract shall not relieve the accepted Bidder from any risks or liabilities or from the responsibility of completing and handing over the Works all as defined in the Contract.

B. BIDDING DOCUMENTS

IB.7 Contents of Bidding Documents

- 7.1 The Bidding Documents, in addition to invitation for bids, are those stated below and should be read in conjunction with any Addenda issued in accordance with Clause IB.9.
1. Instructions to Bidders
 2. Bidding Data

3. Form of Bid & Appendices to Bid
 4. Forms
 - 4.1 Form of Bid Security
 - 4.2 Form of Performance Security/Bond
 - 4.3 Form of Agreement
 - 4.4 Mobilization Advance Guarantee/Bond
 5. General Conditions of Contract, Part-I (GCC)
 6. Particular Conditions of Contract, Part-II (PCC)
 8. Specifications - Special Provisions/Preliminaries (Part of BOQ)
 9. Specifications - Technical Provisions (Volume II)
 10. Appendix D - Bill of Quantities (Volume III)
 11. Drawings (Volume IV)
- 7.2 The Bidders are expected to examine carefully the contents of all the above documents. Failure to comply with the requirements of submission will be at the Bidder's own risk. Pursuant to Clause IB.26, bids which are not substantially responsive to the requirements of the Bidding Documents will be rejected.

IB.8 Clarification of Bidding Documents

- 8.1 Any prospective Bidder requiring any clarification(s) in respect of the Bidding Documents may notify the Employer in writing at the Employer's address indicated in the Invitation for Bids. The Employer will respond to any request for clarification which he receives earlier than the period stipulated in item no. 3 of Appendix-A to Bid, prior to the deadline for submission of bids.

Copies of the Employer's response will be forwarded to all purchasers of the Bidding Documents, including a description of the enquiry but without identifying its source.

The Engineer will not be bound by, and the Bidder shall not rely upon, any oral interpretation or clarification of the Bid Documents.

IB.9 Amendment of Bidding Documents

- 9.1 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.
- 9.2 Any addendum thus issued shall be part of the Bidding Documents pursuant to Sub-Clause 7.1 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.
- 9.3 To afford prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer may extend the deadline for submission of Bids in accordance with Clause IB.20

No Alteration to Documents

- 9.4 No addition, omission or alteration is to be made by the Bidder to the Bid Documents except otherwise as mentioned in the following clause. If any such alteration is made or if these instructions are not fully complied with or if any incomplete Bid is submitted, the Bid may be rejected. Cost of un-priced items shall be deemed as included in the final Bid price, adjusted in other relevant BOQ item.

C. PREPARATION OF BIDS

IB.10 Language of Bid

10.1 The Bid and all correspondence and documents related to the Bid exchanged by a Bidder and the Employer shall be in the bid language stipulated in the Bidding Data and Particular Conditions of Contract. Supporting documents and printed literature furnished by the Bidders may be in any other language provided the same are accompanied by an accurate translation of the relevant parts in the language, in which case, for purposes of evaluation of the Bid, the translation in Bid language shall prevail.

IB.11 Documents Accompanying the Bid

12

11.1 Each Bidder shall:*

- (a) Submit a written power of attorney authorizing the signatory of the Bid to act for and on behalf of the Bidder;
- (b) Update the information indicated and listed in the Bidding Data and previously submitted with the application for prequalification, and continues to meet the minimum criteria set out in the prequalification documents which as a minimum, would include the following:
 - (i) Evidence of access to financial resources along with average annual construction turnover;
 - (ii) Financial predictions for the current year and the two following years including the effect of known commitments;
 - (iii) Work commitments since prequalification;
 - (iv) Current litigation information; and
 - (v) Availability of critical equipment.
- (c) furnish a technical proposal taking into account the various Appendices to specially the following:

Appendix-E to Bid	Proposed Construction Schedule
Appendix-F to Bid	Method of Performing the Work
Appendix-G to Bid	List of Major Equipment
Appendix-K to Bid	Organization Chart for Supervisory Staff and other pertinent information such as mobilization programme etc;
- (d) Submit a Labour histogram: with the Bid for the proposed manpower for the entire duration of the project in the form of a labour histogram.
- (e) Manufacturers / Suppliers of Materials

The Bidder shall submit with his Bid a schedule of sub-contractors and suppliers he proposes to use during the execution of the works.

For list of suppliers of material refer Annexure-A.

All sub-contractors other than those nominated by the Engineer must have had a minimum of five years experience in their sub-contract element or similar projects and they will be subjected to a pre-qualification procedure. The capabilities and quality of the sub-contracts and their staff will be carefully reviewed by the Engineer. If, in the opinion of the Engineer a designated sub-contractor is incapable of carrying out the works to the standard required by the contract documents, the Contractor shall within a period of one week put forward names of alternative sub-contractors. Anyone or all of them will be subjected to the same procedure as stated above. This procedure will be carried out until suitable

sub-contractors are approved by the Engineer whose decision is final and binding on the Contractor.

- 11.2 Bids submitted by a joint venture of two (2) or more firms shall comply with the following requirements:
- (a) The Bid and in case of a successful, the Form of Contract Agreement shall be signed so as to be legally binding on all partners;
 - (b) one of the joint venture partners shall be nominated as being in charge; and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the joint venture partners;
 - (c) the partner-in-charge shall always be duly authorized to deal with the Employer regarding all matters related with and/or incidental to the execution of Works as per the terms and Conditions of Contract and in this regard to incur any and all liabilities, receive instructions, give binding undertakings and receive payments on behalf of the joint venture;
 - (d) all partners of the joint venture shall at all times and under all circumstances be liable jointly and severally for the execution of the Contract in accordance with the Contract terms and a statement to this effect shall be included in the authorization mentioned under Sub-Para (b) above as well as in the Form of and in the Form of Contract Agreement (in case of a successful); and
 - (e) a copy of the agreement entered into by the joint venture partners shall be submitted with the stating the conditions under which it will function, its period of duration, the persons authorized to represent and obligate it and which persons will be directly responsible for due performance of the Contract and can give valid receipts on behalf of the joint venture, the proportionate participation of the several firms forming the joint venture, and any other information necessary to permit a full appraisal of its functioning. No amendments / modifications whatsoever in the joint venture agreement shall be agreed to between the joint venture partners without prior written consent of the Employer.
- 11.3 Bidders shall also submit proposals of work methods and schedule, in sufficient detail to demonstrate the adequacy of the Bidders' proposals to meet the technical specifications and the completion time referred to in Sub-Clause 1.2 hereof.

IB.12 Bid Prices

- 12.1 Unless stated otherwise in the Bidding Documents, the Contract shall be for the whole of the Works as described in Sub-Clause 1.1 hereof, based on the unit rates and / or prices submitted by the Bidder. Each Bidder shall be deemed to have satisfied himself fully before submitting Bid as to all aspects of work, correctness and sufficiency of his Bid and of rates and prices stated in the Bill of Quantities which rates and prices shall except in so far as it is otherwise expressly provided in the Contract, cover all his obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the Works.
- 12.2 The Bidders shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by a Bidder will not be paid for by the Employer when executed and shall be deemed covered by rates and prices for other items in the Bill of Quantities.
- 12.3 All duties, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as on the date 28 days prior to the deadline for submission of bids shall be included in the rates and prices and the total Price submitted by a Bidder.

- Additional / reduced duties, taxes and levies due to subsequent additions or changes in legislation shall be reimbursed / deducted as per Sub-Clause 70.2 of the General Conditions of Contract Part-I.
- 12.4 The rates and prices quoted by the Bidders are subject to adjustment during the performance of the Contract in accordance with the provisions of Clause 70 of the Conditions of Contract. The Bidders shall furnish the prescribed information for the price adjustment formulae in Appendix-C to, and shall submit with their bids such other supporting information as required under the said Clause.
- 12.5 The Bidder will be required to provide the Engineer with full and detailed breakdowns of any of his rates or the rates of his sub-contractors whether nominated or otherwise within 3 (three) days of being so requested. The breakdown is to show the actual calculations of the Preliminaries, Labour, Plant and Material costs for the Works, the build-up of measured rates with on-costs and overheads and any other allowances used to arrive at the final rate. The build-up of such rates shall clearly show the ex-works cost of the material (including copies of all relevant quotations invoices or receipts from suppliers or manufacturers), site delivery charges, insurance's, customs duties, off-loading at site and storing, getting out of store, delivery to final position, fixing, any preparatory work, final cleaning, etc. and profit and overheads. Profit and overheads shall be separated into on-site overheads, off-site overheads, and profit and any other costs included under this headings which have not been priced in Preliminaries e.g. financing, insurances, bonds, etc. A detailed breakdown shall also be provided of both on-site and off-site overheads. The Bidder must also be prepared to submit details of his hourly labour rates, commencing from the Labourer's or Tradesman's basic hourly or daily wage.
- 12.6 The quantities contained in the Bill of Quantities are estimated quantities to be used only for comparing Bids. These quantities are likely to vary and payment will only be made on the actual quantities of the work done at the unit rate entered in the Bill of Quantities.

IB.13 Currencies of Bid and Payment

- 13.1 The unit rates and the prices shall be quoted by the Bidder entirely in Pak rupees. A Bidder expecting to incur expenditures in other currencies for inputs to the Works supplied from outside the Employer's country (referred to as the "Foreign Currency Requirements") shall indicate the same in Appendix-B to. The proportion of the Price (excluding Provisional Sums) needed by him for the payment of such Foreign Currency Requirements either (i) entirely in the currency of the Bidder's home country or, (ii) at the Bidder's option, entirely in Pak rupees provided always that a Bidder expecting to incur expenditures in a currency or currencies other than those stated in (i) and (ii) above for a portion of the foreign currency requirements, and wishing to be paid accordingly, shall indicate the respective portions in his bid.
- 13.2 The rates of exchange to be used by the Bidder for currency conversion shall be the TT&OD Selling Rates published or authorized by the State Bank of Pakistan prevailing on the date 28 days prior to the deadline for submission of bids.

For the purpose of payments, the exchange rates used in preparation shall apply for the duration of the Contract. No compensation shall be made due to currency fluctuations or inflation.

IB.14 Validity

- 14.1 Bids shall remain valid for the period stipulated in the Bidding Data/Appendix-A to Bid after the Date of Opening specified in Clause IB.23.
- 14.2 In exceptional circumstances, prior to expiry of the original validity period, the Employer may request that the Bidders extend the period of validity for a specified additional

period which shall in no case be more than the original Bid validity period. The request and the responses thereto shall be made in writing. A Bidder may refuse the request without forfeiting his Security. A Bidder agreeing to the request will not be required or permitted to modify his , but will be required to extend the validity of his Security for the period of the extension, and in compliance with Clause IB.15 in all respects.

IB.15 Bid Security

- 15.1 Each Bidder shall furnish, as part of his bid, a Bid Security in the amount stipulated in the Bidding Data in Pak Rupees or an equivalent amount in a freely convertible currency.
- 15.2 The Bid Security shall be, at the option of the Bidder, in the form of Deposit at Call or a Bank Guarantee issued by a Scheduled Bank in Pakistan or from a foreign bank duly counter guaranteed by a Scheduled Bank in Pakistan in favor of the Employer valid for a period 28 days beyond the Bid Validity date.
- 15.3 Any Bid not accompanied by an acceptable Bid Security shall be rejected by the Employer as non-responsive.
- 15.4 The Bid securities of unsuccessful Bidders will be returned as promptly as possible, but not later than 28 days after the expiration of the period of Bid Validity.
- 15.5 The Bid Security of the successful Bidder will be returned when the Bidder has furnished the required Performance Security and signed the Contract Agreement.
- 15.6 The Bid Security may be forfeited:
 - (a) If the Bidder withdraws his except as provided in Sub-Clause 22.1;
 - (b) If the Bidder does not accept the correction of his Price pursuant to Sub-Clause 27.2 hereof; or
 - (c) In the case of successful Bidder, if he fails within the specified time limit to:
 - (i) Furnish the required Performance Security; or
 - (ii) Sign the Contract Agreement.

IB.16 Alternate Proposals by Bidder

- 16.1 Should any Bidder consider that he can offer, under a separate covering letter with the Bid, marked as Alternate Proposal, any advantages to the Employer by a modification to the designs, specifications or other conditions, he may, in addition to his bid to be submitted in strict compliance with the Bidding Documents, submit any Alternate Proposal(s) containing (a) relevant design calculations; (b) technical specifications; (c) proposed construction methodology; and (d) any other relevant details / conditions, provided always that the total sum entered on the Form of Bid shall be that which represents complete compliance with the Bidding Documents.
- 16.2 Alternate Proposal(s), if any, of the lowest evaluated responsive Bidder only may be considered by the Employer as the basis for the award of Contract to such Bidder.
- 16.3 Acceptance or refusal of any or all such alternatives shall be at the sole discretion of the Employer and no claim for loss of profit or additional expenses will be entertained by the Employer in connection with the incorporation of any or all item(s) of the proposed alternative.
- 16.4 In all other aspects, the alternative Bid shall be deemed to comply with requirements of the Bid documents.

- 16.5 If such alterations necessitate redesign of the Architectural, Structural or MEP drawings then the Contractor will be required to bear the cost of the redesign work.

IB.17 Pre-Bid Meeting

- 17.1 The Employer may, on his own motion or at the request of any prospective Bidder(s), hold a pre- meeting to clarify issues and to answer any questions on matters related to the Bidding Documents. The date, time and venue of pre-bid meeting, if convened, are as stipulated in the Bidding Data. All prospective Bidders or their authorized representatives shall be invited to attend such a pre- meeting.
- 17.2 The Bidders are requested to submit questions, if any, in writing so as to reach the Employer not later than seven (7) days before the proposed pre-meeting.
- 17.3 Minutes of the pre- meeting, including the text of the questions raised and the replies given, will be transmitted without delay to all purchasers of the Bidding Documents. Any modification of the Bidding Documents listed in Sub-Clause 7.1 hereof which may become necessary as a result of the pre- meeting shall be made by the Employer exclusively through an Addendum pursuant to Clause IB.9 and not through the minutes of the pre- meeting.
- 17.4 Absence at the pre-meeting will not be a cause for disqualification of a Bidder.

IB.18 Format and Signing of Bid

- 18.1 Bidders are particularly directed that the amount entered on the Form of Bid shall be for performing the Contract strictly in accordance with the Bidding Documents.
- 18.2 All appendices to Bid are to be properly completed and signed.
- 18.3 No alteration is to be made in the Form of Bid nor in the Appendices thereto except in filling up the blanks as directed. If any such alterations be made or if these instructions be not fully complied with, the Bid may be rejected.
- 18.4 Each Bidder shall prepare by filling out the forms completely and without alterations one (1) original and number of copies, specified in the Bidding Data, of the documents comprising the Bid as described in Clause IB.7 and clearly mark them "ORIGINAL" and "COPY" as appropriate. In the event of discrepancy between them, the original shall prevail.
- 18.5 The original bid and all copies of the Bid shall be typed or written in indelible ink (in the case of copies, Photostats are also acceptable) and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder pursuant to Sub- Clause 11.1(a) hereof. All pages of the Bid shall be initialed and stamped by the person or persons signing the Bid.
- 18.6 The Bid shall contain no alterations, omissions or additions, except to comply with instructions issued by the Employer, or as are necessary to correct errors made by the Bidder, in which case such corrections shall be initialed by the person or persons signing the.
- 18.7 Bidders shall indicate in the space provided in the Form of Bid their full and proper addresses at which notices may be legally served on them and to which all correspondence in connection with their bids and the Contract is to be sent.
- 18.8 Bidders should retain a copy of the Bidding Documents as their file copy.
- 18.9 Each & every page of the priced Bid documents should be stamped and initialed by the Bidder's authorized representative. All Bid prices shall be inserted in ink.

D. SUBMISSION OF BIDS

IB.19 Sealing and Marking of Bids

19.1 Each Bidder shall submit his Bid as under:

- (a) The original Bid Security must be sealed in a separate envelop titled "**BID SECURITY**" If the Bid Security is not found in confirmation with the stipulation of the Bid Documents, the actual Bid shall be rejected and returned to the bidder unopened.
- (b) ORIGINAL and each copy of the Bid shall be separately sealed and put in separate envelopes and marked as such.
- (c) The envelopes containing the ORIGINAL and copies will be put in one sealed envelope and addressed / identified as given in Sub- Clause 19.2 hereof.

19.2 The inner and outer envelopes shall:

- (a) Be addressed to the Employer at the address provided in the Bidding Data;
- (b) Bear the name and identification number of the contract as defined in the Bidding Data; and
- (c) Provide a warning not to open before the time and date for opening, as specified in the Bidding Data.

19.3 In addition to the identification required in Sub- Clause 19.2 hereof, the inner envelope shall indicate the name and address of the Bidder to enable the Bid to be returned unopened in case it is declared "late" pursuant to Clause IB.21

19.4 If the outer envelope is not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.

IB.20 Deadline for Submission of Bids

Employer reserves the right for the Extension in Bid submission date at his own discretion in case found in the best interest of the works.

- 20.1
- (a) Bids must be received by the Employer at the address specified no later than the time and date stipulated in the Bidding Data.
 - (b) Bids with charges payable will not be accepted, nor will arrangements be undertaken to collect the bids from any delivery point other than that specified above. Bidders shall bear all expenses incurred in the preparation and delivery of bids. No claims will be entertained for refund of such expenses.
 - (c) Where delivery of a Bid is by mail and the Bidder wishes to receive an acknowledgment of receipt of such Bid, he shall make a request for such acknowledgment in a separate letter attached to but not included in the sealed package.
 - (d) Upon request, acknowledgment of receipt of bids will be provided to those making delivery in person or by messenger.
- 20.2 The Employer may, at his discretion, extend the deadline for submission of bids by issuing an amendment in accordance with Clause IB.9, in which case all rights and obligations of the Employer and the Bidders previously subject to the original deadline will thereafter be subject to the deadline as extended.

IB.21 Late Bids

- 21.1 (a) Any received by the Employer after the deadline for submission of bids prescribed in Clause IB.20 will be returned unopened to such Bidder.
- (b) Delays in the mail, delays of person in transit, or delivery of a Bid to the wrong office shall not be accepted as an excuse for failure to deliver a Bid at the proper place and time. It shall be the Bidder's responsibility to determine the manner in which timely delivery of his Bid will be accomplished either in person, by messenger or by mail.

IB.22 Modification, Substitution and Withdrawal of Bids

- 22.1 Any Bidder may modify, substitute or withdraw his Bid after Bid submission provided that the modification, substitution or written notice of withdrawal is received by the Employer prior to the deadline for submission of bids.
- 22.2 The modification, substitution, or notice for withdrawal of any Bid shall be prepared, sealed, marked and delivered in accordance with the provisions of Clause IB.19 with the outer and inner envelopes additionally marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL" as appropriate.
- 22.3 No Bid may be modified by a Bidder after the deadline for submission of bids except in accordance with Sub-Clauses 22.1 and 27.2.
- 22.4 Withdrawal of a Bid during the interval between the deadline for submission of Bids and the expiration of the period of validity specified against item 9 of Appendix-A to Bid may result in forfeiture of the Security in pursuance to Clause IB.15.

E. OPENING AND EVALUATION

IB.23 Opening

- 23.1 The Employer will open the bids, including withdrawals, substitution and modifications made pursuant to Clause IB.22, in the presence of Bidders' representatives who choose to attend, at the time, date and location stipulated in the Bidding Data. The Bidders' representatives who are present shall sign a register evidencing their attendance.
- 23.2 Envelopes marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause IB.22 shall not be opened.
- 23.3 The Bidder's name, total Bid Price and Bid Price of any Alternate Proposal(s), any discounts, modifications, substitution and withdrawals, the presence or absence of Security, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening of bids.
- 23.4 Employer shall prepare minutes of the opening, including the information disclosed to those present in accordance with the Sub-Clause 23.3.
- 23.5 The Employer reserves the exclusive right to accept or reject all or any Bid without stating reasons.

IB.24 Process to be Confidential

- 24.1 Information relating to the examination, clarification, evaluation and comparison of Bid and recommendations for the award of a contract shall not be disclosed to Bidders or

any other person not officially concerned with such process before the announcement of Bid evaluation report which shall be done as stipulated in item 10 of Appendix-A to Bid. 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. Any effort by a Bidder to influence the Employer's processing of bids or award decisions may result in the rejection of such Bidder's Bid. Whereas any Bidder feeling aggrieved may lodge a written complaint to the Employer not later than fifteen (15) days after the announcement of the Bid evaluation report; however mere fact of lodging a complaint shall not warrant suspension of the procurement process.

IB.25 Clarification of Bids

- 25.1 To assist in the examination, evaluation and comparison of bids, the Employer may, at his discretion, ask any Bidder for clarification of his bid, including breakdowns of unit rates. The request for clarification and the response shall be in writing but no change in the price or substance of the Bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the bids in accordance with Clause IB.28.

IB.26 Examination of Bids and Determination of Responsiveness

- 26.1 Prior to the detailed evaluation of bids, the Employer will determine whether each Bid is substantially responsive to the requirements of the Bidding Documents.
- 26.2 A substantially responsive Bid is one which (i) meets the eligibility criteria; (ii) has been properly signed; (iii) is accompanied by the required Bid Security; and (iv) conforms to all the terms, conditions and specifications of the Bidding Documents, without material deviation or reservation. A material deviation or reservation is one (i) which affects in any substantial way the scope, quality or performance of the Works; (ii) which limits in any substantial way, inconsistent with the Bidding Documents, the Employer's rights or the Bidder's obligations under the Contract; or (iii) adoption/rectification whereof would affect unfairly the competitive position of other Bidders presenting substantially responsive bids.
- 26.3 If a Bid is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

IB.27 Correction of Errors

- 27.1 Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:
- (a) Where there is a discrepancy between the amounts in figures and in words, the amount in words will govern; and
 - (b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern, unless in the opinion of the Employer there is an obviously gross misplacement of the decimal point in the unit rate, in which case the line item total as quoted will govern and the unit rate will be corrected.
- 27.2 The amount stated in the Form of Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and with the concurrence of the Bidder, shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected Bid Price, his Bid will be rejected, and the Bid Security shall be forfeited in

accordance with Sub- Clause 15.6(b) hereof.

IB.28 Evaluation and Comparison of Bids

- 28.1 The Employer will evaluate and compare only the bids determined to be substantially responsive in accordance with Clause IB.26.
- 28.2 In evaluating the bids, the Employer will determine for each Bid the evaluated Bid Price by adjusting the Price as follows:
- (a) Making any correction for errors pursuant to Clause IB.27;
 - (b) excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities, but including competitively priced Day Work; and
 - (c) Making an appropriate adjustment for any other acceptable variation or deviation.
- 28.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bid evaluation.
- 28.4 If the Bid of the successful Bidder is seriously unbalanced in relation to the Employer's estimate of the cost of work to be performed under the Contract, the Engineer/Employer may require the Bidder to produce detailed price analyses for any or all items of the Bill of Quantities to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the Performance Security set forth in Clause IB.32 be increased at the expense of the successful Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.
- 28.5 Any Bid found to be front loaded shall be liable to rejection unless the Bidder agrees to revise the rates as instructed by the Engineer to arrive at the balanced rates, within 48 hours of instructed so.

F. AWARD OF CONTRACT

IB.29 Award

- 29.1 Subject to Clauses IB.30 and IB.34, 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 Price, provided that such Bidder has been determined to be eligible in accordance with the provisions of Clause IB.3 and qualify pursuant to Sub-Clause IB 29.2.
- 29.2 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.

IB.30 Employer's Right to accept any and to reject any or all Bids

- 30.1 Notwithstanding Clause IB.29, the Employer does not bind himself to accept the lowest or any Bid and will not assign any reason for the rejection of any Bid, and reserves the right to accept or reject any, 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 except that the grounds for rejection of all bids shall upon request be communicated to any bidder who submitted a bid, without justification of grounds. Rejection of all Bids shall be notified to all Bidders promptly.

IB.31 Notification of Award

- 31.1 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. This letter shall name the sum which the Employer will pay the Contractor in consideration of the execution and completion of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Conditions of Contract called the "Contract Price").
- 31.2 No Negotiation with the Bidder having evaluated as lowest responsive or any other Bidder shall take place until the completion of the evaluation process. However, the Employer may have clarification meetings to get clarification of any item in the evaluation report.
- 31.3 The notification of award and its acceptance by the Bidder will constitute the formation of the Contract, binding the Employer and the Bidder till signing of the formal Contract Agreement.
- 31.4 Upon furnishing by the successful Bidder of a Performance Security, the Employer will promptly notify the other Bidders that their Bids have been unsuccessful and return their Bid securities.

IB.32 Performance Security

- 32.1 The successful Bidder shall furnish to the Employer a Performance Security in the form and the amount stipulated in the Bidding Data and the Conditions of Contract within a period of 28 days after the receipt of Letter of Acceptance.
- 32.2 Failure of the successful Bidder to comply with the requirements of Sub-Clause IB.32.1 or Clauses IB.33 or IB.35 shall constitute sufficient grounds for the annulment of the award and forfeiture of the Security.

IB.33 Signing of Contract Agreement

- 33.1 Within 14 (Fourteen) calendar days of submission of the Performance Security the Employer will send the successful Bidder the Contract Agreement in the form provided in the Bidding Documents, incorporating all agreements between the parties.
- 33.2 The formal Agreement between the Employer and the successful Bidder shall be executed within the period stipulated in item 37 of Appendix-A to Bid.

IB.34 General Performance of the Bidders

The Employer reserves the right to obtain information regarding performance of the Bidders on their previously awarded contracts/works. The Employer may in case of consistent poor performance of any Bidder as reported by the employers of the previously awarded contracts, inter-alia, reject his and/or refer the case to the Pakistan Engineering Council (PEC). Upon such reference, PEC in accordance with its rules, procedures and relevant laws of the land take such action as may be deemed appropriate under the circumstances of the case including black listing of such Bidder and debaring him from participation in future Bidding for similar works.

IB.35 Integrity Pact

The Bidder shall sign and stamp the Integrity Pact provided at Appendix-L to in the Bidding Documents for all Federal Government procurement contracts exceeding Rupees ten million. Failure to provide such Integrity Pact shall make the Bidder non-responsive.

IB.36 Instructions not Part of Contract

Bids shall be prepared and submitted in accordance with these Instructions which are provided to assist Bidders in preparing their bids, and do not constitute part of the Bid or the Contract Documents.

Manufacturers / Suppliers of Material

Annexure-A

Sr. No.	Item	Manufacturer	
1	CEMENT	i	LUCKY
		ii	FALCON
		iii	ATTOCK
		iv	D.G
		v	CHERAT
2	STEEL	i	AMRELI
		ii	RAZZAK
		iii	ASG
		iv	HSJ
		v	FAIZAN
		vi	AGHA
3	ALUMINUM	i	Pakistan Cable
		ii	ALCOP
		iii	KRUDSONS
		iv	THERMEC ENGINEERING (PVT.) LTD.
		v	LUCKY ALUMINUM
4	PAINTS	i	ICI PAINTS
		iii	BERGER PAINTS
5	WALL COATINGS	i	ROCK SHIELD
		ii	ROCK WALL
		iii	GRIT WALL FINISHES
6	CERAMIC TILES	i	MASTER TILES
		ii	STILE
		iii	EMCO
7	CONCRETE FLOOR TILES, PAVERS & PAVING BLOCKS,SOLID BLOCKS, HOLLOW BLOCKS & LIGHT WEIGHT BLOCKS	i	ENVICRETE LTD.
		ii	GRAND WORK
		iii	TUFF PAVERS
		iv	HUBCRETE (PVT.) LTD.
		v	IZHAR
		vi	MAGNACRETE
		Vii	BASE BLOCK
		Viii	BANU MUKHTAR
8	FALSE CEILING	i	DAIKEN (JAPAN)
		ii	SADDI METAL
		iii	DAMPA (DENMARK)
9	G.I PIPE	i	M/S. INTERNATIONAL INDUSTRIES LIMITED (IIL)
		iii	M/S. JAMAL PIPE INDUSTRIES (PVT.) LTD.
10	G.I. PIPE FITTING	i	M/S. IIL
		ii	M/S. TG CHINA

11	C.I. PIPE AND FITTING	i	M/S. ALPINE STEEL (PVT.) LTD.
		ii	M/S. SANDAL ENGINEERING (PVT.) LTD.
		iii	(TEEPU SUPREME SPUN PIPES)
12	SANITARY FIXTURES	i	M/S. I.C.L
		iii	M/S. PORTA
		iv	M/S. KARAM CERA
13	KITCHEN SINKS	i	M/S. SUPER ASIA
		ii	M/S. ATLAS
14	SANITARY FITTINGS	i	M/S. MASTER
		ii	M/S. FAISAL
		iii	M/S. PERFECT INDUSTRIES GUJRANWALA
15	VALVES	i	M/S. KITZ-JAPAN OR APPROVED FOREIGN MAKE
16	GAS WATER HEATERS	i	M/S. SINGER
		ii	M/S. CORONA
		iii	M/S. ADMIRAL
17	WATER COOLER	i	M/S. MECCO
		ii	M/S. CARAVELL
		iii	M/S. CORONA
18	C.I. COVERS WITH FRAME FLOOR DRAINAGE & FLOOR CLEANOUTS	i	M/S. ALPINE STEEL (PVT.) LTD.
		ii	M/S. SANDAL ENGINEERING (PVT.) LTD.
19	PVC CONDUIT & ACCESSORIES	i	BETA
		ii	ROYAL
		iii	TESCO
		iv	DADEX
		v	SHAVYL
20	STEEL CONDUIT & ACCESSORIES	i	HILAL INDUSTIES
		ii	III
		iii	JAMAL
		iv	POINEER
		v	BASHIR
21	SWITCHES, SOCKETS ETC.	i	BAUSCH
		ii	MILANO
		iii	LEGRAND
		iv	ABB
		v	CLIPSAL
		vi	ADISON
			OR AS APPROVED BY THE ENGINEER
22	BACK BOXES, PULL BOXES ETC.	i	BAUSCH
		ii	MILANO
		iii	LEGRAND
		iv	ABB
		v	OR AS APPROVED BY THE ENGINEER
		vi	ELECTRA

23	TELEPHONE CABLES DISH ANTENNA CABLES	i	SIEMENS GERMANY
		ii	PAKISTAN CABLES LIMITED
		iii	PIONEER CABLES
		iv	NEWAGE CABLES
		v	COMSCOPE USA & 3M
24	TELEPHONE JUNCTION BOXES	i	S.A. ELECTRIC
		ii	N.R. INDUSTRIES
		iii	MISTO INDUSTRIES
25	FANS	i	PAK
		ii	MILLAT
		iii	CLIMAX
		iv	ROYAL
26	MCCBS AND MCBS	i	MARLIN GERLIN (MG) FRANCE)
		ii	SIEMENS (GERMANY)
		iii	ABB (ITALY)
		iv	LEGRAND
27	ACBs	i	SIMENS (GERMANY)
		ii	ABB (ITALY)
		iii	MG
		iv	LEGRAND
		v	TERASAKI
28	Electric Cables		Pakistan Cables, New Age Cables or Equivalent
29	UPVC pipes		Dadex or equivalent
30	PPR pipes		Dadex or equivalent

BIDDING DATA

Bidding Data

The following specific data for the Works to be bided 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 and address of the Employer:

University of Turbat – Turbat Kech.

1.1.1 Name of the Project & Scope of the Works:

The Project:

Construction of Boundary Wall around Girls Hostel Phase-II

The construction of complete Boundary Wall with Main Gate. The construction works involve complete sub structure, super structure, Architecture works, contractor shall provide all labour, material tools, equipment, supervision services, and other related items required to complete the project as per the scope of work and specifications and other ancillary works

2.1 Name of the Borrower/Source of Financing/Funding Agency:

Higher Education Commission, Government of Pakistan.

2.1 Amount and type of financing: Not applicable

3.1 Eligible Bidders

Duly licensed by the Pakistan Engineering Council (PEC) in appropriate Category.

8.1 Time limit for clarification:

Minimum number of days to seek clarification by the prospective Bidder shall be the number of days before the last date for Bid Submission as specified in (item 3 Appendix-A to Bid).

10.1 Language:

English

11.1 (b) Prequalification Information to be updated:

Following items of information to be updated:

- Evidence of access to financial resources,
- latest status of financial resources commitment for two years (including the current year)
- Works awarded during the interim period
- availability of essential critical equipment, and
- information about litigation presently in process

11.1(c) Furnish Technical Proposal:

The Bidder to submit a technical proposal in sufficient detail to demonstrate the adequacy of the Bid in meeting requirements for timely completion of the Works.

13.1 Bidders to quote entirely in Pak. Rupees.

14.1 Period of validity:

90 (Ninety) calendar days from the date of opening of Bid (Item 9 of Appendix-A to Bid)

15.1 Amount of Bid Security:

Three percent (3%) of the bid amount valid for a period of 28 days after the bid validity period in the form of Bank Draft, Pay Order, Call Deposit Cheque, Bank guarantee from Schedule Bank of Pakistan

17.1 Venue, time, and date of the pre-bid meeting:

Will be informed if required (Item 4 of Appendix-A to Bid)

18.4 Number of copies of the Bid to be completed and returned:

"One original and Three copies, (CDs) will also be required to be submitted by the bidder at the time of bids opening."

- 19.1(d)** The firms which meet the criteria are invited to submit a comprehensive proposal Single Stage One Envelope bidding procedure envelopes, duly marked as such, for the services required not later than the date mentioned in Tender Notice.

19.2(a) Employer's address for the purpose of Bid submission:

**Office of the Project Director,
University of Turbat,
GPO Road, Turbat, Baluchistan**

19.2(b) Name and Number of the Contract:

Construction of Boundary Wall around Girls Hostel Phase-II

Contract No: EUOT/...../.....

20.1(a) Deadline for submission of Bids:

As per NIT (Item 5 in Appendix-A to Bid) Time 11:00 P.M

23.1 Venue, time, and date of opening:

As per NIT (Item 7 in Appendix-A to Bid)

32.1 Standard form and amount of Performance Security acceptable to the Employer:

Within 7(seven) calendar days of LOA for an amount of 10% (Ten) percent of the Accepted Amount named in the Letter of Acceptance in the form of irrevocable bank guarantee, or an Insurance Guarantee from an Insurance company of at least AA rating from PACRA / JCR, acceptable to the Employer. (Item 12 of Appendix-A to Bid)

FORM OF BID AND APPENDICES TO BID

FB-1

FORM OF BID

Reference No. _____
(Name of Contract/Works)

To:

Gentleman,

1. Having examined the Bidding Documents including Instructions to Bidders, Bidding Data, Conditions of Contract, Specifications, Drawings and Bill of Quantities and Addenda Nos. _____ for the execution of the above-named Works, we, the undersigned, offer to execute and complete such Works and remedy any defects therein in conformity with the Conditions of Contract. Specifications, Drawings, Bill of Quantities and Addenda for the sum of Rs. _____ (Rupees _____) or such other sum as may be ascertained in accordance with the said conditions.
2. We understand that all the Appendices 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 Rupees _____ (Rs. _____) drawn in your favour or made payable to you and valid for a period of _____ days beginning from the date bids are opened.
4. We undertake, if our Bid is accepted, to commence the Works and to complete the whole of the Works comprised in the Contract within the time stated in Appendix-A to Bid.
5. We agree to abide by this 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, together with your written acceptance thereof, shall constitute a binding contract between us.
7. We do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other Bidder for the Works.
8. We understand that you are not bound to accept the lowest or any Bid you may receive.

Dated this _____ day of _____ 20____

Signature: _____

In the capacity of _____ duly authorized to sign bids for and on behalf of

(Name of Bidder in Block Capitals)
(Seal)

FB-2

Address: _____

Witness:

Signature: _____

Name: _____

Address. _____

Occupation _____

BA-1
Appendix-A to Bid

SPECIAL STIPULATIONS

For ease of reference, certain information and Special Stipulations applicable to the contract, which are the subject of this Bid, are set forth herein. Where these Conditions conflict with the provisions or requirement set forth elsewhere in the Contract Document, the Conditions as given in Appendix-A to Bid shall govern.

**Clause
Reference**

A- BID SUBMISSION, EVALUATION & VALIDITY			
1	Date of Issuance of Bid	Letter of Invitation for Bid	As per advertisement/Letter of Invitation for Bid
2	Place of Issuance of Bid		As per Letter of Invitation for Bid
3	Last Date for receiving the queries by the Engineer from the Bidder	BD2, 8.1	As per advertisement/Letter of Invitation for Bid
4	Venue, time, and date of the pre-bid meeting	BD-2, 17.1	As per Letter of Invitation for Bid
5	Last Date and Time of Bid submission	BD-2, 20.1 (a)	As per Letter of Invitation for Bid
6	Venue of Bid submission	BD-2, 23.1	Office of Project Director, University of Turbat, GPO Road, Turbat, Balochistan
7	Venue, time, and date of Bid opening	BD-2, 23.1	As per Letter of Invitation for Bid
9	Validity of Bid	BD-2, 14.1	90 (Ninety) calendar days from the date of opening of Bid.
10	Not used		
B- COMMERCIAL			
11	Amount and validity of Bid Security	BD-2, 15.1	Three percent (3%) of the bid amount valid for a period of 28 days after the bid validity period in the form of Bank Draft, Pay Order, Call Deposit Bank guarantee from the Schedule Bank of Pakistan.

12	Time of submission and Amount of Performance Security valid until completion of the expiry of the Defect Liability period.	PCC 10.1, 10.4	Within 14(fourteen) calendar days of LOA for an amount of 10% (Ten) percent of the Accepted Amount named in the Letter of Acceptance in the form of Insurance Guarantee from an Insurance company of at least AA rating from PACRA / JCR, acceptable to the Employer.
13	Amount and Schedule of payment of Mobilization Advance * (Interest Free)	PCC 60.12	10% (Ten percent) of the contract value against a Guarantee in the shape of Bank Guarantee from a Schedule Bank of Pakistan.
14	Recovery of Mobilization Advance.		15% (Fifteen percent) of the IPC value. In any event the entire Amount of Mobilization Advance shall be recovered two months before the original Completion period stipulated in the contract documents.
15	Validity of Mobilization Advance Bond/Guarantee		Construction Period/full recovery of the mobilization advance
16	Secured Advance against materials delivered on site.	PCC 60.11	75 % of the Invoice Value of the material or 50% of BOQ item value, whichever is less.
17	Percentage of Retention money	GCC 60.2	10% (Ten percent) of gross amount of work done from each Interim Payment Certificate
17 a	Limit of Retention Money	GCC 60.2	5% (Five percent) of the Contract Price stated in the Letter of Acceptance
18	Percentage of Retention during Defects Liability Period	GCC 60.3	50% (fifty percent) of total Retention Money shall be released after issuance of Substantial Completion Certificate and the balance 50% after successful completion of Defects Liability Period duly certified by the Engineer or against bank guarantee if payable at the time of completion.
19	Not used		
20	The Ex-Factory Cost of material from approved source to be used shall be:	PCC 60.12	Not Applicable
21	Amount of Liquidated Damages per day in case of non-completion of works within the period specified in Clauses 30 & 31 hereof.	GCC 47.1	0.1% of the contact value per day of delay, for the whole or part of the work remained unfinished, up to a Maximum of 10% (ten percent) of total Contract Price
22	Advanced Liquidated Damages		Assessment of progress shall be done after every 90 days for this purpose.

23	Not used		
24	Table of Exchange Rates	Appendix-B to Bid	Not applicable
25	Currencies of Bid and Payment	BD-2,13.1	Pak Rupees.
<u>C- INSURANCES</u>			
26	Minimum Amount of Third Party Insurance	GCC 23.2	Rs. One million per occurrence. No. of occurrences unlimited.
27	Minimum Amount of CAR Policy	PCC 21.1, 21.4	Contract Price plus 15% of the replacement cost
28	Validity of Third party and CAR Policies		Construction plus Defects Liability Periods
29	Validity of Workmen Compensation Policy	GCC 24.1, 24.2	Construction plus Defects Liability Periods
30	Approved Insurance Companies with treaty bond limit	PCC 25.5,	At least AA rating from PACRA / JCR, approved by the Employer
<u>D- TIMES, DATES & PERIODS</u>			
31	Not used		
32	Time for furnishing the letter of acceptance by the Bidder along with his the Program of Work & Cash Flow	PCC 14.1. i & ii, 14.5	Within 14 (fourteen) calendar days following receipt of the Letter of Acceptance (LOA) by the Employer.
33	Penalty in case of delay in submission of Program of Work & Cash Flow		Not applicable
34	Submission of the Shop Drawings & As-Built Drawings	PCC 6.6,6.7	Shop Drawings : within 14 days of instruction of the Engineer's As-Built Drawings: within 28 days of substantial completion of the project.
35	Penalty in case of delay in submission of Shop Drawings		Not applicable
36	Time for sending the Contract for signing by the Contractor.		Not applicable
37	Time for signing the Contract Agreement	See IB.33	Within 14(Fourteen) calendar of Contractor's acceptance of Employer's LOA
38	Time for Engineer's Order to Commence the work	PCC 41.1	Within 7 (seven) calendar days of signing of the Contract Agreement

39	Date of commencement of work	PCC 41.1	Within 14 (Fourteen) calendar days from the date of receipt of Engineer's Notice to Commence.
41	Time of completion of Overall Works	GCC 43.1, 48.2; SP 8	06 Months (180) Calendar days including Mobilization from the date of receipt of Engineer's Notice to Commence.
42	Defect Liability Period	GCC 49.1	365 (Three hundred sixty five) days from the effective date of Taking Over Certificate
<u>E- PAYMENTS</u>			
43	Minimum amount of interim payment certificate	PCC 60.2	7% minimum of the total value of the work named in the Letter of Acceptance
44	Intervals for Interim Payments	PCC 60.1	Monthly
45	Not used		
46	Time of payment from delivery of Engineer's Interim Payment Certificate to the Employer	PCC 60.10	Within 28 (twenty eight) calendar days, after issuance of Payment Certificate by the Engineer
47	Time of payment from delivery of Engineer's Final Payment Certificate to the Employer		Within 56 (fifty six) calendar days after the date of Substantial Completion of the works, subject to submission of the Bill by the Contractor
48	Delay in Payment to the Contractor from the Employer	PCC 60.10	In case of delay in payment from the Employer, the contractor shall be compensated as per the clause referred herein.
49	Rate of Interest on Unpaid Sums	GCC 60.10	Not applicable
<u>F- GENERAL</u>			
50	Alternate Proposal	IB.16	Not allowed
51	Engineer's Authority to issue Variation in emergency	PCC 2.1.viii	2% of the Contract Price stated in the Letter of Acceptance.
52	Engineer's Fee in case of delay in completion for reasons Contractor shall be responsible for	PCC 80.1	These charges shall be deducted from Contractor's running / Final Bill (s), and shall be paid by the Employer to the Engineer.
53	Not used		
54	Governing Law	GCC 5.1	Law of Islamic Republic of Pakistan
55	Venue of arbitration	PCC 67.3	Karachi, Pakistan

BB-1
Appendix-B to Bid

FOREIGN CURRENCY REQUIREMENTS

1. The Bidder may indicate here in below requirements of foreign currency (if any), with reference to various inputs to the project.
2. Foreign Currency Requirement as percentage of the Price excluding Provisional Sums _____%.
3. Table of Exchange Rates

Unit of Currency	Equivalent in Pak. Rupees
Australian Dollar	-----
Euro	-----
Japanese Yen	-----
U.K. Pound	-----
U.S. Dollars	-----
-----	-----
-----	-----

PRICE ADJUSTMENT UNDER CLAUSE 70 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:

(To be filled by the Employer)

Cost Element	Description	Weightages	Applicable index
1	2	3	4
(i)	Fixed Portion	0.38	Government of Pakistan (GP) Federal Bureau of Statistics (FBS) Monthly Statistical Bulletin.
(ii)	Local Labour**	0.12	
(iii)	Cement – in bags	0.15	
(iv)	Reinforcing Steel	0.30	
(v)	High Speed Diesel (HSD)	0.05	
	Total	1.00	

** Percentage increase in the cost of Unskilled Labour as arrived from the above Monthly Statistical Bulletin shall be applicable to the Skilled Labour of any trade as well.

Notes:

- 1) Indices for "(ii)" to "(vii)" 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) Any price adjustment shall be worked out only by taking the difference between the base cost indices or prices stated in the Government of Pakistan Federal Bureau of Statistics, Monthly Statistical Bulletin 28 days prior to the latest day for submission of bids and those indices or prices applying 28 days prior to the last day of the billing period taken from.

The actual amount of above stated adjustments shall be calculated as stipulated in clauses 70.1 of the Particular Conditions for Contract, and GS/SCC-34 of Supplementary Conditions of Contract.

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

BD-1
Appendix-D to Bid

BILL OF QUANTITIES

See separate volume - III

Separately Bounded

BE-1

Appendix-E to Bid

PROPOSED CONSTRUCTION SCHEDULE

Pursuant to Sub-Clause 43.1 of the General Conditions of Contract, the Works shall be completed on or before the date stated in Appendix-A to Bid. The Bidder shall provide as Appendix-E to Bid, the Construction Schedule in the bar chart (CPM, PERT or any other to be specified herein) showing the sequence of work items and the period of time during which he proposes to complete each work item in such a manner that his proposed programme for completion of the whole of the Works and parts of the Works may meet Employer's completion targets in days noted below and counted from the date of receipt of Engineer's Notice to Commence (Attach sheets as required for the specified form of Construction Schedule):

<u>Description</u>	<u>Time for Completion</u>
a) Whole Works	_____days

PRE BID

All Bids must be accompanied by a preliminary Construction Schedule and the Organization Chart prepared in the latest version of software e.g. M.S. Project or Primavera and Visio.

The Construction Schedule and a Method Statement has been formed a part of the priced Bill of Quantity. The Bidders are required to fill out the commencement and completion dates of all the major milestones and activities as outlined above. Special weightage will be given to the bidder's construction schedule at the time of evaluation of their bids.

The construction schedule shall contain the details of construction programme proposed by the Bidders for carrying out the Work from commencement of mobilization to the completion of Work.

The construction schedule shall be in such form and sufficient details so as to adequately show the sequence of proposed operations, period of time estimated for completion of each phase of work.

AFTER ACCEPTANCE OF BID

- i Within a week, after the acceptance of his Bid, the Contractor shall have a meeting with Engineer and ascertain the available data to enable the Contractor to submit a programme in writing to the Engineer within 14 days of the letter of Acceptance, showing the order of procedure, the method and arrangements for carrying out the works and of the constructional plant and temporary works which the Contractor intends to supply, use or construct as the case may be and full particulars of the organization and the staff by which he proposes to direct and administer his performance of the contract. The Contractor shall not delay the submission of the programme for want of formal issuance of any drawings, design etc.
- ii The construction program/schedule to be updated modified from time to time with the mutual consent of the Engineer and the Contractor and subject to the approval of the Employer. The submission to or approval by the Engineer of such programme or the furnishing of such particulars or information shall not relieve the Contractor of any of his duties or responsibilities under the Contract.
- iii The programme/schedule shall be comprehensive and shall show all critical non-critical activities of principal elements and types of construction or operation is scheduled to begin and when it should be complete. The programme shall also indicate the period when double shift or night work is likely to be requested.

BF-1
Appendix-F to Bid

METHOD OF PERFORMING THE WORK

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

1. Organization Chart indicating head office and field office personnel involved in management and supervision, engineering, equipment maintenance and purchasing.
2. Mobilization in Pakistan, the type of facilities including personnel accommodation, office accommodation, provision for maintenance and for storage, communications, security and other services to be used.
3. The method of executing the Works, the procedures for installation of equipment and machinery and transportation of equipment and materials to the site.
4. An outline of his proposed method of construction which shall clearly define the sequence of construction, the co-ordination of the works between that of the Main Contractor and sub-contractors whether nominated or otherwise and all other relevant factors to allow the Engineer to properly evaluate the Bidder's proposal.
5. In addition to a general construction scheme, the contractor shall be required to submit for Engineer/Consultants approval comprehensive construction schemes/methodologies proposed by the contractor for specialized works such as Pile Foundation, Dewatering, Excavation, Formwork and Concreting, Pre-cast Paneling and Curtain Wall etc., in addition, for any other works as may be required by the Engineer. Such specialized works shall be undertaken by the contractor only after the requisite scheme /methodology is approved by the Engineer/Consultant.

The Bidder, keeping in view his clause 14 programme, size and shape of the building, shall submit together with his Bid an outline of his proposed method of construction which shall clearly define all other relevant factors to allow the Engineer to properly evaluate the Bidder's proposal, including but not limited to a Plan showing all dimensions and levels of-

- a- Outline of the plot, and the working space (if available) showing the layout of Temporary Fencing,
- b- Location and sizes of the offices for Employer, Engineer, Contractor & all Subcontractors, and & Parking spaces for their cars.
- c- Storage spaces for Formwork, Cement, Aggregate & Rebars,
- d- Workshops (if required)
- e- Pedestrian Entrance and Vehicular Entrance for the heavy machinery & Mobile Concrete Mixers & Pumps etc,
- f- Roof Plan of the entire building showing external periphery and level of the Podium Top of the building, external periphery of the Tower/(s) with levels at every change of area,
- g- Position of Hoists for Workers
- j- Position and capacity of tower cranes showing the boom length and circumference, etc.

BG-1

Appendix-G to Bid

LIST OF MAJOR EQUIPMENT – RELATED ITEMS

[The Bidder will provide on Sheet 2 of this Appendix a list of all major equipment and related items, under separate heading for items owned, to be purchased or to be arranged on lease by him to carry out the Works. The information shall include make, type, capacity, and anticipated period of utilization for all equipment which shall be in sufficient detail to demonstrate fully that the equipment will meet all requirements of the Specifications.]

BG-2

Appendix-G to Bid

LIST OF MAJOR EQUIPMENT

Owned Purchased or Leased	Description of Unit (Make, Model, Year)	Capacity HP Rating	Condition	Present Location or Source	Date of Delivery at Site	Period of Work on Project
1	2	3	4	5	6	7
a. Owned						
b. To be Purchased						
c. To be arranged on Lease						

BH-1

Appendix-H to Bid

CONSTRUCTION CAMP AND HOUSING FACILITIES

The Contractor in accordance with Clause 34 of the Conditions of Contract shall provide description of his construction camp's facilities and staff housing requirements.

The Contractor shall be responsible for pumps, electrical power, water and electrical distribution systems, and sewerage system including all fittings, pipes and other items necessary for servicing the Contractor's construction camp.

The Bidder shall list or explain his plans for providing these facilities for the service of the Contract as follows:

1. Site Preparation (clearing, land preparation, etc.).
2. Provision of Services.
 - a) Power (expected power load, etc.).
 - b) Water (required amount and system proposed).
 - c) Sanitation (sewage disposal system, etc.).
3. Construction of Facilities
 - a) Contractor's Office. Workshop and Work Areas (areas required and proposed layout, type of construction of buildings, etc.).
 - b) Warehouses and Storage Areas (area required, type of construction and layout).
 - c) Housing and Staff Facilities (Plans for housing for proposed staff, layout, type of construction, etc.).
4. Construction Equipment Assembly and Preparation (detailed plans for carrying out this activity).
5. Other Items Proposed (Security services, etc.).

BI-1

Appendix-I to Bid

LIST OF SUBCONTRACTORS

I/We intend to subcontract the following parts of the Work to subcontractors. In my/our opinion, the subcontractors named hereunder are reliable and competent to perform that part of the work for which each is listed.

Enclosed are documentation outlining experience of subcontractors, the curriculum vitae and experience of their key personnel who will be assigned to the Contract, equipment to be supplied by them, size, location and type of contracts carried out in the past.

Part of Works (Give Details)	Subcontractor (With Complete Address)
1	2

BJ-1

Appendix-J to Bid

ESTIMATED PROGRESS PAYMENTS

Bidder's estimate of the value of work which would be executed by him during each of the periods stated below, based on his Programme of the Works and the Rates in the Bill of Quantities, expressed in thousands of Pakistani Rupees:

Quarter/ Year/ Period	Amounts (1,000 Rs.)
1	2
1 st Quarter	
2 nd Quarter	
3 rd Quarter	
4 th Quarter	
5 th Quarter	
6 th Quarter	
7 th Quarter	
8 th Quarter	
Price	

BK-1

Appendix-K to Bid

**ORGANIZATION CHART
FOR THE
SUPERVISORY STAFF AND LABOUR**

The Bidder shall submit with his Bid, names and qualifications of all key personnel to be involved with the contract

BL-1
Appendix-L 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 times 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]

FORMS

BID SECURITY

PERFORMANCE SECURITY

CONTRACT AGREEMENT

MOBILIZATION ADVANCE GUARANTEE

BS-1

BID SECURITY (Bank Guarantee)

(On the required value of non-judicial stamp paper of the Government of Pakistan)

Security Executed on _____
(Date)

Name of Surety (Bank) with Address: _____
(Scheduled Bank in Pakistan)

Name of Principal (Bidder) with Address _____

Penal Sum of Security Rupees. _____ (Rs. _____)

Reference No. _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the and at the request of the said Principal (Bidder) we, the Surety above named, are held and firmly bound unto

_____ (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 Bidder has submitted the accompanying dated _____ for No. _____ for _____ (Particulars of) to the said Employer; and

WHEREAS, the Employer has required as a condition for considering said that the Bidder furnishes a Security in the above said sum from a Scheduled Bank in Pakistan or from a foreign bank duly counter-guaranteed by a Scheduled Bank in Pakistan, to the Employer, conditioned as under:

- (1) That the Security shall remain in force up to and including the date 28 days after the deadline for validity of bids as stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Surety is hereby waived;
- (2) That the Security of unsuccessful Bidders will be returned by the Employer after expiry of its validity or upon signing of the Contract Agreement; and
- (3) That in the event of failure of the successful Bidder to execute the proposed Contract Agreement for such work and furnish the required Performance Security, the entire said sum be paid immediately to the said Employer pursuant to Clause 15.6 of the Instruction to Bidders 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 with the said Employer in accordance with his as accepted and furnish within twenty eight (28) days of his being requested to do so, 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 within the time specified for its validity then this obligation shall be void and of no effect, but otherwise to remain in full force and effect.

PROVIDED THAT the Surety shall forthwith pay the Employer the said sum 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 Surety at its address given above.

BS-2

PROVIDED ALSO THAT the Employer shall be the sole and final judge for deciding whether the Principal (Bidder) 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 Surety shall pay without objection the said sum upon demand from the Employer forthwith and without any reference to the Principal (Bidder) or any other person.

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

SURETY (Bank)

WITNESS:

Signature _____

1. _____

Name _____

Title _____

Corporate Secretary (Seal)

Corporate Guarantor (Seal)

2. _____

Name, Title & Address

PS-1

FORM OF PERFORMANCE SECURITY (Bank Guarantee)

Guarantee No. _____
Executed on _____
Expiry date _____

[Letter by the Guarantor to the Employer]

Name of Guarantor (Bank) with address: _____
(Scheduled Bank in Pakistan)

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 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 49, Defects Liability, 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 defenses 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 which payment will be effected by the Guarantor to Employer's designated Bank & Account Number.

PS-2

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-bounden 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. _____	Signature _____
_____	Name _____
Corporate Secretary (Seal)	
Title _____	
2. _____	
_____	_____
Name, Title & Address	Corporate Guarantor (Seal)

CA-1

FORM OF CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT (hereinafter called the "Agreement") made on the _____ day _____ of _____ (month) 20____ between _____ (hereafter called the "Employer") of the one part and _____ (hereafter 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 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, listed in their priority order, 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 Contract Agreement;
 - (b) The Letter of Acceptance;
 - (c) The completed Form of Bid;
 - (d) Special Stipulations (Appendix-A to Bid);
 - (e) The Particular Conditions of Contract – Part II;
 - (f) The General Conditions – Part I;
 - (g) The priced Bill of Quantities (Appendix-D to Bid);
 - (h) The completed Appendices to Bid (B, C, E to L);
 - (i) The Drawings;
 - (j) The Specifications.
 - (k) _____ (any other)
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 with 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 Agreement to be executed on the day, month and year first before written in accordance with their respective laws.

Signature of the Contactor

(Seal)

Signature of Employer

(Seal)

CA-2

Signed, Sealed and Delivered in the presence of:

Witness:

(Name, Title and Address)

Witness:

(Name, Title and Address)

MG-1

MOBILIZATION ADVANCE BANK GUARANTEE

Guarantee No. _____ Date _____

WHEREAS _____ (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 Rupees _____ (Rs _____) 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 mobilization advance for the performance of his obligations under the said Contract.

AND WHEREAS, _____
(Scheduled Bank in Pakistan or Insurance Company acceptable to the Employer)
(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 fulfilment 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, 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 remain in force until the advance is fully adjusted against payments from the Interim Payment Certificates of the Contractor or until _____ whichever is earlier.

(Date)

The Guarantor's liability under this Guarantee shall not in any case exceed the sum of Rupees _____ (Rs _____).

This Guarantee shall remain valid up to the aforesaid date and shall be null and void after the aforesaid date or earlier if the advance made to the Contractor is fully adjusted against payments from Interim Payment Certificates of the Contractor provided that the Guarantor agrees that the aforesaid period of validity shall be deemed to be extended if on the above mentioned date the advance payment is not fully adjusted.

GUARANTOR

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

MG-2

WITNESS

1. _____

Corporate Secretary (Seal)

2. _____
(Name Title & Address)

Corporate Guarantor (Seal)

FEDERATION INTERNATIONALE DES INGENIEURS-

Bidder is supposed to possess a copy with him

FEDERATION INTERNATIONALE DES INGENIEURS- CONSEILS

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

“Copies of the FIDIC Conditions of Contract can be obtained from:

FIDIC Secretariat
P.O. Box 86, 1000 Lausanne 12, Switzerland
E-mail: fidic.pub@fidic.org – FIDIC.org/bookshop]

CONSEILS

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

“Copies of the FIDIC Conditions of Contract can be obtained from:

FIDIC Secretariat
P.O. Box 86, 1000 Lausanne 12, Switzerland
E-mail: fidic.pub@fidic.org – FIDIC.org/bookshop]

TABLE OF CONTENTS

PART II - PARTICULAR CONDITIONS OF CONTRACT

Clause	Title	Page
1.1	Definitions	1
2.1	Engineer's Duties and Authority	1
2.2	Engineer's Representative	2
2.7	Engineer Not Liable	2
2.8	Replacement of the Engineer	3
5.1	Language(s) and Law	3
5.2	Priority of Contract Documents	3
6.6	Shop Drawings	3
6.7	As-Built Drawings	4
10.1	Performance Security	4
10.4	Performance Security Binding on Variations and Changes	4
14.1	Programme to be Submitted	4
14.3	Cash Flow Estimate to be Submitted	4
14.5	Detailed Programme and Monthly Progress Report	4
15.2	Language Ability of Contractor's Representative	5
15.3	Contractor's Representative	5
16.3	Language Ability of Superintending Staff of Contractor	6
16.4	Employment of Local Personnel	6
19.3	Safety Precautions	6
19.4	Lighting Works at Night	6
20.4	Employer's Risks	6
21.1	Insurance of Works and Contractor's Equipment	7
21.4	Exclusions	7
25.5	Insurance Company	7
31.3	Co-operation with Other Contractors	8
31.4	Coordination with other Contractor(s) (Gen Req- 1.32)	8
34.2	Rates of Wages and Conditions of Labour	8
34.3	Employment of Persons in the Service of Others	8
34.4	Housing for Labour	8
34.5	Health and Safety	9
34.6	Epidemics	9
34.7	Supply of Water	9
34.8	Alcoholic Liquor or Drugs	9
34.9	Arms and Ammunition	9
34.10	Festivals and Religious Customs	9
34.11	Disorderly Conduct	9
34.12	Compliance by Subcontractors	10
35.2	Records of Safety and Health	10
35.3	Reporting of Accidents	10
36.6	Use of Pakistani Materials and Services	10
41.1	Commencement of Works	10
47.3	Bonus for Early Completion of Works	10
48.2	Taking Over of Sections or Parts	10
51.2	Instructions for Variations	11

Clause	Title	Page
52.1	Valuation of Variations	11
53.4	Failure to Comply	11
54.3	Customs Clearance	11
54.5	Conditions of Hire of Contractor's Equipment	11
59.4	Payments to Nominated Sub-contractors	11
59.5	Certification of Payments & Nominated Subcontractors	11
60.1	Monthly Statements	12
60.2	Monthly Payments	12
60.10	Time for Payment	12
60.11	Secured Advance on Materials	12
60.12	Financial Assistance to Contractor	13
63.1	Default of Contractor	15
65.2	Special Risks	15
67.3	Arbitration	15
68.1	Notice to Contractor	15
68.2	Notice to Employer and Engineer	16
70.1	Increase or Decrease of Cost	16
73.1	Payment of Income Tax	17
73.2	Customs Duty & Taxes	18
74.1	Integrity Pact	18
75.1	Termination of Contract for Employer's Convenience	18
76.1	Liability of Contractor	18
77.1	Joint and Several Liability	18
78.1	Details to be Confidential	18
79.1	Increase or Decrease of Cost	19
80.1	Supervision after Expiry of the Completion Period	19
81.1	Documents not to be Altered or Mutilated	19
	Index	21

**PART II - PARTICULAR CONDITIONS OF CONTRACT
(Mandatory Provisions not to be Amended / Substituted except
As instructed by PEC)**

1.1 Definitions

The Employer is **The Federal Government of Pakistan** through **Higher Education Commission**

- (a) (i) **The Engineer is the Employer himself**, or any other competent person appointed by the Employer, nominated as Engineer and notified to the Contractor, to act in replacement of the Engineer. Provided always that except in cases of professional misconduct, the outgoing Engineer is to formulate his certifications/recommendations in relation to all outstanding matters, disputes and claims relating to the execution of the Works during his tenure.

The following paragraph is added:

- (a)(iv) "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 there from 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 here below, 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".

(Note: Employer may further vary according to need of the project)

* (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) Supplementary condition of contract-Part III
- (6) The Particular Conditions of Contract – Part II;
- (7) The General Conditions – Part I;
- (8) The priced Bill of Quantities (Appendix-D to Bid);
- (9) The completed Appendices to Bid (B, C, E to L);
- (10) The Drawings;
- (11) The Specifications; and
- (12) (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 (i.e. Soft copy in latest AutoCAD Format) amended to conform to the Works as built. The price of such Drawings shall be deemed to be included in the Contract Price.

9.1 Contract Agreement

Delete the entire text and substitute:

The Contractor shall enter into and execute the Contract Agreement, to be prepared and completed at the cost of the Contractor, in the form annexed to these Conditions with such modifications as may be necessary. The Contractor shall pay all taxes and duties in connection with the preparation of Agreement. The Contractor shall provide five copies of signed Contract Documents to the Employer in proper book form for record. All costs for preparing and providing the copies of the Contract Documents shall be borne by the Contractor.

10.1 Performance Security (Item 12 of Appendix-A to Bid)

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 the period as stipulated in item 12 of Appendix-A to Bid after the receipt of the Letter of Acceptance. The Performance Security shall be of an amount equal to 10% of the Contract Price stated in the Letter of Acceptance. Such Security shall be in the form of either (a) bank guarantee from any Scheduled Bank in Pakistan or (b) bank guarantee from a bank located outside Pakistan duly counter-guaranteed by a Scheduled Bank in Pakistan.

The cost of complying with requirements of this Sub-Clause shall be borne by the Contractor.

The following Sub-Clause 10.4 is added:

10.4 Performance Security Binding on Variations and Changes (Item 12 of Appendix-A to Bid)

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.

11.1 Inspection of Site

Add the following at the end of sub-clause

If any data is provided by the Employer, the Contractor is solely responsible for ascertaining The correctness of such data and the Employer shall not be liable in this behalf and no claim whatsoever in nature shall be entertained by the Engineer.

14.1 Programme to be submitted

The programme shall be submitted within 07 days from the date of receipt of Letter of Acceptance, which shall be in the form of:

- i) Level-IV Work Schedule on latest version of Primavera.
- ii) CPM identifying the critical path/activities.

14.3 Cash Flow Estimate to be submitted

The detailed Cash Flow Estimate shall be submitted within 14 Calendar 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, 5 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 authorized 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 should be registered 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 staffs 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.

19.1 Safety, Security and Protection of Environment

Add the following paragraphs (d), (e) and (f) at the end:

d) The contractor, to ensure protections of the environment, shall take all necessary Measures and precautions in conformity with statutory and regulatory environmental Requirements enforced and amended from time to time.

e) The Contractor shall exercise due care to protect the natural landscape and shall Conduct his construction operations so as to prevent any unnecessary destruction, scarring or defacing of the natural surroundings in the vicinity of the Works, except Where clearing is required for Permanent Works, Approved Temporary Works and for Excavation operations. All watercourses, ponds wells trees and native vegetation shall be preserved and shall be protected from damage, which may be caused, by the Contractor's construction operations and equipment. On completion of the Works, all work areas shall be smoothed and graded in a manner to conform to the natural appearance of the landscape. Where unavoidable, destruction, scarring, damage or defacing may occur as a result of the Contractor's operations, it shall be repaired, replaced, replanted or otherwise corrected at Contractor's expenses to the satisfaction of the Engineer and national and/or provincial Environment Protection Agency.

f) During performance of the work, the Contractor shall carryout proper and sufficient measures as often as necessary to reduce dust pollution.

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

As per items 27 & 28 of Appendix-A to Bid

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-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.

44.1 Extension of time for completion

Delete the entire text of this Sub- Clause and substitute as follows:

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 breach of Contract by the Contractor 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. For the avoidance of doubt, it is clarified that the special circumstances referred to in this Sub-Clause 44.1(e) shall not include any occurrence in any part of the country where the Works are located or to be performed which gives rise to generalized security, safety or other concern to the Contractor or his Subcontractors or to the their employees.

The following Sub-Clause 47.3 is added:

47.3 Bonus for Early Completion of Works

The Contractor shall in case of earlier completion for either whole or part(s) of the Works pursuant to Sub-Clauses 48.1 and 48.2(a) respectively of the General Conditions of Contract, be paid bonus up-to a limit and at a rate equivalent to 50% of the relevant limit and rate of liquidated damages prescribed in Appendix-A to Bid "Special Stipulations".

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?

For any additional item, if the Contract does not contain any rates or prices applicable to the varied work, the rates and prices in the Contract shall be worked out on the basis of prevailing market rates for the basic cost of the item, and a markup of 25% only should be added for all type of Overheads, Profit and the Income Tax etc.

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-Clause 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" minimum value of IPC should not be less than 7% of contract value.

60.8 Final Payment Certificate

Delete the words "other than pursuant to Clause 47" from para (b) line 2 and 3
Add the following para at the end of this sub-clause The Contractor shall also submit the following documents with his final statement to the Engineer:

- (a) Approved final As-built drawings.
- (b) An affidavit by the Contractor that the Works have been executed according to approved specifications, drawings, designs and standard and have not concealed any defects known to him together with a "No Claim Certificate

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 14 days after such Interim Payment Certificate has been delivered to the Employer, or, in the case of the Final Certificate referred to in Sub Clause 60.8, within 28 days after such Final Payment Certificate has been delivered to the Employer; Provided that the Interim Payment shall be caused in 42 days and Final Payment in 56 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 rate of 8% per annum in local 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 60.12 is added:

60.11 Secured Advance on Materials (Item 16 of Appendix-A to Bid)

- 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 (Only Steel reinforcement bars)** 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 there for;

- (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 affected from the monthly payments on actual consumption basis.
 - (c) This advance will be allowed only against an agreement/bond to be executed by the Contractor, undertaking that the material shall not be removed from the site without written permission from the Employer. A certificate in respect of the quantity and cost of the material brought to the Site by the Contractor will be issued by the Engineer for obtaining advance from the Employer.

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:

(Appropriate alternative only to be retained)

Alternative One: Mobilization Advance (13 of Appendix-A to Bid)

- (a) An interest-free Mobilization Advance up to 10% of the Contract Price stated in the Letter of Acceptance shall be paid by the Employer to the Contractor in two equal parts upon submission by the Contractor of a Mobilization Advance Guarantee for the full amount of the Advance in the specified form from a Scheduled Bank in Pakistan.
 - (1) First part within 14 days after signing of the Contract Agreement or date of receipt of Engineer's Notice to Commence, whichever is earlier; and
 - (2) Second part within 42 days from the date of payment of the first part, subject to the satisfaction of the Engineer as to the state of mobilization of the Contractor.
- (b) This Advance shall be recovered in equal instalments; first instalment at the expiry of third month after the date of payment of first part of Advance and the last instalment two months before the date of completion of the Works as per Clause 43 hereof.

Alternative Two: Mobilization/ Demobilization Cost

Mobilization Cost shall be paid to the Contractor as a part of the priced Bill of Quantities. This cost shall not exceed 10 % of the Tender Price and shall be paid to the Contractor as follows:

- (i) 80 % of the Mobilization Cost shall be paid for mobilization at Site. This payment shall be in three stages as follows:
- Stage I: 20 % of Mobilization Cost upon obtaining and furnishing of Performance Security and insurance policies and construction of camp and housing facilities as required under the Contract;
 - Stage II: 30 % of Mobilization Cost upon providing and installing preliminary requirements of Contractor's Equipment, materials and temporary structures for the commencement of Works to the satisfaction of the Engineer and achieving 3 % value of the Works (excluding payment under Stage-I);
 - Stage III: 30 % of Mobilization Cost upon providing balance Contractor's Equipment to complete full requirement for the entire work and after achievement of progress to the extent of 6 % value of the Works (excluding payments under Stages I and II); and
- (ii) 20 % of Mobilization Cost shall be paid for operation and maintenance of the constructed facilities and for demobilization as per schedule of payment to be submitted by the Contractor in accordance with Clause 57.2 and approved by the Engineer.

Alternative Three: Materials Supplied by Employer

The Employer shall supply to the Contractor materials, like cement, steel, bitumen or any other material whichever deemed necessary to complete the project; and the cost thereof shall be recovered from the Contractor through monthly statements on the basis of actual consumption.

The list of materials, quantities and rates to be charged to the Contractor shall be provided alongwith Appendix-A to Bid "Special Stipulations".

(Employer may opt either "Secured Advance on Materials" or "Financial Assistance to Contractor")

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 as mentioned in Item 55 of the Appendix-A to Bid.

68.1 Notices 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:

Higher Education Commission of Pakistan.

b) The Engineer:

EA Consulting Pvt. Ltd

Al-9, 15th Lane, Khayaban-e-Hilal, Phase-VII, DHA. Karachi-75500.

Tel: 111-111-584, Fax: 35841825

70.1 Increase or Decrease of Cost

Sub-Clause 70.1 is deleted in its entirety.

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. Formula for Price Adjustment

1. The formula mentioned below is in its generalized form. The Employer/ user shall determine the proportions of A, b, c, d, by appropriate rate analysis following the procedure enumerated herein below:

$$P_n = A + \frac{L_n}{b L_o} + \frac{M_n}{c M_o} + d \frac{E_n}{E_o} + \dots\dots\dots$$

where,

"P_n" is the Price Adjustment factor for the work carried out in the period "n".

"A" is a constant or the Non-Adjustable Portion of the Price Adjustment Factor to be specified in Appendix-C to Bid, representing the Non-Adjustable Portion of the Contract Price.

"b, c, d" are Coefficients or weightages of the order of 0. xx (i.e., fractions rounded off to two decimals) for each specified element of adjustment in the Contract. The sum of A, b, c, d, etc., shall be one.

"L_o, M_o, E_o "are the Base Date Prices/ Indices for the specified (adjustable) elements.

"L_n, M_n, E_n "are the Current Date Prices/ Indices of the specified (adjustable) elements for the period "n".

If "P" is the amount payable (prior to adjustment) at the rates entered in the Price Schedule of the work carried out in period "n" then, Adjusted amount payable to the Contractor for the work carried out in the period "n" shall be equal to **P_nxP**.

For the purpose of calculating P_n, the coefficient for each eligible element shall be used irrespective of the actual constituents of the work performed during the billing period.

2. Base Date Prices and Current Date Prices

The Base Date Prices and Current Date Prices of the specified elements shall be obtained from the sources specified in the Amendment to the contract.

3. Elements for Price Adjustment

The Specific Elements for highway and bridge construction would typically be:

- (i) POL (HSD);
- (ii) Labour;
- (iii) Cement;
- (iv) Steel;
- (v) Bitumen;
- (vi) Aggregate ; and
- (vii) Other major elements depending on the nature of the project.

Similarly, the specified elements for building construction would typically be:

- (i) POL (HSD);
- (ii) Labour ;
- (iii) Cement;
- (iv) Steel;
- (v) Bricks;
- (vi) Tiles;
- (vii) Cables;
- (viii) Conduits (all types);
- (ix) Pipes (all types);
- (x) Steel Sheet (all types);
- (xi) Steel Sections (all types);
- (xii) Aluminum Sections (all types);
- (xiii) Electric Switch Gears; and
- (xiv) Other major elements depending upon the nature of the project.

Similarly, major specified elements for other types of projects can be specified in the Amendment to the Contract in addition to or instead of the specified elements as enumerated above.

4. Coefficients or Weightages

The coefficient for each specified adjustable element shall be determined by the user proportionate to its ratio in the Contract Price, in accordance with the procedure D-1 given under Part-I. The sum of these coefficients shall form the adjustable portion of the Contract, which shall not exceed 0.70.

5. Adjustable Portion of the Contract

The adjustable portion of the Contract shall be computed as provided in foregoing Procedures,

6. Sources of Prices

Sources of Base Date Prices and. Current Date Prices shall be as stipulated at item D-4 under Part-I. The sources shall be clearly stated in the Amendment to the Contract.

The following Sub-Clauses 73.1, 73.2, 74.1, 75.1, 76.1, 77.1 and 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

(Employer may incorporate provisions where applicable)

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.

PART II –PARTICULAR CONDITIONS OF CONTRACT

Index	Clause
Alcoholic Liquor or Drugs	34.8
Arbitration	67.3
Arms and Ammunition	34.9
As-Built Drawings	6.7
Bonus for Early Completion of Works	47.3
Cash Flow Estimate to be Submitted	14.3
Commencement of Works	41.1
Compliance by Sub-Contractors	34.12
Conditions of Hire of Contractor's Equipment	54.5
Contractor's Representative	15.3
Customs Clearance	54.3
Customs Duty and Taxes	73.2
Default of Contractor	63.1
Definitions	1.1
Detailed Programme and Monthly Progress Report	14.5
Details to be Confidential	78.1
Disorderly Conduct	34.11
Employer's Risks	20.4
Employment of Local Personnel	16.4
Employment of Persons in the Service of Others	34.3
Engineer Not Liable	2.7
Engineer's Duties and Authority	2.1
Engineer's Representative	2.2
Epidemics	34.6
Exclusions	21.4
Failure to Comply	53.4
Festivals and Religious Customs	34.10
Financial Assistance to Contractor	60.11
Health and Safety	34.5
Housing for Labour	34.4
Increase or Decrease of Cost	70.1
Instructions for Variations	51.2
Insurance of Works and Contractor's Equipment	21.1
Insurance Company	25.5
Integrity Pact	74.1
Joint and Several Liability	77.1
Language Ability of Contractor's Representative	15.2
Language Ability of Superintending Staff of Contractor	16.3
Language(s) and Law	5.1
Liability of Contractor	76.1
Lighting Work at Night	19.4
Monthly Payments	60.2

Index	Clause
Monthly Statements	60.1
Notice to Contractor	68.1
Notice to Employer and Engineer	68.2
Payment of Income Tax	73.1
Payments of Nominated Subcontractors	59.4
Performance Security	10.1
Performance Security Binding on Variation and Changes	10.4
Priority of Contract Documents	5.2
Programme to be Submitted	14.1
Rates of Wages and Conditions of Labour	34.2
Records of Safety and Health	35.2
Replacement of the Engineer	2.8
Reporting of Accidents	35.3
Safety Precautions	19.3
Secured Advance on Materials	60.11
Shop Drawings	6.6
Special Risks	65.2
Supply of Water	34.7
Taking Over of Sections or Parts	48.2
Termination of Contract for Employer's Convenience	75.1
Time for Payment	60.10
Use of Pakistani Materials and Services	36.6
Valuation of Variations	52.1

PART III: SUPPLEMENTARY CONDITIONS OF CONTRACT

TABLE OF CONTENTS

	PAGE NO
SCC – 1 : Progress Reports	1
SCC – 2 : Attendance of Meetings	1
SCC – 3 : Electric Supply	1
SCC – 4 : Rates and Prices Inclusive	2
SCC – 5 : Provision of Plant	3
SCC – 6 : Rates Inclusive of all Lead and Lift	4
SCC – 7 : Borrow Areas	4
SCC – 8 : Time for Completion of Works	4
SCC – 9 : Document not to be Altered or Mutilated	4
SCC – 10 : Personal Liability of Public Officials	4
SCC – 11 : Utility Lines	5
SCC – 12 : First Aid Facilities	5
SCC – 13 : Location of Contractor's Camp	5
SCC – 14 : Final Hand-Over	5
SCC – 15 : Making Good Damage to Services, Earthwork, etc.	5
SCC – 16 : Return of Plant, Materials, etc.	5
SCC – 17 : Method of Measurement	5
SCC – 18 : Record of Measurement	6
SCC – 19 : Dangerous Materials	6
SCC – 20 : Progress Photographs	6
SCC – 21 : As Built Drawings/Shop Drawings	6
SCC – 22 : Safety Precautions	7
SCC – 23 : Fixed withholding Tax	8
SCC – 24 : Approved Insurance Companies	9
SCC – 25 : Sign Board	9
SCC – 26 : Mobilization Advance	9
SCC – 27 : Mobilization Advance Bond	10
SCC – 28 : Secured Advance	10
SCC – 29 : Contractor and Engineer's Site Offices	10
SCC – 30 : Procedures for Submittal Approvals and Document Distribution	11
SCC – 31 : Site Screening, Fencing and Signage Etc.	11
SCC – 32 : Approval from Regulatory Bodies	12
SCC – 33 : Site Dewatering	12
SCC – 34 : Escalation/De-escalation of Prices	12
SCC – 35 : Supervision during Holidays/ After Normal Working Hours	13
SCC – 36 : Supervision after Expiry of the Completion Period	13
SCC – 37 : Coordination between the Main Contractor and the Foundation Specialist Subcontractor.	13

SCC – 38	:	Increase or Decrease of Cost (Appendix-C to Bid, GCC-70.1, PCC-70.1)	13
SCC – 39	:	Supervision after Expiry of the Completion Period (Not applicable)	14
SCC – 40	:	Documents not to be Altered or Mutilated	15

SUPPLEMENTARY CONDITIONS OF CONTRACT

SCC - 1 **Progress Report**

The Contractor shall submit to the Employer fortnightly progress reports fully supported with photographs of 8" x 12" size or in sizes and nos. as specified by the Engineer, depicting the completed stages of the Works, in two copies detailing the progress in the execution of work during the reporting period. The submission of the progress reports shall be condition precedent to the payment of Contractors Bills by the Employer. One week in advance the Contractor shall submit for the Employer's approval, particulars of the work he proposes to execute within the following two weeks.

In case of non-compliance, the Engineer or Engineer's representative reserves the right to withhold certification of the Contractor's payment till the Contractor complies with this provision of the Contract. This action of the Engineer or Engineer's representative shall not make the Employer liable to any loss or damage that the Contractor may suffer due to non-payment as a result of non-compliance of this provision.

SCC - 2 **Attendance of Meetings**

- (a) The Contractor shall attend and should call his Sub-Contractors (if any approved) to attend any or all meetings when called by the Employer or the Engineer to discuss progress of the Work and other matters related to the Work and the Contract, without any compensation from the Employer.
- (b) The Contractor shall bear all expenses of the Employer and representatives and the Engineer, and representatives for any meetings requested by the Contractor for instructions and approvals away from the site within or outside Pakistan.

SCC - 3 **Electric and Water Supply**

The Contractor shall make arrangement for the three phase electric power and water for drinking and for construction supply and distribution of the same at the Site of Works for the completion of the Works at his own expense. These arrangements may be used by other sub-contractors, their labour and staff, appointed by the Contractor or the Employer for the Project from time to time through sub-meters, including necessary wiring/light fixtures, to be installed by the contractor entirely at his own cost.

To ensure a smooth flow of works at all times, the Contractor will have to maintain in proper working condition a stand-by generator of minimum 100 KVA operating capacity. A full time technician will always be available to maintain and operate the diesel generator. All costs pertaining to the above shall be borne by the contractor.

The Contractor shall use 30A trip RCD's and Earth Leakage Circuits Breakers (ELCBs) for personal protection on all electrical circuits. The Contractor shall follow all procedures to be outlined by the Electrical Consultant for temporary electrical distribution and in accordance to International Standards. However, all costs of electricity so consumed by other contractors or sub-contractors employed directly by the Employer shall be proportionately borne by the respective contractors or sub-contractors.

SCC - 4 Rate and Prices Inclusive

The rates and prices quoted by the Contractor in the priced Bill of Quantities shall include all freight, customs, import duties, taxes, pilotage, landing Supplementary Conditions of Contract charges, wharfage, octroi, excise duties, royalties and all other costs, charges imposed whatsoever in respect of any or other things provided by him for the Works.

The prices in the Bill of Quantities include also all additional costs and provisions required for the correct execution of work in compliance with the time Schedule and the Specifications.

By way of illustration but not enumeration the Unit Prices shall include besides the costs for supply of material and equipment, cost of their transport, Contractor's profit etc., the cost for provision of the following:-

- (a) Furnishing and maintenance of Contractor's Equipment, fuel for Equipment, temporary works, tests, samples and labour necessary for execution of the works, Equipment for transport, machines, test laboratories, Site Office and sheds including all expenses for the furnishing and maintenance of the Workshops and storage areas used by the Contractor.
- (b) Required power, water and other services.
- (c) Illumination and safety at Site.
- (d) All additional costs due to any kind of difficult working, conditions and interruptions which may possibly be caused by adverse physical conditions.
- (e) Staff allowances, ambulances, expenses for medical treatment, traveling expenses, holiday wages and salaries and all other costs for all employees, the required means of communications such as telephone and the like, the required means for protection against accidents.
- (f) All expenses for royalties, licenses, liabilities insurances, rent, hire and the like in connection with the Works.
- (g) Traffic management / diversion during construction including installation / provision / maintenance of diversion arrows, night time hazards lights, flagmen, diversion barriers and all other measures necessary for smooth and save movement of traffic during construction.
- (h) Other special work arrangements and provisions not mentioned here but necessary for the proper and complete execution of the Works.
- (i) All Government and/or Municipal taxes, customs duties, excise duties, stamp duties or any other dues, taxes or charges.
- (j) Cost of all insurances to be kept in force during the period of construction and the period of maintenance of the works under the Contract.
- (k) Mobilization, demobilization and clearance of site.
- (l) Contractor's camp for staff and labour including the services.
- (m) Performance Security and Bank Guarantees as and when required under the Contract.

The cost of the above shall be deemed to be included in the rates and prices tendered for the works and no separate payment shall be made on this account.

SCC - 5 Provision of Plant

In respect of any contractor's Equipment in general, except as provided for in these Documents, which the Contractor shall be required to have available at Site for execution of Works in accordance with the Drawings, Specifications or as directed by the Employer, he shall make his own arrangements for foreign exchange, import formalities, customs, transport to the Site of Works and all other formalities whatsoever at his own cost and responsibility.

The Contractor shall be deemed to have taken into consideration all Government or Local Bodies regulations, for the time being in force, regarding the re-export of any plant and equipment which he may have to import in connection with the works. Any amendments to the existing rules and/or further regulations imposed in this respect by the Government of Pakistan shall be strictly followed by the Contractor.

Deployment of Specialized Equipment/Plant

The works shall be carried out using specialized equipments/plant considering the expected workspace limitations and height of the proposed building. The specialized equipment of specified capacity/ size shall include but not limited to the Batching Plant, Transit Mixers, Mobile and/or Stationary Concrete Pumps, Construction Passenger and Cargo Lifts with all safety measures as well as the On-Site Communication System. The contractor shall incorporate the use of such equipments/plant into his construction schemes.

The Bidder shall also furnish a list of all major machinery & plants to be used on the project, in Appendix –G to Bid.

TOWER CRANE

The Bidder is required to specify and furnish Tower Crane details which he intends to use in this Project. The height of Tower Crane, length of Boom and Tip load should be adequate with respect to the material load, Building dimension, Site condition and the place where the Crane is to be installed. Contractor shall submit drawings showing locations of Tower Crane to be installed for approval.

The make and fitness of the crane will be inspected by the Engineer. No work will be carried out by the crane until the Manufacturer or his Agent/Independent Party has successfully carried out a test and issued a Certificate to the effect. The Contractor will not be allowed to proceed for work until a final agreement between the Employer and the Bidder is signed, unless sufficient proof is provided by the Bidder, of his intentions for the mobilization of a building tower crane at the said site of minimum specifications as stated in Preliminaries and Pricing Preambles to the Bill of Quantities with necessary back up power generator in the absence of electricity from the local power supply authority. The crane and the generator should be made available at the site within four weeks after mobilization of the contractor at the site. No tender will be accepted without necessary provision of the same has been indicated in the tender up to the complete satisfaction of the Employer and the Engineer. The crane should be well maintained and shall be kept fully operational at all times at the Contractor's risk and cost and all lifting and shifting of material and equipment as much as possible should be carried out by the tower crane. If the crane malfunctions for any reason, the Contractor will have it repaired within 3 days for a major problem and within 24 hours for minor problems.

STAND-BY ARRANGEMENTS FOR BREAKDOWNS

Contractor to do all necessary arrangements for keeping spare tools & plants etc. to make sure that the progress of work is not interrupted due to breakdown of any working machinery/plants etc.

SCC - 6 Rates inclusive for all Lead and Lift

The tendered rates shall include all lead and lift required in earthwork.

SCC - 7 Borrow Areas

The Contractor shall make his survey/enquiries regarding the suitable and nearest Borrow Areas, and shall apply to the Engineer for approval for the use of the borrow area. It will be the responsibility of the Contractor to acquire the Borrow Areas approved by the Engineer and pay for all royalties/ malkana and all other costs. In case the materials from the approved Borrow Areas do not meet the Specifications, in the opinion of the Engineer, the Contractor shall have to propose new Borrow Areas for approval, and nothing shall be paid to the Contractor for abandonment of the previously approved Borrow Areas.

SCC -8 Times for Completion of Works

The Work is required to be completed in the time stated in Appendix-A to Bid and the Bidder to whom the Contract is given will be required to complete and deliver the whole of the Permanent Work strictly within the time so stated. If the Bidder states, in his Tender, a shorter time than shown in the Appendix, then such shorter time governs.

Any indication of work to go beyond the period mentioned as above, in the Preliminary Construction Schedule submitted at the time of tender, may make the tender liable to rejection. The Bidder shall submit a schedule of works and programme of works with his Bid, to meet the Milestone dates mentioned in Appendix-E to Bid.

SCC -9 Documents not to be Altered or Mutilated

No alteration or mutilation (other than filling in all the blanks intended to be filled in) shall be made in the form of Tender or in any of the documents attached to it. Any comments which it is desired to make shall not be placed on any of the documents attached hereto, but shall take the form of a separate statement which shall be as brief as possible and referenced to items, clauses and pages of the annexed documents.

Such statements shall not qualify the acceptance of the Tender based upon a proposed change or changes in the annexed documents, nor shall be binding upon the Employer in any way in making the award. Alterations of already written prices must be signed in the place of alteration by the Bidder or his legally authorized representative.

SCC-10 Personal Liability of Public Officials

In carrying out any of the provisions of these Specifications, or in exercising any power of authority granted to them by or within the scope of the Contract, there shall be no liability upon the Employer and Engineer, or their authorized representatives.

SCC-11 Utility Lines

The Contractor shall conduct his operations, make necessary arrangements, take suitable precautions and perform all required work incident to the protection of and avoidance of interference with power transmission, telegraph, telephone and natural gas lines, oil lines water and sewerage mains and other utilities within the

areas of his operations in connection with this Contract and the cost thereof shall be borne by the Contractor and the Contractor shall save harmless and indemnify the Employer in respect of all claims, demands, proceedings, costs, charges and expenses whatsoever arising out of or in relation to any such interference.

SCC-12 First Aid Facilities

The Contractor shall provide and maintain adequate First Aid Facilities convenient to the Site to the approval of the Employer.

SCC-13 Location of Contractor's Camp

The location of houses, barracks, stores and offices, etc., shall be determined in agreement with Employer. Installation for the supply of electricity and water, fuel, lighting, etc., must be present to the necessary extent.

SCC-14 Final Hand Over

At the end of the Defects Liability Period stipulated in the Contract, the Employer on application of the Contractor, shall decide the members of the final hand over committee and announce the same to the Contractor. The committee, after investigation of Work, if satisfied that there are no deficiencies or defects due to work of the Contractor, shall certify the final hand-over, and the Employer will then issue a Defects Liability Certificate as provided under Clause 62.1 of Conditions of Contract.

SCC-15 Making Good Damage to Services, Earthwork, etc.

The Contractor shall make good, at his own cost, all damages, caused by him or due to the construction of the works to telephone, telegraph and electric cables or wires, sewers, water or other pipes except where the Authority, Employer or Private Party owing or responsible for the same elects to make good the damage.

All injury to the surface of the land, to the beds of water courses, protecting banks, riverbeds, etc. Where disturbed by the works (other than where specifically ordered by the Employer), shall be repaired by the Contractor or the Authorities concerned, at the Contractor's expense. All such making good shall be to the approval of the Employer.

SCC-16 Returns of Plant, Materials, etc.

The Contractor shall forward to the Employer at the end of each month returns showing the Constructional Plant, materials, etc., on Site.

SCC-17 Method of Measurement

The quantities in the Bill of Quantities have been prepared generally in accordance with the **Standard Method of Measurement of Building Works, seventh edition – 1988 (SMM 7), issued by the Royal Institution of Chartered Surveyors, and The Building Employers Confederation.**

The measurement of the Work shall be performed on the basis of the Specifications. If these measurements exceed the measurements indicated in the Specifications and Drawings, excepting those directed by the Employer, such excess shall be on the account of the Contractor and he shall not be entitled to any compensation therefore. But if they are less than the measurements indicated in the Specifications and Drawings then the Works actually executed shall be measured, provided they are technically acceptable and there is no provision to the contrary in any other part of the Contract Documents. All work completed under the Contract shall be measured according to the metric system for all items, unless otherwise provided herein or in the special Provisions. All longitudinal measurements for area or volume will be made horizontally along the road centre line. All transverse measurements for area or volume of pavement courses will be made horizontally in accordance with the dimensions indicated on the plans, or

the dimensions ordered by the Employer. In computing volume of excavation, embankment and borrow, the average end-area method will be used.

Quantities of materials wasted or disposed off in a manner not called for under the Contract or rejected loads of materials, including material rejected after it has been placed by reason of the failure of the contractor to conform to the provisions of the Contract, or material not unloaded from the transporting vehicle, or material placed outside of the lines indicated on the drawings or established by the Employer, or material remaining on hand after completion of the work will not be paid for and such material should be disposed off by the Contractor at his own expenses.

No compensation will be allowed for hauling rejected materials. The Works shall be measured net notwithstanding any general or local custom except where otherwise specifically described or prescribed in the Contract.

SCC-18 Record of Measurements

The Contractor will supply to the Engineer six (6) copies of the abstract of Contractor's certificate of payment every month along with two copies of detailed measurements, quality control tests and cross sections with calculations, and any other document or information which form the basis of payment.

SCC -19 Dangerous Materials

The Contractor and his sub Contractors shall convey, store and make use of all explosives, dangerous petroleum, acetylene, carbide of calcium and other similar material provided by them for use in or on the works in strict accordance with the provision of all laws, orders and regulations that are in force at the Site or may be issued from time to time by the Government.

SCC -20 Progress Photographs

The Contractor shall furnish to the Engineer every two weeks at least four photographs to clearly show the progress of construction. The photographs shall be submitted in three glossy prints 20 cm x 30.4 cm, together with the negative. Each print shall be marked on the back with the date and serial number. There shall be no writing, lettering or marking on the face of the photograph.

SCC-21 As-built Drawings/Shop Drawings

During construction, the Contractor shall keep an accurate record of all deviations of his work as actually installed from that shown or indicated on the Contract Drawings upon completion of the Work; the Contractor shall deliver to the Employer cloth/milar paper tracings, the same size as Contract Drawings and at an approved scale showing the Work as actually installed. All Drawings are to become the property of the Employer. In addition the Contractor shall scan all as built drawings on a CD ROM, two copies of which shall be delivered to the Employer by the Contractor.

All the shop drawings/fabrication drawings shall be prepared by the Contractor and submitted to the Engineer within the period stipulated in item 33 of Appendix-A to Bid. The Engineer shall check and approve or return the same to the Contractor for correction/modification within the period of 14 (fourteen) days from the day of receipt of the drawings. All work is to be executed by the Contractor in accordance with the drawings approved before the commencement of the works.

The Contractor shall adopt the following procedure for maintaining the aforesaid record:

- a) Make records in a neat and legibly printed manner with a non-smudging medium.
- b) Identify each Record Drawing as the "Project Record Copy", maintain Drawings in good condition, and not use them for construction purposes, and make them readily available to the Engineer.
- c) Maintain project Record Drawings in a state current to the project. Failure to comply with this requirement may prejudice Progress Payments. The Engineer's visual inspection shall constitute proof that Record Drawings are current.
- d) The Contractor on the completion of the Contract shall submit to the Employer through the Engineer one complete set of Contract Drawings and As Built Drawings (one transparency and three print of each drawing) along with the computer files of the same in AutoCAD (Latest Version) saved on C.D., showing Work as actually constructed.

SCC-22 Safety Precautions

The Contractor shall adequately provide for the safety, health and welfare of persons and for the prevention of damage to works, material, and equipment for the purpose of or in connection with the Contract.

The Contractor shall strictly follow at his own cost the Safety Programme outlined below and such additional measures as the Engineer or Engineer's representative may determine to be reasonably necessary.

- a) Prior to commencement of work the successful Contractor shall submit safety programme for discussion with the Employer and the Engineer.
- b) The Contractor shall prepare a plan of the Works Site to assure that storage areas for materials and equipment are located on the project/work site for maximum efficiency. This plan will be subject to the approval of the Engineer.
- c) Activities between different operations and different crafts will be coordinated.
- d) The Contractor shall layout and provide an efficient access system with information and directional signs posted as necessary.
- e) All employees will be instructed on safe work method.
- f) The Contractor shall advise all his supervisory staff of their responsibility for the prevention of injury to persons or damage to property or equipment in their respective areas of supervision.
- g) Safety will be included in all job planning. This will include providing safe construction equipment and vehicles, protective equipment necessary for protection of workmen, and establishing methods for safe operation.
- h) Good housekeeping will be maintained at all times.
- i) Scaffolds, ladders, ramp, runways etc. will be constructed properly and maintained in safe condition.
- j) Ample fire protection will be provided and fire hazards guarded, by the Contractor.

- k) Adequate lighting, ventilation etc. will be provided as necessary, by the Contractor.
- l) Equipment will be properly and regularly inspected and maintained by the Contractor to the satisfaction of the Engineer.
- m) Electric power shall be distributed through circuit breakers/ELCB, PVC cables and RCD's (30mA trip on each circuit).
- n) The Contractor will assign to his employees only such duties as are within their physical and mental capabilities.
- o) The Contractor will hold monthly meetings with his supervisory staff and the man in charge at the lower level will hold safety meetings of 10 to 15 minutes with his crew each week. Upon request the Engineer will arrange safety materials from the Employer.
- p) First Aid facilities will be provided at job sites, the services of doctors and hospitals made available, and all supervisors instructed in handling of injured employees.
- q) Adequate toilet facilities will be provided and maintained in a hygienic condition and their use enforced by the Contractor.
- r) Accident reports will be furnished to the Engineer for onward transmission to the Employer within 7 days of the reported accident.
- s) Copies of the safety programme will be supplied by the Contractor to the Engineer and will be promptly posted in all offices in use of projects/works under this Contract.
- t) No workers, supervisors and other senior staff member shall be allowed on site without wearing hard hat and safety shoes.
- u) The contractor shall make sure to put temporary but strong railings on all edges of the open areas on all floors and staircases etc until secured by permanent structure as per drawings. The contractor will not be allowed to proceed further if found violating this clause. The Contractor shall indemnify the Engineer & the Employer against all claims/damages etc as a result of ignorance of the requirements of this sub-clause.
- v) No worker will be allowed to work on scaffolding without a safety belt to prevent him from falling down.

SCC-23 Fixed Withholding Tax

A sum in Pakistani Rupees, in accordance with the prevailing income tax laws of Pakistan shall be deducted from all actual payments made to the Contractor and be deposited with the Government of Pakistan towards payment of income tax by the Contractor. When such deduction is made from the payments a certificate to that effect shall be issued by the Employer to the Contractor.

Notwithstanding such deduction of income tax at source, the Contractor shall be liable to pay the balance income tax, super tax and other taxes on income or his profits arising out of the Contract, and his employees on their remunerations etc, in accordance with the prevailing income tax laws of Pakistan.

SCC-24 Insurance Companies

The Insurance Companies as mentioned in item 29 of Appendix-A to Bid shall constitute the only Insurance Companies in Pakistan which the Employer will recognize for all Insurance required under the Contract within treaty bond limit mentioned against each company.

SCC-25 Sign Board

The Contractor shall provide a Sign Board of dimensions not less than 10'-0" x 6'-0" in a position to be approved by the Engineer or Engineer's representative. The Contractor shall paint on this Sign Board the name of the Works, the Building Contractor's name in addition to that of the Employer, Engineer and the Consultants.

- i Only Project signs and notices for safety or instruction shall be permitted on Site. Project name board will be supplied by the Contractor.
- ii Format, location and quantity of site signs and notices pertaining to the Works, will be approved by Engineer.
- iii Signs and notices for safety or instruction shall be in Urdu and English language, or commonly understood graphic symbols.
- iv The Contractor shall maintain signs and notices for duration of project and remove or dispose of signs from Site when directed by Engineer.
- v Sole rights of advertising on the Job Site are reserved to the Employer. Contractor shall not without the written consent of the Employer /Engineer erect or display any Notice or Advertisement. The Contractor shall arrange to display the title board on a composite name board.

SCC-26 Mobilization Advance

- i Mobilization advance shall be paid to the contractor as stipulated in item 12 of Appendix-A to Bid, for procurement of construction equipment, materials and plant, all for the performance of the work under the Contract as described herein. The advance payment guarantee shall be submitted by the Contractor at the time of signing of the Agreement.
- ii Repayment of the funds advanced to the Contractor pursuant to the provision of sub-clause (i) hereof will be made by deduction as stipulated in item 13 of Appendix-A to Bid, of the amount due to the Contractor from each bill of work completed in accordance with the provisions of this Contract until the full amount of the funds advanced have been repaid to the Employer. In all circumstances all advance amount will be recovered before completion of 85% of originally tendered works, and recovery of this amount shall commence from the first bill of the contractor.

SCC-27 Mobilization Advance Bond

As a pre-requisite to obtaining the advance of funds under the provision of sub-clause 11 (ii) hereof the Contractor shall furnish to the Employer Mobilization Advance Bond from a First Class Approved Scheduled Bank based in Pakistan, guaranteeing the faithful and correct use of the funds advanced. The Mobilization Advance Bond shall have a value at least equal to the amount of funds advanced and may be reduced by the amount recovered by the Employer from the Contractor's running bills.

Upon submission of the aforesaid Mobilization Advance Bond, pursuant to PCC clause 60.11 the sum shall be advanced to the contractor in accordance with the

applicable alternative selected by the employer and mentioned against item 12 of Appendix-A to Bid, and shall be released upon satisfactory deployment of equipment and facilities at site etc., after issuance of the Engineer's Certificate.

SCC-28 Secured Advance

An advance up to **75%** of the ex-works value of the material purchased by the Contractor and brought to the Site may be allowed to the Contractor, if approved by the Engineer. This advance will be allowed only against an agreement/bond to be executed by the Contractor, undertaking that the material shall not be removed from the site without written permission from the Employer. A certificate in respect of the quantity and cost of the material brought to the Site by the Contractor will be issued by the Engineer for obtaining advance from the Employer. The Advance against these two materials shall be recovered and deducted from the Contractor's next or following bill as determined by the Engineer. The Employer will have the discretion to accept or reject such requests.

SCC-29 Contractor and Engineer's Site Offices

i Contractor shall provide and maintain temporary, weather tight Mobile shipping containers site offices for the Engineer's use to accommodate five personnel of the Engineers in this office, Office shall be air-conditioned and should have heating facilities. Offices should have attached washroom containing W.C and washbasin. All necessary office furniture, including filing facilities complete with facilities for filing, drawings, specifications, correspondence, and other appurtenances necessary for the proper execution of the Work. The contractor shall also provide latest model computers (2-Sets) with two laser printers with all peripherals as required by the Engineer, printers to be capable of printing A-3 size sheets, photo copier capable of copying up to A-3 size sheets (powder copies), and Internet/E-mail account for all computers as per the requirement of the Engineer for exclusive use of Engineer/consultant and their staff.

ii The contractor shall provide brand new following transportation facilities exclusively for the use of site staff of the Engineer/Consultant during the construction as well as the maintenance period as approved by the Engineer. The Contractor shall furnish, supply and provide, as may be necessary without specific direction of the Engineer, all fuels (10 liters/per day), lubricants, tires and other supplies all car accessories, all maintenance, repairs and running costs, comprehensive insurances and suitably qualified drivers with all below mentioned cars at all times. On completion of the Contract, the vehicles shall become the property of the Contractor. There will also be no separate measurement of payment for the provision of Vehicles personnel, the costs of which will be considered as an incidental obligation of the Contractor and covered under other items in the Bills of Quantities.

Where in the opinion of the Engineer inadequate or unsatisfactory maintenance / repair has been done by the Contractor, such payment for maintenance / repair will be deducted by running IPC as considered appropriate by the Engineer.

New Suzuki Cultus, Latest model or equivalent accept to the Engineer (min. 1000 cc) - 1 No.

SCC-30 Procedures for Submittal Approvals & Document Distribution

Notwithstanding anything contained elsewhere to the contrary the contractor shall direct all his submittal for necessary approvals as well as distribute his correspondence strictly in accordance with the procedures for submittal approvals and document distribution as laid down and updated from time to time by the Engineer.

SCC-31 Site Screening, Fencing and Signage Etc.

The Contractor shall provide and install temporary screens/curtains in green or orange colour, made of the material approved by the Engineer, on the front, back or any side of the plot area during the construction phase. This shall include fixing of the aforesaid screen/curtains with steel scaffolding framework up to the height of the constructed building with anticipated minimum three cycles of normal wear and tear and subsequent replacements with new material.

Temporary eight feet high G.I. fencing shall be erected by the Contractor on all the open plot sides with temporary gates for ingress/egress of vehicles, the fencing/gates shall be supported/fixed on steel/wooden pipes or posts with J-bolts etc., duly enamel painted on both sides as per the approval of the Engineer.

The contractor shall also provide and install traffic diversion lights and signage as well as safety signage, at appropriate locations at site duly approved by the Engineer, and provide necessary covering to excavated or other material being disposed off from the site, as per direction of the Engineer. Arrangement for washing and cleaning of tires of vehicles before leaving site area shall also be made by the contractor to the satisfaction of the Engineer.

The transportation of any loose construction material like sand, crush, earth etc. will not be allowed unless properly covered with tarpaulin sheet tied firmly on the body of the vehicle.

All of the aforesaid shall be provided by the contractor entirely at his own cost.

SCC-32 Approval from Regulatory Bodies

The Contractor at his own cost and well in time shall seek necessary approvals/NOCs where necessary, from the Government authorities and regulatory bodies for providing temporary connections of utilities at site, diversion of roads/walkways, alterations for smooth ingress/egress of construction machinery and equipment, placement of tool/plant, materials, scaffolding and erection of temporary site offices etc. on public land; in addition to any other approval/NOC required for smooth execution of site work. The Contractor shall provide copies of all such approvals to the Engineer.

If required by the Employer, the Contractor shall assist the Employer in obtaining any approvals/NOCs from competent authorities which may be required to be obtained on Employers part:

SCC-33 Site Dewatering

The Contractor shall at his own cost, ensure that the dewatering of the excavated area is carried out in perfectly dry conditions in accordance with the drawings and specifications. For attaining the objective, the contractor shall engage a specialist sub-contractor whose credentials shall have to be approved by the Engineer prior to any dewatering activity at site. It is expressly stated that round the clock dewatering of site area may be required for an extended period of time as per the structural requirements.

SCC-34 Not used

SCC-35 Not used

SCC-36 Not used

SCC - 37 Coordination between the Main Contractor and the Foundation Specialist Subcontractor.

In order to make sure the timely start of the Main Contractor's Structural work with smooth continuation of Foundation Piles work, the Specialist Contractor for Enabling and Foundation work shall be required to work in close coordination with the Main Contractor. For this purpose the Foundation Specialist Contractor shall match his programme with the Main Contractor's programme approved by the Engineer and shall maintain a proper record of the section of the work completed by him and handed over to the Main Contractor with the latter's acknowledgement and a copy of the same shall be forwarded to the Engineer.

Pursuant to item 21 of Appendix-A of the Contract documents any delay in handing over of any section of the work by the Foundation Specialist Contractor to the Main Contractor according to the agreed programme shall invoke the application of the liquidated damages upon the former proportionate to the quantum of the entire balance work of the Pile foundations.

Although the payment to each of the Contractors, i.e. Foundation Specialist and the Main Contractor will be done separately and directly by the client after having certified by the Engineer, however the payment to the Foundation Specialist Contractor shall be done only after his payment application has been endorsed by the Main Contractor.

However the quality of the work of Enabling and Foundation Piling rest with the Foundation Specialist Contractor.

In case of any dispute the Engineer's decision shall be final and binding upon both the Contractors.

SCC – 38 Increase or Decrease of Cost (Appendix-C to Bid, GCC-70.1, PCC-70.1)

If there occurs any change beyond 5% (five percent) in the prices of the items given in the Material Rates Schedule, the Contractor shall report and Engineer shall establish such change in the prices of the Item Rates Schedule. The contractor shall be liable to receive sum as calculated by the Engineer and approved by the Employer due to the rise in the prices of the said items and the Contractor shall pay to the Employer the sum as calculated by the Engineer if there occurs fall in the prices. Only the difference beyond 5% shall be payable.

The sum calculated by the Engineer and approved by the Employer becomes payable to the Contractor or vice versa due to escalation/de-escalation of the prices as aforesaid shall be binding and final on the Contractor.

SCC – 39 Supervision after Expiry of the Completion Period

In case the actual completion period extends after the completion date as per item 40 of Appendix-A owing to reasons the Contractor is responsible for, the contractor, in addition to the Liquidated Damages as per item 21 of Appendix-A, shall pay supervision charges to the Consultants/Engineer at the rates shown below. These charges shall be deducted from the running and final bills of the Contractor and paid to the Engineer by the Employer.

SCC – 40 Documents not to be Altered or Mutilated

No alteration or mutilation (other than filling in all the blanks intended to be filled in) shall be made in the form of Tender or in any of the documents attached to it. Any comments which it is desired to make shall not be placed on any of the documents attached hereto, but shall take the form of a separate statement which shall be as brief as possible and referenced to items, clauses and pages of the annexed documents.

Resident Engineer	Rs.10,000/- per day or part there of
Project Engineer	Rs. 7,600/- per day or part there of
Planning & Scheduling Engineer	Rs. 5,600/- per day or part there of
Coordination Engineer	Rs. 5,600/- per day or part there of
Site Engineer	Rs. 3,200/- per day or part there of
Quantity Surveyor	Rs. 6,400/- per day or part there of

Such statements shall not qualify the acceptance of the Tender based upon a proposed change or changes in the annexed documents, nor shall be binding upon the Employer in any way in making the award. Alterations of already written prices must be signed in the place of alteration by the Bidder or his legally authorized representative.

**ESTABLISHMENT OF UNIVERSITY OF TURBAT
TURBAT TOWN (South-West of Baluchistan)
IN DISTRICT KECH**

**CONSTRUCTION OF BOUNDARY WALL AROUND
GIRLS HOSTEL PHASE II**

Civil Specification

Contents

SECTION-1	GENERAL
SECTION-2	SITE CLEARING, GRUBBING AND SETTING OUT OF WORKS.....
SECTION-3	EXCAVATION, FILLING, BACKFILL AND DISPOSAL.....
SECTION-4	TERMITE CONTROL
SECTION-5	WATER
SECTION-6	CONCRETE
SECTION-7	STEEL REINFORCEMENT
SECTION-8	BLOCK MASONRY.....
SECTION-9	PLASTERING
SECTION-10	FLOORING.....
SECTION-11	WOODEN DOORS AND WINDOWS.....
SECTION-12	TIMBER JOINERY AND HARDWARE
SECTION-13	ALUMINUM ANODIZED DOORS/WINDOWS AND VENTILATORS.....
SECTION-14	FALSE CEILING
SECTION-15	GLASS & GLAZING
SECTION-16	ROOF TREATMENT
SECTION-17	PAINTING / DISTEMPERING
SECTION-18	COLORCRETING.....
SECTION-19	STEEL WINDOWS, VENTILATORS, GATES AND GRILLS
SECTION-20	STRUCTURAL STEEL WORKS

SECTION - 1

1.0 GENERAL

- 1.01 This General Specification is to be taken as applying to all the works in this Contract. Figured dimensions on the working drawings shall be followed in preference to the scale.
- 1.02 Until and unless specified otherwise, all goods and materials are to be Pakistan manufactured and to be of the best quality, and where not otherwise specified shall be according to latest engineering practice and conforming to Pakistan Standards (P.S) or British Standard Specifications (B.S.S) or Standard of American Society of Testing Materials (ASTM). The Engineer or the Consultants may also supplement such specifications during the progress of work.
- 1.03 All materials and goods used for such and other items shall be subjected to standard testing and if found below the specified standard such as PS or BSS or ASTM or their equivalent shall be removed from the site immediately at Contractor's own expense. All testing of materials finished and unfinished, shall be carried out by the Contractor at his cost, in the presence of Engineer or Engineer's Representative for which the Contractor shall maintain a reasonably well equipped laboratory of his own, close to the site of work or make any other additional arrangement to the satisfaction and convenience of the Engineer. The Contractor shall include testing charges in his quotations and shall not be entitled to any reimbursement on this account for routine testing.
- 1.04 The Contractor must give early attention to the submission of samples of materials for approval of the Engineer, indicating the names of the manufacturing firms, where applicable especially of cement, sand, aggregates, steel, water, tiles, hard-core and all fittings. Whenever practicable, samples shall be submitted at least three weeks before it is proposed to use the materials. Until and unless specified otherwise and whenever materials are ordered to be forwarded to a testing laboratory other than site laboratory for check/ testing, the Contractor will be reimbursed the cost of fees for such tests if proved satisfactory, by the Employer. The Contractor, however, will be required to bear the cost of the fees for tests, which proved unsatisfactory.
- 1.05 The Contractor must take all steps necessary to prevent damage or interference with all supply lines such as water, electric power, fuel, telephones, drains, buried cables and any construction designed for the use of the public, government or semi government authorities or the Employer. The Contractor shall be responsible for any damage caused to such services or constructions and settle all claims in respect of such damage.
- 1.06 The Contractor shall protect from injury by covering all work, internally and externally needing protection including new concrete, brickwork, surface renderings, floors, etc., to the satisfaction of the Engineer, including the work of his sub-contractors at his own cost.

- 1.07 The whole work shall be carried out in the best manner in accordance with the instructions contained in these documents and those given by the Engineer from time to time during the progress of the work. The work shall be carried out in conformity with the best of the standard construction practices preferably the British Codes of Practices.
- 1.08 The Contractor shall submit to the Engineer for his approval before beginning the work, a complete plan of the proposed sequence and methods of operations for the execution of the works. Detailed drawings showing the location and construction of dumping and working platforms, gantries, building and all other structures in connection with the Contractor's plant and material storage sheds shall also be submitted to the Engineer for his approval before construction.
- 1.09 Orders and directions may be given orally by the Engineer or his Representative, and shall be received and promptly obeyed by the Contractor or his Representative or any superintendent or foreman or any supervisor of the Contractor whosoever may have charge of the particular part or section of work in relation to which the orders or directions are given, and a confirmation in writing of such order or directions will be given to the Contractor by the Engineer, if so requested. The Contractor shall provide and maintain at his own expense during the performance of the work an office in the vicinity of work. Orders or directions, written or oral, from the Engineer or his Representative delivered at such office shall be considered as delivered to the Contractor. The Contractor's office shall be fitted with a telephone connected to the local Telephone Exchange.
- 1.10 The Contractor shall not use the site for any other purpose than that of carrying out this Contract work. The operations of the Contractor shall be confined to the area immediately adjoining the buildings and the works included in this Contract but site clearance shall be kept to the satisfaction of the Engineer to permit carrying out of other works by other Contractors. The Contractor shall not affix advertisements; neither shall he permit advertisements to be displayed without the written consent of the Engineer.
- 1.11 The contract drawings are the working drawings to guide the Contractor generally about the shape and size of all the structures and fittings. Before proceeding to make preparations, fabrication, execution, erection of any such fittings and other details of any temporary works, scaffolds, railings, shutterings, details of doors, windows, partitions, iron mongery works, etc; the Contractor shall be under obligation to prepare and submit all detailed shop drawings to the satisfaction and the approval of the Engineer, before doing any or all of that described above or as directed. Approval of the contractor's drawings shall not relieve the Contractor for any part of his obligation to meet all the requirements of the specifications or correctness of his drawings.
- 1.12 No cement work shall be permitted during extreme cold weather when unless otherwise authorized by the engineer.

1.13 Form work, steel, steel ladder, scaffolding for inspection all time to be at site.

1.14 **PAYMENT**

Contractor shall not be entitled to any separate or additional payment on account of all these general requirements and any other arrangement or action Contractor has to undertake under the direction of the Engineer for a proper carrying out of the works and meeting all obligations of the Contract.

SECTION - 2

2.0 **SITE CLEARING, GRUBBING AND SETTING OUT OF WORKS**

2.01 **SCOPE OF WORK**

The work covered by this section of specifications consist of furnishing all labour, necessary equipment, services, miscellaneous and necessary items required to satisfactorily complete the clearing, grubbing and setting out of the works, as indicated on drawings, specified herein or both.

2.02 **CLEARING**

Clearing shall consist of cutting, or trimming of trees, if any, and the satisfactory disposal of tree and other vegetation designated for removal, together with the timber snags, bushes, and rubbish occurring within the area. Trees, other vegetation stumps, roots, and bushes in area to be cleared shall be cut off flush with or below the original ground surface except such individual trees, group of trees and vegetation as may be indicated on the drawing or designated by Engineer or his Representative to be left standing. Individual trees and other vegetation, to be left standing shall be thoroughly protected from damage during construction operation, by erection of barriers or by such other means as the circumstances require and as approved by the Engineer's Representative. Clearing operation shall be conducted in a manner that existing structures and installations under construction, employees and others remain safe.

2.03 **GRUBBING**

Grubbing shall consist of the removal and disposal of all stumps, roots and matted roots in the designated grubbing areas. Stumps, roots, logs and timber and other debris, shall be excavated and removed to a depth not less than 2 feet below any sub-grade level. In areas where the cut is over 3'-6" grubbing shall not be necessary.

2.04 **DISPOSAL OF DEBRIS**

Timber and other refuse to be disposed off by burning shall be burned at location, approved by the Engineer's Representative, in a manner that will avoid all hazard such as damage to existing structures, construction in progress, trees and vegetation. The contractor shall be responsible for compliance with all pertinent laws and regulations pertaining to the burning of fire. Disposal by burning shall be kept under constant attendance, and residual, until materials will not be permitted to be pushed or placed on the adjacent areas without written approval of the owner/owners. The stones and concrete shall be broken and removed from the site for receiving the structure/flooring where required. All debris shall be disposed off by the Contractor as directed by the Engineer.

2.05 **SETTING OUT OF WORKS**

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 direction, levels, dimension and alignment 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 the error to the satisfaction of the Engineer. The Contractor shall construct accurate benchmarks so that the lines and levels can easily be checked by the Engineer.

2.06 **DRAINAGE DITCHES**

The Contractor shall construct and maintain such ditches, in addition to those shown

on drawings or as may be ordered by the Engineer to adequately drain and areas under construction.

2.07 **PAYMENT**

No separate payment shall be made for the work covered in this section of the specification and all costs of site clearing and setting out shall be covered in the unit rates of the Contractor for other items.

SECTION - 3

3.0 EXCAVATION, FILLING, BACKFILLING AND DISPOSAL

3.01 SCOPE OF WORK

The work covered by this section of the Specifications consists of furnishing all Plant, Labour Equipment Appliances and materials and in performing all operations in connection with excavating, filling, backfilling and disposal for building construction, and other foundations complete in strict accordance with this section of the Specifications and the applicable drawings and subject to the terms and conditions of the Contract.

3.02 BORING LOG DATA

A preliminary report on Sub-Soil investigation and exploratory data of the site area is available for reference only in the office of the Engineer. The Employer or Engineer's predications, regarding character or extent of soil or other sub-surface conditions to be encountered during the work are not binding on the Contractor. The Contractor shall make his own deductions for sub-surface conditions which may affect methods or cost of constructions of the work hereunder and he shall make no claim whatsoever for damages or compensation, should he find conditions during the progress of the work, different from those indicated by the soil investigation report of Engineer.

3.03 EXCAVATION

(a) Classification

Excavation shall include the removal of all materials of every category and nature. If rock is encountered it shall be removed carefully and without excessive noise and vibration. Blasting shall not be resorted to without specific permission in writing from the Engineer.

(b) The excavation shall conform to the dimensions and elevations as indicated on the Drawings. Foundations on made up ground shall be taken down to natural bottom soil as per direction and approval of the Engineer. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms installation of services and for inspection but the same shall not be paid.

(c) In the event of any excavations being carried out wider or deeper than authorized, the same shall be filled in by the Contractor at his own cost to the required levels with lean concrete if below footing or with properly compacted local river sand if beneath slabs or as directed by the Engineer.

(d) Shoring and Bracing:

The Contractor shall provide at his own cost, where required all shoring walls, supports etc. to the sides of the excavation to prevent sliding or any movement. Where necessary, excavated sides shall be sloped as directed by the Engineer.

(e) Dewatering and Drainage:

The Contractor shall control the grading in the vicinity of site of work in order to prevent any water from running into the excavated areas. He shall at his own cost keep dry all pits and trenches during construction and all de- watering

and pumping out whether due to ground water seepage or otherwise, shall be included in the rates as quoted by the Contractor. The method employed in all cases shall be approved and agreed by the Engineer or his Representative.

(f) Protection of utility lines:

When any existing utility lines whether to be retained or be removed are encountered within the area of operations, the Contractor shall notify the Engineer and his Representative, and shall not proceed until necessary measures are taken for protection or removal of the lines and instructions are obtained from the Engineer.

(g) Excess and undesirable material from excavation not required for fill or backfill of the building site, shall be disposed off, removed and/or deposited as for filling and leveled anywhere on the work site as directed by the Engineer. Earth suitable and meant for backfill shall be stored at site in a manner not to interfere with the progress of construction works.

3.04 **FILL AND BACKFILL**

Where concrete slabs are to be placed on the ground, any loam, organic and other unsuitable material shall be removed. Fill where required to raise the sub-grade for concrete slabs shall be clean, unadulterated local river sand or gravel and shall be free from wood, stones and other debris. Excavated material shall only be used for fill if approved by the Engineer in writing. All the backfill behind the sub-grade walls shall be done with clean local river sand or approved excavated soil. Fill shall be compacted upto 95% modified AASHTO Density by a Power vibratory roller, mechanical rammer, or other approved equipment, in layers not more than 6 inch thick. Each layer shall be uniformly spread, watered to the extent of optimum moisture requirement for the required degree of compaction and then compacted. Contractor shall arrange at his own cost the testing of the filling where required by the Engineer or his Representative, after completion of foundation footings, walls, slabs and other construction below the elevation of the final grades and prior to backfilling. Backfill shall be placed in horizontal layers not more than 6 inches thick and shall have proper moisture content for the required degree of compaction of 95%. Each layer shall be compacted by mechanical tampers or by other suitable equipment approved by the Engineer. Backfill shall be brought to a suitable elevation above grade to provide for anticipated settlement and shrinkage thereof.

Backfill shall not be placed against foundation walls etc., prior to the damp proofing treatment, if specified and approved by the Engineer or his Representative. Backfill shall be brought up evenly on each sidewall as far as practicable. Heavy equipment for spreading and compacting backfill shall not be operated closer to the wall than distance equal to the height of the backfill above the top of footing.

3.05 **COMPACTION:**

Fill and/or backfill within the building or structures and for a distance of 6 ft. outside structures shall be compacted to a density of not less than 95% maximum density at optimum moisture content.

3.06 **ROUGH GRADING:**

(a) Necessary rough grading shall be carried out by the Contractor to establish grade or construction requirements of the site. Grades not otherwise indicated shall be uniform levels or slopes between points on existing and finished

grades. Abrupt changes in slopes shall be rounded. Additional fill required to complete rough grading shall be provided as directed by the Engineer or his Representative.

- (b) Where paving or slabs are specified, all rough grading shall be done to the sub-grade of the base course, removing all large stones and debris and shall be compacted uniform to the correct lines and levels ready to receive the paving or slab. Refilling, where required shall be executed with suitable selected materials in layers not exceeding 6 inch thick and thoroughly compacted to the required density. In place density tests shall be carried out by the Contractor for the approval of the compaction by the Engineer.

3.07 **FOOTING BOTTOM LEVELS:**

The levels as noted in the Drawings are only approximate and must be adjusted in the field with the approval of Engineer, depending on the soil conditions encountered. No concreting shall begin until the soil bearing capacity is substantiated by visual inspection by the Engineer or his Representative. The Contractor in planning his work shall make arrangement and provisions to construct the lowest level footings first.

3.08 **FIELD LEVELS:**

Prior to starting the work, the Contractor shall arrange to take the levels of the piece of land on which the building is located as directed by the Engineer. The same shall be simultaneously checked by the Engineer or his Representative and shall form the basis of payments for excavation and filling etc.

3.09 **DISPOSAL OF SURPLUS EARTH AND RUBBISH:**

All surplus earth and rubbish shall be disposed off at site as directed by the Engineer. The term disposal shall include all operations of loading, unloading, stacking, spreading, rehandling, filling in depressions, including consolidating and ramming in layers not exceeding 6 inch thickness.

3.10 **MEASUREMENTS AND PAYMENTS:**

All excavation shall be measured net and perpendicular and no allowance shall be made for any increase in bulk of the excavated material after excavation or for sloping sides, or widened trenches to accommodate formwork, shoring and bracing etc. Similarly the measurements for filling/backfilling shall be thoroughly compacted and measured net and no allowance shall be made for any increase in bulk after excavation. Excavation, filling and Disposal shall include all leads and lifts as specified elsewhere in these specifications. Payment for all the items under this section shall be made at the rates entered in the BOQ appended to the contract and in accordance with the applicable conditions of the contract.

Note:-

1. Imported earth fill item payment will be separately paid as per BOQ appended to the contract and in accordance with applicable condition of the contract.

SECTION - 4

4.0 TERMITE CONTROL

4.01 SCOPE OF WORK:

The work covered by this section of Specification consists of furnishing all labour, materials, equipment, services, miscellaneous and necessary items required to complete Termite Control work, related works as indicated on drawings specified herein or both.

4.02 MATERIALS:

- (a) Pesticides shall be solution of an approved chlorinated hydrocarbon such as 0.5% Dieldrin or 0.5% Aldrin mixed in clean water for application to or in earth, and mixed in pure turpentine for application to wood.
- (b) Pesticides (dieldrin and aldrin) shall be obtained from the Government of Pakistan, Department of Agriculture, in sealed drums at rates in force at the time of their acquisition and only in the quantity necessary for work of this Project. All mixing shall be done at site and the amount of pesticides used shall be verified by the Engineer his Representative.

4.03 METHOD OF APPLICATION:

Pesticides solution shall be applied with approved pressure spraying equipment maintaining a pressure of 1N/Sq.mm (150 lb/sq.in.) for all applications, to, on, or in earth. Spraying to wood shall be done by hand compression sprayers with an approximate pressure of 0.15 N/Sq.mm (20 lb/Sq.in).

4.04 EXTENT OF APPLICATION:

- (a) At excavation, all walls and bottoms of all pits or trenches for footings or foundations are to be sprayed. Pesticide shall penetrate to a depth of 1'-0" minimum in porous earth at bottom and 3" minimum at sides of excavations.
- (b) Stockpiled excavated material to be used as back fill is to be treated as above. After back-filling to plinth level, area of the whole building upto 10'-0" outside the building line is again to be sprayed penetrating a minimum of 1 ft. into soil.
- (c) After grading, compaction and sand filling before formation of hard core/soling under floor slabs all areas to be covered shall be sprayed with pesticides, penetrating a minimum of 1 ft. into soil.
- (d) All rough woodwork for the entire project shall be pesticide treated (before application of so lignum in the case of material to receive both treatments). Pesticide shall be sprayed on all surfaces of blocking, furring, planks, scantlings, boards etc. before installations. Spraying shall be once again done at the site, after delivery and before installation. All spraying will be done within one week of working of the material.

4.05 LOCATION AND SCHEDULING:

- (a) Saturation of earth is to be done in such a manner as to in no way disrupt the progress of work.
- (b) Spraying of rough woodwork shall be done on or near the site at location and in such enclosures as proposed by the Contractor and approved by the Engineer. Such work is to be scheduled and done by sufficient skilled personnel as to in no way impede the progress of the work.
- (c) Care shall be exercised to ensure that no marks or damage occurs to the finished building as a result of the work under this Section, and Contractor shall verify and ensure that no material used herein will impede the growth of grass or plants at areas where spraying is done.

4.06 STANDARD:

All methods of termite protections used herein shall be in accordance with the standard practices of National Pest Control Association, U.S.A, and the British Wood Preserving Association.

4.07 GUARANTEE:

The Contractor is to guarantee that the building shall be free from termite (white ants), wood bores and other pests or rodents which cause damage to wood or other organic material for 10 years from the date of acceptance of the building.

In the event of any damage caused within the guarantee period, the Contractor shall replace at his own cost such damaged material finishes affected and suitably preserve and treat the entire premises with the best method known to the trade to prevent the spreading of termites and other pests.

4.08 TESTING:

All materials and samples shall be subjected to standard testing in accordance with the standards specified herein and shall be rejected if found below these standards. Rejected materials shall be removed from the site immediately.

4.09 PAYMENT:

Payment will be made for building site which will be paid separately on the basis of plinth area covered by this treatment including all ditches, pits, excavation, fills etc. complete as per rate quoted in the Bill of Quantities.

SECTION - 5

5.0 WATER

5.01 SCOPE:

The work covered by this section of the Specification consists of furnishing all labour, appliances and in performing all operations in connection with obtaining, conveying and storing water at site of work.

5.02 QUALITY OF WATER:

The water used for construction shall be free from impurities and fit for drinking purpose.

5.03 TESTING:

Water if required, shall be subjected to standard testing at the cost of the Contractor and if found to be unsuitable for construction work then the Contractor shall take such action as directed by the Engineer.

5.04 PAYMENT:

No separate payment will be made for the work covered under this section, and all costs in connection therewith shall be deemed to be included in the unit rates.

5.05 TEMPORARY STORAGE TANK:

The Contractor shall provide on site at his own cost temporary storage water tank with all necessary G.I. Pipes and fittings as per instructions of the Engineer. No separate payment will be made for tank, pipes and accessories, etc. These tanks shall be removed or dismantled or demolished and the area shall be cleaned and made good on completion of work as per direction of Engineer.

SECTION - 6

6.0 CONCRETE

6.01 SCOPE OF WORK:

The work covered by this section of the Specifications consists of furnishing all plants, labour equipment appliances and materials and in performing all operations in connection with concrete work complete in strict accordance with the applicable Drawings and the Specifications herein and subject to the terms and conditions of the Contract.

6.02 GENERAL:

Full cooperation shall be extended to other trades to install embedding items, and form ducts and openings etc. Embedded items shall have been inspected and check tested for concrete and other materials or for mechanical operations and approved before concrete is placed.

6.03 MATERIALS:

6.03.1 CEMENT

- i) Grey/ white Portland Cement shall be normal setting cement of the specific gravity, fineness and chemical composition fully conforming to Pakistan Standard Specifications P.S. No.232:1967 and shall be capable of satisfying all tests such as the tensile strength tests contained therein. Standard test briquettes prepared with 1:3 cement sand mortar shall give the following tensile strengths:

At 3 days not less than 300 Lbs/Sq.in(2.1N/Sq.mm).

At 7 days not less than 400 Lbs/Sq.in(2.8N/Sq.mm).
- ii) Sulphate Resistant Cement where required shall be sulphate Resistant Cement type 'A' fully conforming to Pakistan Standard Specification PS No.612:1967 and satisfying the requirements for fineness, chemical composition strength, setting time and soundness, etc.
- iii) For all types of cements, described in sub-Clauses (i) and (ii) above, the average compressive strength of three concrete cubes shall not be less than 1200 Lbs/Sq.in(8.2 N/Sq.mm) at three days and not less than 2000 Lbs/Sq.in(14 N/Sq.mm) at seven days as described in Ps.No.232.1962. Alternatively, the average compressive strength of three mortar cubes prepared with 1:3 cement and standard silica sand mortar shall not be less than 2200 Lbs/Sq.in(15.2 N/Sq.mm) at three days and not less than 3400 Lbs/Sq.in(23.5 N/Sq.mm) at seven days. The initial setting time shall not be less than 45 minutes and final setting time not more than 10 hours.
- iv) The supply of cement must be so programmed by the Contractor that

at no time the quantity of cement stock shall be less than that required for an average consumption of four weeks. Lorry or truck or other means of transportation, for the conveyance of cement to the site of works, shall be clean, dry, metallised lined and covered from top with water proof sheets, so that cement is sufficiently protected from any deterioration during transit.

- v) The Contractor shall provide at his own cost, on the Site, all necessary sheds, which shall be perfectly dry and watertight for the storing of cement to be delivered to the works, to ensure adequate supplies being available at site of work.
- vi) If at any time the Engineer or his Representative considers that any batch of cement may have deteriorated on the site during storage for any reason, he will direct that tests shall be made and that batch of cement on the site shall not be used until it has been shown by test at a laboratory, approved or appointed by the Engineer, to be satisfactory. Contractor shall bear all costs of such testing. Any rejected cement shall be removed from the site by the Contractor without delay. Cement reclaimed from cleaning bags or leaking containers shall not be used.
- vii) Cement shall be consumed in the sequence of receipt of shipments unless otherwise directed by the Engineer or his Representative.

6.03.2 AGGREGATES

- i) All fine and coarse aggregates to be used shall be supplied from approved sources, which shall not be changed without permission in writing from the Engineer. Aggregates shall conform to the test requirements of Pakistan Standard 243:1963 or equivalent.
- ii) Fine aggregates, shall be approved sand and shall be clean, sharp, free from clay, earth, vegetable and organic matters, alkaline or acid reactions or other deleterious matter or impurities.
- iii) Fine aggregates shall conform to Pakistan Standard Specifications PS No.243:1963 "Natural Aggregates for Concrete" and shall be graded as follows:-

B.S.SIEVE NUMBER.	PERCENTAGE (BY WEIGHT) PASSING	
	Grading Zone 1.	Grading Zone 2.
3/8"(9.5 mm)	100	100
3/16"(4.8 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	08 - 30
No.100	0- 10	00 - 10

- iv) Coarse aggregates shall be approved hard crushed stone from a

source approved by the Engineer and shall be clean, free from sand, dust, salt, lime, chalk, clay and organic impurities or other deleterious matter.

- v) Coarse aggregates shall conform to the relevant Pakistan Standard Specifications PS No.243:1963 Coarse aggregate shall be graded as follows:-

FOR CONCRETE CLASSES A, B & C (Nominal Size of Graded Aggregate 3/4" to 3/16" (19 mm to 4.8 mm).

B.S.SIEVE NUMBER	PERCENTAGE (BY WEIGHT) PASSING
1" (25.4mm)	100
3/4" (19 mm)	090 - 100
3/8" (9.5mm)	020 - 55
3/16"(4.8mm)	000 - 10

FOR CONCRETE CLASSES D & E (Nominal Size of Graded Aggregate 1-1/2" to 3/16" (38 mm to 4.8 mm).

1 1/2" (38 mm)	100
1" (25.4 mm)	95 - 100
3/4" (19 mm)	35 - 70
3/8" (9.5mm)	10 - 33
3/16"(4.8mm)	0 - 5

- vi) All aggregates shall be stored on properly constructed paving and in bins and there shall be a physical partition between the stockpiles of coarse and fine aggregate. No mixed up aggregates shall be used in any concrete. Under no circumstances aggregates shall be allowed to be in contact with ground.
- vii) If required, aggregates shall be washed and screened to the satisfaction of the Engineer or his Representative before use by processing through proper screening and washing plant. Adequate time is to be allowed therefore, for the moisture content to become substantially uniform before use in works.
- viii) Sieve analysis and other necessary tests of all aggregates shall be carried out as and when required by the Engineer or his Representative. Samples for such tests shall be taken in the presence of the Engineer or his Representative. All costs in connection with the tests shall be borne by the Contractor.
- ix) All aggregates shall be subject to the approval of the Engineer. Any batch of aggregates not found to the required standard shall be rejected by the Engineer or his Representative and shall have to be removed from site without delay. Concrete structures executed with

rejected aggregates shall be dismantled and rebuilt at the Contractor's expense.

- x) Special fine gravel of 9 mm (3/8") or 12 mm (1/2") maximum size shall be used if and where called for on the Drawings or as directed by the Engineer.
- xi) If suitable gravel meeting with the Specifications is not procured by the Contractor, he will have to arrange suitable crush stone if demanded by the Engineer. No extra payment shall be made to the Contractor to effect this change.

6.03.3 WATER shall be as specified under section on water.

6.04 CLASSIFICATION OF CONCRETE:

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

TABLE-I: Showing minimum required compressive strengths 150 x 150 x 150 mm (6"x6"x6") test cubes and minimum quantity of cement required per m3 or 100 cft. of finished concrete for various mixes and under various conditions.

Class of Concrete	Nominal Min. Ratio	Min. Qty. of Cement		Preliminary Cube strength				Work Cube	
		Lbs. per 100 cft.	Kg. / Cu. m.	at 7 days		at 28 days		at 7 days	
				Lbs./ Sq. in.	N/ Sq.mm	Lbs./ Sq. in.	N/ Sq.mm	Lbs./ Sq. in.	N/ Sq.mm
A.	1:1:2	3024	485	4000	28.0	4500	31.5	3000	21.0
B.	1:12:3	2520	404	3350	23.4	3750	26.3	2500	17.5
C.	1:2:4	2016	323	2700	18.9	3000	21.0	2000	14.0
D.	1:3:6	1344	216	1300	9.1	1500	10.5	1000	7.0
E.	1:4:8	1008	161	850	5.9	1000	7.0	650	4.5

6.05 PROPORTIONING OF CONCRETE MIXES:

6.05.1 All concrete shall be proportioned by volume for concrete mixes, unless specifically directed by Engineer to proportion them by weight, when the ratios will also differ. The proportions given above in Table-I are suitable only when the specific gravities of

the aggregates are in the region of 2.5. The Contractor shall submit to the Engineer proposed mix designs for concrete to be used, based on preliminary laboratory tests to determine proportion of cement, aggregates and water in the concrete conforming to the quality and strength requirements specified herein. Preliminary test results of at least three different mixes of each class of concrete with varied water cement ratios shall be submitted. The results of 7 days and 28 days cube tests shall be used to establish the ratios between 7 days and 28 days strengths. The Engineer may make adjustments in the ratio of fine to coarse aggregate in the mix for a certain work. Preliminary design of mixes and testing shall be the responsibility of the Contractor. The proportion of voids in the coarse aggregate shall be controlled and if it exceeds 45% than sand and consequently the cement content shall be increased by the Contractor without any charge. If the proportion is less than 40%, sand shall be decreased but not the cement.

6.05.2 MAXIMUM ALLOWABLE WATER CONTENT:

All concrete specimens shall be made, cured and tested in accordance with British Standard or ASTM Standard. A curve representing the relation between the water content and the average 28 days Compressive Strength or earlier strength at which the concrete is to receive its full working load shall be established for a range of values, including all the compressive strengths shown on the plans, The curve shall be established by at least four points each point representing average values for atleast four specimens. The maximum allowable water content for the concrete shall be as determined from this curve and shall correspond to a strength 15% greater than indicated on the plans. No substitution shall be made in the materials used in the work without additional tests in accordance with this procedure to indicate that the quality of the concrete is satisfactory.

6.05.3 SLUMP TEST:

The Slump for concrete, determined in accordance with PS No.422:1964 "Slump Test for Concrete" shall be minimum of 25 mm (1") and a maximum of 75 mm (3") provided the requisite strength is obtained. Corrective additions to remedy deficiencies in aggregate gradations shall be used only with the written approval of the Engineer. When such additions are permitted the materials shall be measured separately for each batch of concrete.

6.06 BATCHING AND MIXING:

6.06.1 Concrete shall be mixed by a mechanical batch type mixing plant with adequate facilities for accurate measurements and control of each material entering the mixer and for changing the proportions to conform to varying conditions of the work. The mixing plant assembly shall permit ready inspection of operations at all times. The plant and its location shall be subject to approval of the Engineer. However, if approved by the Engineer, Volumetric batching can be adopted, using cement by weight, at 20°C or 70°F according to the following table:

Class Mix.	Nominal	Cement		Sand		Coarse Aggregate	
		Lbs.	Kg	Cft.	Litre	Cft.	Litre
A	1:1:2	110	50	1 3/4	35	2 2	70
B	1:1 1/2:3	110	50	1 3/4	50	3 2	106
C	1:2:4	110	50	2 2	70	5	140
D	1:3:6	110	50	3 2	106	7 2	212
E	1:4:8	110	50	5	140	10	280

Water shall be measured for every batch with due allowance made for water already present in aggregates.

6.06.2 **Batching** units where used shall be supplied with the following items:-

- i) Weighing unit shall be provided for each type of material to indicate the scale load at convenient stages of the weighing operations. Weighing units shall be checked at times directed by and in the presence of the Engineer or his Representative and required adjustments shall be made before further use.
- ii) Water mechanism shall be tight with the valve interlocked so that the discharge valve cannot be opened before the filling valve is fully closed and shall be fitted with graduated gauge.
- iii) Discharge gate shall control the mix to produce a rib boning and mixing of cement with aggregates. Delivery of materials from the batching equipment to the mixer shall be accurate within the following limits:-

<u>MATERIAL</u>	<u>PERCENTAGE BY WEIGHT</u>
Cement	1/2
Water	1/4
Fine Aggregate	1
Coarse Aggregate	2

6.06.3 **MIXING UNIT:**

- i) Operations:
Mixers shall not be charged in excess of noted capacity nor be operated in excess of noted speed. Excessive mixing requiring addition of water to preserve required consistency shall not be permitted. The entire batch shall be discharged before re-charging.
- ii) Mixing time shall be measured from the instant water is introduced into the mixer drum containing all solids. All mixing water shall be introduced before one-fourth of the mixing time has elapsed. Mixing time for mixers of one cubic meter or less shall be 2 minutes; for larger than one cubic meter capacity mixers time shall be increased 15 seconds for each additional half cubic meter or fraction thereof. If an air-entraining agent is used, additional mixing time shall be allowed such as to provide the specified air-content.
- ii) Discharge Lock:

Unless waived by the Engineer device to lock the discharge mechanism, until the required mixing time has elapsed, shall be provided on each mixer.

- iv) No hand mixing under any circumstances even with extra cement shall be permitted. If during concreting, the mixing plant fails, the concrete already poured shall be removed, unless directed otherwise by the Engineer or his Representative.

6.07 **SAMPLES AND TESTING:**

6.07.1 **GENERAL:**

Test cubes of concrete shall be prepared and stored by the Contractor, in accordance with PS No.56O:1965, as and when directed by the Engineer or his Representative. Test cubes be tested in a laboratory and the Contractor shall bear the charges for the same. Aggregates shall be tested as prescribed.

6.07.2 **CEMENT:**

Cement shall be tested as prescribed in Pakistan Standard or British Standard or ASTM Standard.

6.07.3 **AGGREGATES:**

Aggregates shall be tested as prescribed in relevant Pakistan Standard or British Standard 812. In addition fine aggregates shall be tested for organic impurities in conformity with B.S. 812 or equal ASTM Standard or Pakistan Standard.

6.07.4 **REINFORCEMENT:**

Reinforcing bars shall be tested as prescribed in relevant Pakistan or British or ASTM Standards. Mesh Reinforcement shall be tested as prescribed in B.S.785 or ASTM A-185.

6.07.5 **TESTING OF CONCRETE**

- i) The Contractor shall provide for test purposes one set of six cubes taken for each class of concrete poured on each day. The Engineer or his Representative may, however, order for more cube tests if any irregularity is found in the concrete.
- ii) All test cubes shall be 150 x 150 x 150 mm (6"x6"x6") size.
- iii) All test cubes of the same set shall be made from the same batch of concrete.
- iv) Three cubes of the set shall be tested at 7-days and three shall be tested at 28 days or at such ages as directed by the Engineer or his Representative.
- v) All test specimens shall be made and cured in accordance with Pakistan Standard PS 56O:1965 or British Standard B.S. 1881 or ASTM C-31.
- vi) Specimens shall be cured under laboratory conditions except that the

Engineer or his Representative may require curing under field conditions.

- vii) All cube moulds shall be steel moulds perfectly true having all internal and the meeting faces machined to a smooth surface.
- viii) If the strength tests of the laboratory controlled specimens for any portion of the work falls below the minimum allowable compressive strength at 28 days required for the class of concrete used in that portion, the Engineer or his Representative shall have the right to order replacement of the effected work.
- ix) All test cubes cast at site shall bear distinguishing mark showing serial number, date of casting, quality of concrete and place from where sample was taken and where that batch of concrete was placed in the structure. A proper daily record of test specimens made, test results obtained shall be maintained by the Contractor and weekly test results shall be submitted to the Engineer or his Representative.
- x) The Engineer or his Representative may require load tests for the part of the structure from where test specimens have shown unsatisfactory results at the cost of the Contractor. In the event that load tests indicate bad quality of concrete, measures as prescribed by the Engineer shall be taken to correct the deficiency at no additional cost to the Department. The nature, description and details of load test shall be determined by the Engineer and shall be binding on the Contractor.

6.08 TRANSPORTING AND PLACING CONCRETE:

- a. Concrete shall be conveyed and deposited as quickly as possible after mixing and shall proceed so that, as far as possible, a complete section of the work is done in one operation.
- b. Transport of concrete shall be in a manner approved by the Engineer's Representative and shall be so as to avoid segregation or loss of ingredients of concrete.
- c. All foundations and portions of work to be concreted shall be approved by the Engineer's Representative before concrete is poured.
- d. All forms and reinforcement shall be completed, cleared inspected and approved before pouring of concrete. No concrete is to be deposited till the Engineer's Representative has inspected and approved in writing all reinforcement, foundations, forms, details, positioning of all fixture and materials to be embedded in concrete, control levels and screeds, etc. and is satisfied with the arrangements the Contractors has made to efficiently proceed with the work such as sufficient labour, materials, plants etc. Such an approval will not relieve the Contractor from any of his obligations under this Contract. Water shall be removed from excavations before concrete is deposited.
- e. Placing of concrete shall not be permitted when, in the opinion of the

Engineer's Representative, the sun heat, wind, cold, snow or limitations or facilities furnished by the Contractor prevent proper placing, finishing and curing of concrete.

- f. All concrete shall be thoroughly compacted and consolidated by means of Pneumatic or mechanical vibrators or other approved compacting method. Care shall be taken to avoid segregation due o excessive vibration. The Contractor shall maintain on site at all times one or more stand-by vibrators. Tapping or other external vibration of forms shall not be allowed, unless so directed by the Engineer's Representative. Compaction shall be done until the whole mass assumes a jelly like appearance and consistency with the water just appearing on the surface. Concrete shall be sufficiently tamped and consolidated around the steel rods, care taken that the vibrator does not touch steel or formwork and into all parts of the moulds in order that no voids or cavities are left. Steel shall not be disturbed during operations of concreting. Concrete shall be brought up in even layers not more than 150 mm (6") thickness and worked against side of forms to give a smooth and uniform surface. No excessive water shall be allowed to come out and lie on the surface of concrete. The concrete must be of such a consistency that after ramming, consolidating and tamping is completed, a thin film of water is just appearing on the surface.
- g. Hardened concrete, debris and foreign material shall be removed from interior of forms and from inner surface of mixing and conveying equipments.
- h. Runways shall be provided for wheeled concrete handling equipment, and such equipment shall not be wheeled over reinforcement, nor shall runways be supported on reinforcement.
- i. Concrete shall not be dropped freely from a height of more than 3.5 m (12 ft) in columns and 1.5 m (5 ft) elsewhere. Incases where an excessive drop is inevitable the Contractor shall provide spouts, down pipes, chutes, or side parts to forms with pockets which will let concrete stop and flow easily into the form without any risk of segregation. The discharge of the spouts, down pipes or chutes shall be controlled so that the concrete may be effectively compacted into horizontal layers not more than 300 mm (12") thick.
- j. Concrete is to be deposited as quickly as possible after mixing and to proceed continuously. Concrete which has attained its initial set or has contained its mixing water for more than 30 minutes shall not be allowed to be placed in the work.
- k. When concrete is laid on hard core, such as subgrade for floor slabs, or other absorbent material, the surface is to be watered, consolidated and, where specified, blinded before the concrete is deposited.
- l. Fresh concrete shall not be placed on previously laid concrete or on old concrete surfaces until the latter has been cleaned of dirt, scum and laitence by wire brushes. The clean surface shall then be thoroughly wetted and grouted with cement slurry as approved by the Engineer's Representative.

- m. Care shall be taken not to disturb newly placed concrete by vibrator, indirect loading or otherwise. No traffic or loading shall be allowed on the concrete until it has thoroughly set and hardened.
- n. Construction joints in concrete shall only be given at locations indicated on the drawings or as approved by the Engineer or his Representative. At the end of the day's work the concrete shall be finished off against a temporary shutter stop, which shall be vertical and securely fixed. Such stops shall be removed within 24 hours of placing of concrete. Construction joints not shown on the drawings shall be reinforced with steel bars or dowels, if deemed necessary by the Engineer or his Representative shall be furnished by the Contractor without any additional payment.
- o. No concrete shall be placed during rains or in inclement weather and all fresh concrete shall be suitably protected from rain-fall and excessive heat or cold.
- p. Should any part of the exposed surface present a rough uneven or imperfect appearance when the shuttering is removed. It shall be picked out to honeycomb depth and refilled and properly re-surfaced or entirely redone as per directions of Engineer or his Representative at the cost of the Contractor.
- q. On removal of the forms and before the skin has had time to harden, all faces of the concrete inside or outside, to be kept exposed shall be rubbed over with carborandum stone, and washed with cement to remove all marks, projections, hollows or any other defect. No extra payment shall be made for this work.

All exposed surfaces and lines of the concrete work are to be true and fair without cracks, bends, windings and distortions of all kinds, and if occurring, shall be removed without any extra charges by the Contractor. All un-plastered concrete works is to be fair face, smooth, pleasing and to the entire satisfaction of the Engineer or his Representative.

- r. A float or screed is to be worked over the exposed surfaces of all concrete work on the flat or curve, so as to render the surfaces perfectly smooth, clear, and to the necessary slopes or falls or as required to receive the floor or roof finishes, according to the drawings, and as directed by the Engineer or his Representative without any extra charges by the Contractor.

6.09 **PROTECTION AND CURING:**

All exposed concrete shall be cured. Curing shall be accomplished by preventing loss of moisture, rapid temperature change and mechanical injury or injury from rain or flowing water for a period of at least ten (10) days. Curing shall be started as soon as the concrete has hardened sufficiently for the surface not to be marked. Curing shall be done either by continuous sprinkling of water on the surface or by covering with sand, hessian, canvas or other approved fabric mats, which shall be kept continually wet. If required and so directed by the Engineer or his Representative, formed surfaces with forms in position shall also be cured by keeping all forms continually wet. As an alternative, curing of concrete, on all exposed surfaces which could not be kept covered, such as sides of the beams, under side of the slabs, may also be done by sealing concrete surfaces with curing compounds like "Paccacure" or equal so as to arrest loss of moisture from concrete, with approval of Engineer or his Representative. The Contractor shall take special care that curing of concrete is

satisfactorily carried out and in accordance with methods specified herein and / or as instructed by the Engineer or his Representative. Any negligence in this regard may result in total rejection of such concrete works, which in the opinion of the Engineer or his Representative have not been adequately cured.

Minimum period of curing for any concrete shall be 10 days or more as directed by the Engineer. All concrete components of concreted structures shall be clearly marked with non-washable paints to indicate the date of placing concrete. During hot weather, curing shall be done even at night.

6.10 FORMWORK:

6.10.1 General

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

6.10.2 Making Forms

The form-work for columns, beams, slabs lintels fins, shells, blocks, panels, purdees, surrounds for windows, and all other works whether to be precast or cast in situ shall be made of sound and properly seasoned timber or other approved material and shall be rigidly formed and designed by the Contractor to the shapes and forms as per drawings in accordance with the best of the existing practices so as to be able to withstand, without displacement, deflection or deformation movements of any kind, the pressure of the moist concrete and all other loads. For concrete work to show an even finish the timber forms be properly lined with plywood or steel sheets to give a fair face concrete of a homogenous, perfectly even and smooth appearance in exposed surfaces of all beams, columns, walls, slabs, etc.

6.10.3 Rigid with Allowance for Camber and Bulges

It shall be fabricated and erected in position, perfect in alignment, levels and true to plumb and shape and securely braced so as to enable it to stand all weights, live and vibrating to be endured during placing of concrete and its subsequent hardening till the form work is struck. It shall be so sufficiently rigid as not to loose its form and shall be so made for bulging, and deflection as to give the finished concrete to the required lines, plumb, size and shape.

6.10.4 Exposed Surfaces Left Unplastered

For concrete work covered in this contract where concrete Surface is to be exposed in the finished work and left unplastered, the form-work shall be smoothly faced by using plywood sheets or lining the shuttering with smooth steel sheet or non-absorbent material like formica sheets or in any manner as approved by the Engineer or his Representative, so as to make a perfectly smooth surface of the finished concrete. Where any surface defects on the exposed concrete surfaces occur and which do not impair the structural performance, being in excess of the designed surfaces, and the architectural appearance of the work in the opinion of Engineer or his

Representative, such defects may be removed by guniting and grinding with corborandum stone or in any other approved manner, at the cost of the Contractor, otherwise the whole or part of the work may have to be removed and remade good by the Contractor at his own cost. For precast concrete members the forms shall be rigid, exact, smooth and made of steel.

6.10.5 Materials and Labour

The Contractor shall supply all materials and labour, necessary for a good and speedily erection of form-work such as shuttering, planks, struts, bolts, stays, gangways, boards, fillets etc. and shall do all that is essential in executing the job in a workman like manner to the satisfaction of the Engineer.

6.10.6 Form Work not to Interfere or Injure Work

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

6.10.7 Opening in Form-work

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

6.10.8 Openings and other details

Provision shall be kept in the form-work such as openings, recesses holes, pockets, fillets, etc for housing services and other architectural details in the finished concrete or on its surface and edges as shown on drawings or as directed by the Engineer or his Representative to fix all necessary inserts, dowels pipes, holdfasts etc. as shown on drawings or as directed.

6.10.9 Joints in Form-work

All joints in the formwork shall be sufficiently closed to prevent undue leakage of mortar for concrete surface not to be exposed in the finished work. The joints in the form-work for all concrete surfaces to be exposed in the finished work shall be close jointed and perfectly smooth so as not to allow any leakage of the mortar from the concrete; and show any appearance of leaking mortar on concrete surface.

6.10.10 Treatment and Inspection of Forms

All rubbish, particularly chipping, shavings, and sawdust etc. shall be removed from the interior of the forms, immediately before fixing of bars. Forms shall be coated with approved mould oil before reinforcement is placed. Surplus oil on forms and any oil on reinforcing steel shall be removed. Forms surface not exposed to view or normal watering may thoroughly be wetted with soap and water in place of oiling before placing concrete. If the forms are not used within 24 hours, a fresh coat of oil shall be given before placing of concrete.

6.10.11 Striking Shuttering

No struts or timbering which serve the purpose of supporting the shuttering or

centering shall be struck and removed without direct permission from the Engineer or his Authorized Representative in writing and the work of striking and removal after the receipt of such permission shall be conducted under the personal supervision of the competent foreman in the employment of the Contractor and the Contractor shall hold himself fully responsible for any consequences whatsoever. In all cases the Engineer or his Authorized Representative will direct and control the minimum period of time for which the forms, shuttering or centering shall remain in place before being struck; but, for the general guidance of the contractor, when normal Portland Cement has been used in the work, the following are to be considered as the minimum periods in days for the main classes of work:

Removal of Shuttering	10 °C (50°F)	20 °C (70°F)
Beams sides, walls & Columns (unloaded)	03	02
Slabs soffits (props left under)	09	06
Removal of props to slabs	18	14
Beams soffits (props left under)	18	12
Removal of props to beams, and shuttering under shells.	24	18

The Engineer or his Representative may require, however, that any walings, soldiers, struts or other timbers or supports, the removal of which may cause the transference of load to the finished work, to be kept in place for three weeks after the placing of the concrete.

6.10.12 Injury or Damage.

The Contractor shall be responsible for any injury to the work and any consequential damages caused by or arising from the removal and striking of forms, centering and supports, due to striking too soon, and any advice, permission or approval given by the Engineer or his Authorized Representative, relative to the removal and striking of forms, centering and supports shall not relieve the Contractor from the responsibilities herein defined.

6.10.13 Treatment after Removal of Forms.

Any minor surface honey-combing or other irregularities are to be properly made good immediately upon the removal of the form-work and the surface made good to the satisfaction of the Engineer and his Representative. Any small voids shall be neatly stopped with cement mortar consisting of one part of cement to two parts of sand and the whole surface rubbed over with corborandum stone and cement wash and bring the whole to a smooth and pleasing finish and uniform colour.

No form-work shall be measured and paid for separately and shall be deemed to be included in the unit price of concrete whether cast-in-situ or precast and subsequently fixed in position.

6.11 FINISHING OF FORMED SURFACES

6.11.1 SPECIAL ARCHITECTURAL FINISHES

- i) Textured finishes - Textured form liners may be of form plastic sheet, wood sheet, metal, or other material. Liner panels shall be secured in forms by cementing or stapling, but not by methods which will permit impressions of nail heads, screw heads, washers, or the like to be imparted to the surface of the concrete. Edges of textured panels shall be sealed to each other or to divider strips (if specified or shown) to prevent bleeding of grout. The sealant used shall be non-staining to the surface.
- ii) Aggregate transfer finishes - Aggregate transfer and other special finishes shall be produced using methods and materials in such a way as to duplicate sample panels prepared in advance.
- iii) Applied finishes - When special finishes are to be applied, the surface of the concrete shall be prepared to ensure permanent adhesion of the finish. If the concrete is less than about 24 hours old, it can be roughened with a heavy wire brush or scoring mechanically or by etching with dilute hydrochloric acid. After roughening the surface shall be washed free of all dust, acid, chemical retarder, and other foreign material before the final finish applied.

6.11.2 RUBBED FINISHES

The following finishes shall be produced to concrete with a smooth form finish. Where smooth rubbed finish is to be applied, the forms shall have been removed and necessary patching completed as soon after placement as possible without jeopardizing the structures.

- i) Smooth rubbed finish - Smooth rubbed finish shall be produced on newly hardened concrete not later than the day following from removal. Surfaces shall be wetted and rubbed with car texture are produced. No cement grout shall be used other than the cement paste drawn from the concrete itself by rubbing process.
- ii) Grout cleaned finish - No cleaning operation shall be permitted until all continuous surfaces to be cleaned are completed. Mix 1 part Portland cement cement and 1 1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paste. White Portland cement shall be substituted for a part of the grey Portland cement in order to produce color matching the color of the surrounding concrete, as determined by a trial patch. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout and apply the grout uniformly with brushes or a spray gun. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to the surface and fill all air bubbles and holes. While the grout is still plastic, remove all excess grout by working the surface with rubber float, sack, or other means. After the surface whitens from drying (about thirty minutes at normal temperatures), rub vigorously with clean burlap. The finish shall be kept damp for at least 36 hours after final rubbing.
- iii) Cork floated finish - Remove from at an early stage, within 2 to 3 days of placement where possible. Remove ties . Remove all burrs and fins. Mix one part Portland cement and one part fine sand with sufficient water to produce

a stiff mortar. Dampen wall surface. Apply mortar with firm rubber float or with trowel filling all surface voids. Compress mortar into voids using a slow - speed grinder or stone. If the mortar surface dries too rapidly to permit proper compaction and finishing, apply a small texture with a cork float using a swirling motion.

6.11.3 UNSPECIFIED FINISH

If the finish is not designated and applied finishes are also not indicated the following finishes shall be used as applicable:

- i) Rough form finish - For all concrete surface not exposed to public view.
- ii) Smooth form finish - For all concrete surfaces exposed to public view.

6.11.4 RELATED UNFORMED SURFACE

Tops of walls or buttresses, horizontal off-sets, and similar unformed surfaces occurring adjacent to formed surfaces shall be floated to a texture reasonably consistent with that of the formed surfaces. Final treatment on formed surfaces shall continue uniformly across the unformed surfaces.

6.12 CONSTRUCTION JOINTS:

Construction joints shall be located as indicated on the drawings and/or as approved or directed by the Engineer or his Representative. For slabs and beams construction joints shall be located at mid point of the span unless a secondary beam intersects a main beam at the centre in which case the joints in the main beam shall be off set a distance equal to twice the width of the beam and provision for shear shall be made by the use of inclined reinforcement at the cost of the Contractor. Joint in columns shall be made at the under side of the deepest beam framing thereto. Beam stems shall be poured monolithically unless directed otherwise by the Engineer. Joints not specified or shown on the drawings shall be so located as to least impair the strength and appearance of the work. Except where indicated on the drawings no jointing shall be made in footings or foundations without written approval of the Engineer or his Representative. Construction jointing shall be at right angles to the member and shall be formed against firm stop boards. The stop boards shall be removed as soon as possible after placing the concrete but without the risk of movement of the concrete and the concrete surface shall be well brushed with a hard brush and washed off with a spray of water, two to four hours after casting, to expose the aggregates and provide a key for the next pour. In all liquid retaining structures and other sub-structures pits and trenches etc. PVC or any other approved water stops shall be provided at the construction joint in the manner shown on the drawings and/or approved by the Engineer or his Representative.

Whenever a section of concrete is left unfinished, for any reasons with the approval of Engineer's Representative, leaving a surface which will be hard set before additional concrete can be joined to it, dovetails, grooves or other bonds with the new work shall be provided at cost of the Contractor. Before depositing fresh concrete upon or against any concrete which has already set, the surface of the set concrete shall be roughened with a cutting tool, any laitance removed, thoroughly cleansed of all foreign matter, well watered and covered with cement grout, and

special care shall be taken to ram the fresh concrete thoroughly up and against the set concrete; and, if deemed necessary by the Engineer or his Representative the joints shall be reinforced with steel bars or dowels to be all furnished and done by the Contractor without any additional payment.

6.13 CONCRETE FLOOR SLAB FINISHING:

6.13.1 GENERAL

Concrete slabs shall be finished as described herein. In preparation for finishing, floor slabs shall be struck off to the required level at or below the elevation or grade of the finished floors as shown on the drawings. Floors shall be leveled with a tolerance of 1 mm in 1 m (1/8" in 10 feet) except where drains occur in which case the floors shall be pitched to the drains as indicated on the drawings or as directed by the Engineer.

6.13.2 MONOLITHIC FINISH

All concrete surfaces in floors except where other finish is specified shall be finished by steel floats or straight edges to bring the surface to the required finish level shown on the drawings. While the concrete is still green but sufficiently hardened to bear a man's weight without deep imprint it shall be wood floated to a true even plane with no coarse aggregate visible. Sufficient pressure shall be used on the wood floats to bring moisture to the surface. The concrete shall then be hand troweled to produce a smooth impervious surface free from trowel marks. If necessary, the process shall be repeated so that the final finish shall produce a ringing sound from the trowel. No separate payment shall be made for finishing floor slabs in the fore mentioned manner.

6.13.3 CONCRETE TOPPING

Where indicated on the drawings base slab under concrete topping shall receive a screeded finish. After the base slab is thoroughly cured and when directed concrete topping shall be laid to the thickness as indicated on the drawings in alternate panels of suitable sizes as directed by the Engineer or his Representative.

6.14 ANCHOR BOLTS, INSERTS, SLEEVES, CHASES, RECESSES STEEL FRAMES ETC:

The Contractor shall furnish and place in position accurately shown on drawings, all inserts, sleeves, chases, recesses, etc., supplied by himself or other Contractors, as directed, by the Engineer and full cooperation and co-ordination shall be maintained with other Contractors, sub-contractors in this regard.

6.15 WATERPROOF CONCRETE:

Wherever specified on the drawings all liquid or water retaining structures and those subject to water pressure shall be executed with approved waterproof concrete. The water proofing compound shall be of the approved type and shall be mixed with the concrete in strict accordance with the manufacturer's directions and/or as directed by the Engineer or his Representative.

6.16 CLEANING AND REMOVAL OF RUBBISH:

On completion of works herein the Contractor shall remove all concrete debris, rubbish, shuttering materials, scrapes etc., from the vicinity of the structures completed. All areas shall be cleaned to the satisfaction and approval of the Engineer or his Representative.

6.17 COORDINATION:

The Contractor shall provide chases and openings required for other sections of the work and will co-operate and coordinate with other trades in placing their pipes, ducts, reglets and other built-in-items as the work proceeds.

6.18 EXTERNAL EXPOSED CONCRETE SURFACE:

All external exposed un-plastered concrete surfaces of cast in situ or precast units shall be given smooth or pattern finish as shown in the finishing schedule or as directed by the Engineer or his Representative. No separate payment shall be made to the Contractor for this work and it shall be included in the item rates of the respective concrete items in the bill of quantities.

6.19 PARTICULAR SPECIFICATIONS FOR CONCRETE

- a) Allowable bearing pressure of soil for foundation is marked on the drawing of the foundation. It is to be checked that no foundation is placed on the soil with a lower bearing capacity. In cases any weaker strata is encountered at any level the matter is to be reported to the Engineer for necessary changes in footings.
- b) Level of foundations as indicated on the drawings may be varied at site to reach the suitable strata. This matter is to be decided by the Engineer at site.
- c) Before concreting, the excavated surface to receive the concrete should be cut to proper levels. All loose soil is to be removed.
- d) Minimum strength requirements of various concrete mixes at 28 days actually being used for work using ordinary Portland cement shall be as follows:-

Concrete Mix:	1:1:2	-	4500 p.s.i. (Class 'A')
	1:1 1/2:3	-	3750 p.s.i. (Class 'B')
	1:2:4	-	3000 p.s.i. (Class 'C')
	1:3:6	-	1500 p.s.i. (Class 'D')
	1:4:8	-	1000 p.s.i. (Class 'E')
- e) All R.C.C. work shall be in 1:2:4 concrete mix unless otherwise indicated for a richer mix on the drawing or specified.
- f) All concrete is to be thoroughly vibrated mechanically:
 - i. Any concrete failing to meet the specified strength or not formed as shown on drawings, concrete out of alignment, concrete with surfaces beyond require tolerances or with defective surfaces which cannot be properly repaired or patched in the opinion of Engineer=s Representative shall be removed and replaced at Contractor=s expense. The Engineer=s Representative may reject any defective concrete and order it to be cut out in part or in whole and replaced at the Contractors expense. Only in case of minor surface defects the Engineer=s Representative may approve a surface treatment immediately after from removal.
 - ii. All ties and bolt holes and all repairable defective area shall be

patched immediately after removal.

- iii. All honeycombed and other defective concrete shall be removed down to sound concrete. The area to be patched and area at least 150 mm wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared using a mix of approximately 1 part cement to 1 part fine sand passing a No. 25 B.S. Sieve, shall be mixed to the consistency of thick cream and shall then be well brushed into the surface.
- iv. 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 mortar shall consist of not more than 1 part cement to 22 parts sand by damp loose volume. White Portland cement shall be substituted for a part of the grey Portland cement on exposed concrete in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch.
- v. The quantity of mixing water shall be not more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until has reached the stiffest consistency that will permit placing.
- vi. After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as 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.
- g) For heavy concrete members the form work is to be properly designed and approved by the Engineer.
- h) Shuttering should not be struck earlier than the time specified unless otherwise approved by the Engineer.
- i) 18 gauge G.I. binding wire to be used for securely binding the reinforcing bars to avoid dislocation or displacement during concreting.
- j) Clear cover to main reinforcement in concrete members be as follows:-
 - i) For slabs, projections chajjas, fins, walls, staircases precast slabs .. 3/4"
 - ii) For beams, Columns, all members of water tank on the side in contact with water . 1 1/2"

- iii) For foundations, retaining walls and foundation beams . 2"
- k) All the reinforcing bars are to be properly placed as shown on the working drawings. Steel chairs and concrete spacer blocks are to be used without any extra cost. Concrete spacer blocks are to be properly cured to avoid their damage during concreting, thereby causing displacement of bars. Holes made by bolts etc. introduced for keeping the shuttering in tact should be properly treated after striking the shuttering. No such holes shall be allowed in walls of water retaining structures and earth retaining walls.
- l) All bent up bars in slabs are to be properly secured in position. Workers or trollies shall not be allowed in any case over the reinforcement mesh.
- m) Special care is to be taken to see that all expansion joints shown on the drawings are made in perfect straight line and treated as specified.
- n) Construction joints in beams and slabs shall be located at the centre of the span (such that a proper seat is formed for the next part to be cast); unless otherwise indicated on drawings or approved by the Engineer.
- o) DPC
The Concrete mix of DPC will be CC 1:2:4 as specified in this chapter. To protect the dampness water proofing agent APudlo@ or any other water proofing agent as approved by the Engineer will be mixed in CC 1:2:4 @ the ratio of 5 lbs per bg of cement. The DPC will be cured for at least 10 days.

6.20 MEASUREMENT AND PAYMENT

All the concrete work shall be measured net as per execution at site in square or cubic feet for the related items and shall be paid at the rate entered in the BOQ appended to the contract in accordance with the conditions of contract. The rates are inclusive of all type of form-work, its erection and removal, all scaffolding, cost of mixing and batching plants, all T&P required for executing and placing the concrete work in position and Water Stopper, Bitumen Coating etc. Defective and honey-combed work will not be measured & paid and will be liable to be rejected and redone at contracts' cost.

SECTION - 7

7.0 STEEL REINFORCEMENT

7.01 SCOPE OF WORK:

The work covered by the section of the specification consists of furnishing all materials, tools, labour and in performing all operations in connection with the providing, straightening cutting, bending, binding, fixing, including binding wire, chairs, pins, spacer block complete in strict accordance with this section of the Specifications, the applicable drawings, approved bar bending schedule, and the terms and conditions of the Contract.

7.02 MATERIALS:

- A. Reinforcing steel to be new billet stock of mild steel (plain bar), hard grade (deformed bar) and Ribbed Tor steel as specified on the drawings and shall conform to British Standard Specifications or equivalent ASTM or Pakistan Standard.
- B. The Contractor shall furnish to the Engineer's Representative Manufacturers' mills certificate to guarantee that steel meets the standard, specifications requirements and minimum certified yield stresses as follows:-
- i) Mild Steel plain bars conforming to B.S.S. 15 or B.S.S. 4449 or PS-231-1962
 - a) Tensile Strength - 438 to 517 N/Sq.mm (28 to 33 tons/Sq.in).
 - b) Yield Strength - 250 N/Sq.mm (16 Tons/Sq.in)
 - c) Elongation - 16% to 24% (av. 20%).
 - ii) Hard grade deformed bars conforming to ASTM, A-15-85 T. or PS-605-1962
 - a) Tensile Strength - 560N/Sq.mm (35.7 Tons/Sq.in).
 - b) Yield Strength - 350 N/Sq.mm(22.3 Tons/Sq.in).
 - c) Elongation - 1100 000 x %

Tensile Strength
 - iii) Ribbed Tor steel conforming to B.S. 4461
 - a) Tensile Strength - 490 N/Sq.mm(70,000 lbs/Sq.in).
 - b) Yield Strength - 420 N/Sq.mm(60,000 lbs/Sq.in).
 - c) Elongation - 14.5%
- C. All steel to be true to the Standard Specifications with regard to bend ability specially the hard grade deformed bars under 19 mm (3/4") dia. shall be capable of being bent cold through 90 degree round a bar of four times its own diameter without fractures or injury of any kind. In case of deformed bars over 19 mm (3/4") dia. and under 28 mm (1-1/8") dia. round a bar of 6 times its own diameter.

D. 18 gauge galvanized wire shall be used for binding the steel reinforcement.

7.03 TESTING:

Reinforcement shall be obtained only from manufacturers approved by the Engineer's Representative.

If and when required samples shall be tested for above specification in an approved laboratory when required by the Engineer or his Representative and all costs of such tests shall be borne by the Contractor.

7.04 STORAGE

Reinforcing bars shall be stored on platforms above surface of ground and be free from scales, oil, structural defects prior to placement in works. Rusted or dirty steel bars shall not be used in the works unless brushed and cleaned by proper steel wire brushes and after being approved for use by the Engineer or his Representative.

7.05 REINFORCEMENT CUTTING AND PLACING

A. All reinforcement steel shall be cut and bent cold in strict accordance with bar bending schedules approved and drawings supplied by Engineer. The Contractor shall prepare bar bending schedule from approved structural working drawings and instructions to be provided to him by the Engineer. The bending schedules shall be drawn on approved forms and submitted to the Engineer or his Representative for checking and approval. The steel reinforcement shall be cut and bent to sizes as per drawings and approved bending schedules. In case any bars, cut, bent or even fixed in position are found incorrect in dimensions size or shape according to the requirements of the drawings and instructions of Engineer, the Contractor shall replace such steel bars cut bent or fixed in position by correct sized bars at his own cost and no extra payment shall be made to the Contractor on such account. The system of holding bars in place shall ensure that all steel in top section will support weight of workmen without displacement or distortion. Suitable spacers and chairs as approved by the Engineer or his Representative shall be used for supporting and spacing purposes of bars. In case any bars are bent or displaced they shall be straightened or replaced prior to pouring. All reinforcement bars within the limit of a days pour shall be in place and firmly tied with 18 gauge G.I. wires. Bars with kinks or bends not shown on drawings shall not be used.

B. Where indicated in the drawings, mesh shall be of the sizes as shown on drawings and conform to British Standard B.S.785. Mesh reinforcement when used in slabs shall be supported at proper elevations by standard accessories. In slabs on ground, pre cast concrete blocks may be substituted for chairs.

7.06 LAPS AND SPLICES

A. No splicing of bars shall be allowed at position other than shown on the drawings. All lap lengths shall be of the minimum sizes as indicated on the drawings and in no case shall lap length be less than 40 times the diameter of the bigger lapping bars for nominal M.S. bars. Hard grade bars and for steel

shall have laps of 50 time the bigger diameter of lapping bars. Splices of adjacent bars shall be staggered unless approved otherwise by the Engineer or his Representative.

- B. All reinforcing steel fixed in position shall be inspected by the Engineers Representative and no concrete shall be poured until steel placement has been approved by the Engineers Representative. For inspection purposes the Contractor shall give to the Engineers Representative reasonable notice before the scheduled pouring time. Clear concrete cover to reinforcement steel shall be as indicated on the drawings/specified.

7.07 MEASUREMENT AND PAYMENT

- A. The quantity to be paid for shall be the calculated in theoretical number of metric ton of reinforcement steel bars or mesh as determined from the approved bar bending diagrams and incorporated in the concrete and accepted, except when reinforcement is paid for under other items.
- B. The weight of plain or deformed bars will be computed from the theoretical weight of plain round bars of the same nominal size as shown in the following tabulation:

Size in.	Weight in lbs per ft.	Size in.	Weight in lbs per ft.
1/4	0.167	3/4	1.502
3/8	0.376	7/8	2.045
1/2	0.668	1	2.670
5/8	1.043	1 1/8	3.380

- C. Clips, ties, separators, and other material used for positioning and fastening the reinforcement in place, and structural steel, shall not be included in the weight calculated for payment under this item. If bars are substituted upon the Contractor's request and as a result more steel is used than specified only the amount specified shall be included.
- D. When laps are made for splices, other than those shown on the drawings or required by the Engineer and for the convenience of the Contractor, the extra steel shall not be measured nor paid for.
- E. When continuous bars are shown on the drawings, without the splices being shown, the necessary steel in the splices will be paid for on the basis of the individual bars not being shorter than 40 ft.
- F. The accepted quantity measured as provided above shall be paid for at the contract unit price for the items listed in the Bill of Quantities which price and payment shall be full compensation for furnishing materials, labour, equipment and incidentals necessary to complete the item.

SECTION - 8

8.0 BLOCK MASONRY

8.1 SCOPE

The work under this section of the specifications 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 supply and installation of ordinary cement concrete solid and hollow block masonry work including wall ties, anchors, damp-proof courses, complete in strict accordance with this section of the Specifications and applicable drawings, and subject to the terms and conditions of the Contract.

8.2 APPLICABLE STANDARDS

Latest editions of following Pakistan, British and ASTM Standards are relevant to these specifications wherever applicable.

8.2.1 Pakistan Standards

- 232 Ordinary Portland Cement.
- 419 Properties & Specifications of blocks

8.2.2 ISO (International Standardisation Organisation)

- R.679 Method of testing strength of cement compressive and flexural strengths of plastic mortar.
- R.680 Chemical analysis of cements - Main constituents of Portland Cement.
- R.681 Chemical analysis of cement - Main constituents of Portland Cement.

8.2.3 ASTM (American Society for Testing and Material)

- C.144 Aggregate for Masonry Mortar.
- C.331 Light weight Aggregate for Concrete Masonry Units.
- C.404 Aggregates for Masonry Grout.
- C.426 Drying Shrinkage of Concrete Block.
- C.476 Mortar and Grout for Reinforcement Masonry.
- C.149 Bond Strength of Mortar to Masonry Units.

8.2.4 BSI (British Standards Institution)

- 743 Materials for Damp-proof Courses.
- 1243 Specification for Metal Ties for Cavity wall Construction.

4887 Mortar Plasticizer

121 Pt-1 Brick and Block Masonry

122 Pt-2 Walls and Partitions of Blocks and Slabs.

8.3 MATERIALS

8.3.1 For Block

Cement, aggregates and water for concrete blocks shall conform to the requirements as specified in the section for Plain and Reinforced Concrete.

8.3.2 For Mortar

8.3.3 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.

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	0	0

Sand upto 0.0025 inch shall not be more than 8% by weight of the total.

8.3.4 Cement:

Cement shall be Ordinary Portland Cement conforming to BS-12.

8.3.5 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.

8.3.6 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.

8.3.7 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.

8.3.8 Reinforcement:

For reinforcement refer specification section no. 2200.

8.4 CONCRETE BLOCK MAKING

- 8.4.1 The Solid and Hollow blocks shall be factory manufactured/fabricated and 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. The contractor shall submit samples/literature of various manufacturers for Engineer's approval. The contractor should note that only blocks supplied by the approved manufacturer(s) shall be allowed to be used in this project.
- 8.4.2 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 polyethelene 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.
- 8.4.3 Cured concrete blocks shall be stored off the ground, stacked on level platforms which allow air circulation under stacked units. Units shall be covered and protected against wetting.
- 8.4.4 Care shall be exercised in the handling of all concrete blocks. No damaged blocks shall be used in the work.
- 8.4.5 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.
- 8.4.6 The blocks cast on different dates shall be stacked separately and must be labelled showing the date on which they were cast.

- 8.4.7 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.

8.5 PROPERTIES OF BLOCKS

- 8.5.1 All blocks shall be of the size and shape required to complete the work shown in the Drawings or as instructed by the Engineer.
- 8.5.2 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'.
- 8.5.3 All blocks shall comply with ASTM 1988 edition. The compressive strength of various solid and hollow blocks shall be as follows:

S.No.	Type of Concrete Masonry ASTM 1988 Edition	Compressive Strength Psi		Location
		Average of 3 Units	Individual Unit (MPa)	
1.	Solid load bearing Masonry units (ASTM-C-145-85)	1800 (12.4) 1200 (8.30)	1500 (10.4) 1000 (6.90)	Exposed to frost action
2.	Solid/Hollow non load bearing Masonry units	600(4.14)	500 (3.45)	Not exposed to moisture & weather
3.	Hollow load bearing masonry (ASTM-C-90-85)	1000 (6.90) 700 (4.80)	800 (5.50) 600 (4.10)	Exposed to moisture & weather Not exposed to moisture & weather

- 8.5.4 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.
- 8.5.5 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.
- 8.5.6 All properties or specifications of blocks, not explained in these Specifications shall comply with the requirements of ASTM 1988 edition as directed by the Engineer.

8.6 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.

8.7 SOLUBLE SALT CONTENT

For exposed blockwork, 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 and 0.03, percent respectively when ascertained in accordance with BS 3921, at the cost of the Contractor.

8.8 REINFORCING AND ANCHORS OF BLOCK MASONRY

Unless otherwise stated reinforcing and anchors shall conform to undermentioned sizes:

8.8.1 Joint reinforcing shall be 1.32mm (0.05-inch) diameter mild steel wire mesh design, galvanised after fabrication. Steel wire woven into 12mm mesh 75mm wide. Reinforcing bar anchors shall be 250mm dia. Deformed bar minimum 10 inch long.

8.8.2 Two 6mm dia bar shall be provided at every fourth course for anchoring of block masonry to columns. Two 10 mm bars at every fourth horizontal course shall be provided for anchoring masonry walls to plinth beam/floor beam, as shown on the drawings.

8.8.3 Dovetail anchors and slots (if used as an alternate anchorage) shall be not less than 18 gauge galvanized steel.

8.9 ERECTION

8.9.1 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.

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.

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. 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.

8.9.2 The block work shall be carried up in a uniform manner and no portion shall be carried more than one metre above the adjoining one at any time. All masonry shall be kept strictly true and square and the whole properly bonded together and levelled round each floor.

- 8.9.3 Sleeves, Chases, holes, sinking and mortices for other trades shall be correctly located and formed to the sizes as required by the relevant trades. Chiselling of completed walls or the formation of holes shall only be carried out with the approval of the Engineer.
- 8.9.4 Walls of blocks indicated, as being non-load bearing shall be constructed on the insitu concrete floor slab unit after the floor formwork is struck and the concrete has obtained sufficient strength to support their weight. Tothing into load-bearing walls shall not be permitted.
- 8.9.5 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.

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.

- 8.9.6 Care shall be taken during construction of cavity walls so as to avoid the filling up of cavity with mortar. G.I. flashing and weep holes shall be provided wherever specified on the drawings or as per the instructions of the Engineer. Weep holes will be formed by oiled rods, removed after the mortar is set, at specified locations.

8.10 SCAFFOLDING

Contractor shall provide safe scaffolding of adequate strength for use of workmen 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.

8.11 JOINTING

Jointing is the forming of joints as work proceeds. Joints shall be as follows:

- 8.11.1 Exterior exposed joints shall be tightly formed to a weather joint with the point of the trowel.
- 8.11.2 Interiorexposed joints shall be tightly formed to a concave joint.
- 8.11.3 Joints which are subsequently covered with plaster or other finish materials shall be struck flush.

8.12 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 metre. The maximum tolerance in the length, height or width of any single masonry unit shall be ± 3 mm.

8.13 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 manufacturer's specifications and shall be laid at required levels as per drawings and instructions of the Engineer. The D.P.C shall be tamped consolidated, levelled, edges and corners made to the requirements of concerned drawings including finishing and curing complete.

8.14 SOLID BLOCK WORK AROUND OPENING OF HOLLOW MASONRY

Around all openings in hollow block masonry, the Contractor shall provide solid block work of 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.

8.15 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 (8mm) diameter shall be provided at every third horizontal course at 600mm centers, while the vertical reinforcement shall be two bars of (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 the 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.

8.16 CURING AND REPAIRS

8.16.1 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.

8.16.2 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.

8.17 MASONRY SHORT OF HEIGHT

In case of different thickness of slab in different areas or rooms or for any other reasons, whatsoever if chiselling 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 chiselling, but where such cast-in-place concrete is provided, payment for the same will be made at the unit rate of masonry.

8.18 MEASUREMENT AND PAYMENT

8.18.1 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.

18.1.1 Chiselling of masonry, wherever required.

18.1.2 Cement sand mortar used in laying blocks, curing of masonry works and making of weep holes.

18.1.3 Providing and filling Class 'D' Concrete in the cavity of hollow block masonry.

18.1.4 Providing and laying damp proof courses including damp proof materials and GI sheet flashing within cavity wall.

8.18.2 Solid Block Masonry

8.18.2.1 Measurement:

Measurement for acceptably completed works of respective type of solid block masonry will be made on the basis of number of sq meters provided and installed in position as shown on the drawings or as directed by the Engineer. Each measurement shall be taken to the nearest cm. All openings left in the masonry wall shall be deducted. Steel reinforcing bars, joint reinforcing bars, dovetail anchors on any horizontal/vertical reinforcement in hollow/solid block masonry shall be measured separately under relevant Section of Specifications i.e. 2200 and 3000.

8.18.2.2 Payment:

Payment will be made for acceptable measured quantity of respective type of solid block / Hollow Block masonry work on the basis of unit rate quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item. Steel reinforcing bars, joint reinforcing bars, dovetail anchors on any horizontal/vertical reinforcement in hollow/solid block masonry and Including DPC shall not paid separately.

SECTION - 9

9.0 PLASTERING

9.01 Scope of Work:

The work covered by this section of the Specifications consists of furnishing all plant, labour, appliances, and materials and in performing all operations in connection with the installation of plastering complete in strict accordance with this section of the Contract.

9.02 General

Except as may be otherwise shown or surfaces specified all plaster surface shall include walls, partitions jambs, returns, reveals, backs of recesses and jambs and heads of windows and doors and all the soffits, alcoves unless otherwise specified or shown on the drawings.

9.03 Materials:

- a) "WATER" as specified in respective section.
- b) "CEMENT" shall be ordinary Portland Cement and shall conform to B.S.S.12.
- c) "SAND" shall be from approved source and free from dust and salt as specified in Section on concrete.
- d) "METAL LATH" shall be expanded metal not less than 9" wide strips, and weighing at least 2.5 lbs, per square yard or as directed by the Engineer.
- e) "CORNER LATH" shall be strips 6" wide bent to form two 3-inches wings.
- f) **Lime:** (To be used for putty)
 - i. Hydrated lime shall conform to British Standard BS-890 Class A, with the further requirement that the total free (unhydrated) calcium oxide (CaO) and magnesium oxide (MgO) shall not exceed 8 percent by weight, calculated on the "as received" basis.
 - ii. Quicklime (pulverized) shall conform to British Standard B.S.890 A. Pulverized quicklime shall pass a No.20 sieve, and at least 90 percent shall be used throughout the work. After slaking to a putty, the pulverized quicklime shall have a plasticity figure of not less than 200 when tested in accordance with ASTM Standard methods of Test C 110, and at the end of 72 hours the total free (unhydrated) calcium oxide (CaO) and magnesium oxide (MgO) in the hydrated product shall not exceed 8 percent by weight, calculated on the basis of the lime solids in putty.
- g. **Lime Putty** shall be made from hydrated lime, except that quicklime may be used when adequate time and facilities are available for aging. Suitable precautions shall be taken to protect the putty from exposure to the sun and to prevent excessive evaporation when stored. Lime putty prepared from quicklime shall be allowed to cool completely before using. Lime putty shall be prepared as follows:

- i) Quick lime (pulverized) shall be slaked in suitable large batches, and with enough water to form a thick cream. During cold weather, precautions shall be taken to maintain the heat and prevent premature cooling during the process of hydration. The slaked quicklime shall be passed through a No.10 sieve and stored for at least 72 hours before using. When the use of lump quicklime, slaked on the job, in lieu of pulverized quicklime, is specifically approved for plastering, the cooling and aging period shall be not less than 14 days.
- ii. Hydrated lime shall be machine-mixed with water to form putty and shall be allowed to stand for at least 15 minutes before using.

9.04 **MIXING OF MORTAR**

Except where hand-mixing of small batches is approved by the Engineer, mechanical mixers of an approved type shall be used for the mixing of mortar. Frozen, caked, or lumped materials shall not be used. Mechanical mixers, mixing boxes, and tools shall be cleaned after mixing each batch and kept free of mortar from previous mixes. Plaster mortar shall be thoroughly mixed with the proper amount of water until uniform in colour and consistency. Retempering will not be permitted and all mortar, which has begun to stiffen, shall be discarded. Mortar for scratch coats over metal lath shall be fibered by the addition of a pound of hair or fibre per bag of cement.

9.05 **PROPORTIONING OF PLASTER**

- a) All plaster shall be Portland cement plaster, all coats of which shall be mixed in the following proportions by volume or otherwise specified.
 One part cement
 4 parts sand
 1/4 part lime putty, if required or specified.
- b) All coats of plaster in liquid retaining structures shall be water proofed by the addition of an approved compound in liquid or solid form used at the approved rate. The water proofing compound shall be commercially pure with no grease or oils or other ingredients detrimental to the cement.

9.06 **APPLICATION OF PLASTER:**

- i) Strips of metal lath shall be provided between ceiling beams, lintels walls, columns and near by partitions of masonry parallel to the beams if required. The lath shall be laced with the wire at joints between sheets and screwed to the concrete and masonry with galvanized offset head or hood head lath nails. Also lath not less than 3" wide shall be installed over joints between dissimilar base materials where the surface to be plastered by in the same plane and where the base materials can not be effectively bonded or tied together.
- ii) Before the plaster work is commenced it shall be seen that all electric conduits, drainage and sanitary pipes inlets, outlets to tanks, brackets, clamps doors and windows frames and all sorts of inserts are fixed in position. It shall

be the responsibility of the Contractor to bring to the notice of the Engineer if such work is not carried out by the other Contractors. Chiseling and repairing of cement plaster shall not be permitted under any circumstances.

- iii) The walls shall be washed with fresh water and shall be kept damp for 2 hours before the plaster is applied. All masonry joints and concrete surfaces shall be properly roughened before plaster work is commenced. The proportion of cement plaster shall be as per drawings or as specified. The ingredient shall be properly mixed. The sand used for mix shall be only sufficient for one bag of cement. The mixtures shall be turned over and over till the ingredients are thoroughly mixed. Cement slurry shall be applied to the surface to be plastered and allowed to dry before plaster work is commenced.
- iv) The plaster shall be from 1/2" to 3/4" thick and shall not be less than 1/2" thick at any surface. If the plaster is more than 3/4" thick it shall be done in two coats, the first coat shall be made rough. The plaster on all surfaces shall be perfectly in plumb. The edges and corners shall represent a straight line. The plaster shall be kept wet for at least 10 days. No extra payment shall be allowed for jambs, junctions, corners, edges, round surfaces, cement slurry base and for thicker plaster required due to any un-evenness in the work done by the Contractor. At edge of every horizontal projection on external faces of the building if directed by Engineer a drip course of 3/4" is to be provided for trickling of water without any extra cost. Plaster on lath shall be done in three coats. Finish coat shall have a reasonably uniform thickness of approximately 3 mm (1/8"), and the minimum thickness at any point shall not be less than 1.5 mm (1/16") and shall be applied in one continuous operation without staging breaks.
 - a) The Scratch Coat: shall be full and thick and shall be applied with sufficient force to form good keys. The scratch coat shall be cross-scratched upon attaining its initial set and shall be kept damp with a fog spray.
 - b) Brown Coat: shall be applied after the scratch coat has set, but not earlier than 24 hours after the application of the scratch coat. When applied directly to masonry, the brown coat similar to the scratch coat shall be applied with sufficient pressure to fill the raked-out joints in brickwork to prevent air pockets and secure a good bond. The brown coat shall be lightly scratched and broomed after attaining its initial set and shall be kept moist with a fog spray for 2 days and then be allowed to dry out.
 - c) Finish Coat: shall not be applied until the brown coat has seasoned for 7 days. Just before the application of the finish coat, the brown coat shall be wetted evenly with a fog spray. All plaster shall be given a sand float finish of a uniform texture as approved or directed otherwise by the Engineer or his Representative. The finish coat shall be kept moist with a fog spray for at least 7 days and thereafter shall be protected against rapid drying until properly and thoroughly cured and dried.

9.07 SAMPLING OF PLASTER

Samples may be taken by the Engineer at any time from plaster work in place. Areas where over sanding is observed shall be rejected and shall have to be done again at the cost of contractor.

9.08 DRIPS AND GROOVES:

The Contractor shall make drips for rainwater protection and Architectural grooves shall also be made as shown on the drawings or directed by the Engineer.

9.09 ALIGNMENT AND SMOOTHNESS

All cement plaster shall be uniformly true in line level and plumb, smooth trowel finished, free of waves and blemishes etc; to the full satisfaction of the Engineer or his Representative.

9.10 CLEANING AND PROTECTION

Rubbish and debris shall be removed as necessary to make way for work of other trades and as directed by the Engineer or his representative.

As each room or space is completed all rubbish, debris, scaffolding and tools should be removed to leave the room clean.

Protect finished plaster from injury by any source.

Prior to plastering all Aluminium windows and finished metals should be covered by sheet of plastic or tarpaulin to protect it from damage.

Contractor shall also protect walls, floors and work of their trades from plaster materials.

9.13 PAYMENT

Plaster work will be measured and paid for the net area over which it is laid. All openings shall be deducted. The cost for drips and architectural grooves shall be included in the unit rate of plaster and no separate payment shall be made for drips and grooves.

SECTION - 10

10.0 FLOORING

10.01 Scope of Work:

The work covered under this section of the Specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in connection with the construction of floors complete as details of floors in strict accordance with this specification and the schedule of finishing, the applicable drawings and subject to the terms and conditions of the contract.

10.02 Before commencing any work under this section the Contractor shall study applicable drawings, schedule of finishing, details of floors, all levels etc. the Contractor shall also ascertain before starting of flooring that all pipes, trench etc. to pass under flooring have been placed in position and tested. Other concerned trades shall be consulted for completion of all required utilities prior to commencement of the work.

10.03 Sub-Grade

All sub-grade shall be prepared to the lines, levels and falls as indicated on the drawings, all subgrade should be compacted mechanically to obtain a density as specified. All sub-grade shall be inspected and approved by the Engineer before any subbase is placed on it.

10.04 Material:

- i) Water
As specified in the relevant Section of the Specifications.
- ii) Cement
 - a) The grey cement shall be ordinary normal setting cement of any brand complying in all respects with B.S. No.12.
 - b) White cement shall be complying in all respects with British Standard.
- iii) Concreting:
All classes of concreting, "B", "C", "D" or "E" shall conform to their respective specifications as laid down in Section on "Concrete".
- iv) Terrazzo Cast-in-Situ:
 - a) The Contractor shall lay 1/2" thick terrazzo topping with white cement or grey as specified and use marble chips No.1 to 4 of approved colour and quality and shall have an abrasive hardness of not less than 16 as determined by the test of wear resistance in national bureau of Standard Report BMS-98. The various sizes of chips shall conform to following:

Chips size No.	Passing through Screen inches	Retained in Screen inches
-----	-----	-----
1	1/4	1/8
2	3/8	1/4
3	2	3/8

4

5/8

1/2

Chips shall be crushed so that all the dimensions are close to the limits of the specified sizes. Flats or flaky chips shall be kept to a minimum. Colour of the chips shall be selected by the Engineer if the chips are not clean, the Engineer's Representative reserves the right to have them washed at the cost of the Contractor. Terrazzo topping shall be laid over concrete surface as given on the drawings and the ratio shall be 2 part of chips and one part of cement by volume.

b) **Division Strips**

Division strips shall be 1 1/2" wide strips of 5mm thick plate glass and will be suitably embedded and anchored. Division strips shall be fixed on the terrazzo in situ pavements on 4' x 4' grid, unless otherwise shown on the drawings or directed by the Engineer.

vi) **White/Black Glazed Tiles:** (Skid or non-skid)

6"x6"x1/4" or any other size as directed by the Engineer shall be best quality glazed tiles of manufacturer as approved by the Engineer.

10.05 Method of Application:

i) Terrazzo Cast-in-Situ:

The terrazzo shall be machine grinded 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 cavities and thoroughly fill the surface for final grinding.

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 a honed finish. Small areas, inaccessible portions and corners, which cannot be reached by the grinding machine, shall be ground and rubbed manually. After all grinding is completed the surface shall be polished to the entire satisfaction of Engineer or his Representative.

10.06 Terrazzo Tile Flooring:

a. General:

Terrazzo tiles of specified size and thickness made to the best local standard with best quality marble chips '0' to maximum of 3 No. size with white/grey cement and colour and pattern as approved by the Engineer on his Rep. shall be used for all floors except otherwise specified. Tiles shall be laid on a bed of cement-sand mortar of ratio not less than 1:6 and the mortar shall be covered with neat cement slurry and the joints of the tiles shall be kept perfectly tight and grouted with the cement of same colour as that of the matrix of the terrazzo tiles. Tiles shall be laid evenly and to the perfect level and shall be set between the walls of the room so as to cause minimum

cutting of the full size tiles and where the tiles do not "Corner-out-even" the excess space area, joints pattern shall be continued throughout the floor.

Tiles shall be cured for a minimum of seven days after casting. Terrazzo tiles shall be made of grey cement, white cement or a combination of two and to match sample for tiles available in the office of the Engineer. The joints shall not exceed 1/16 inch in any case and shall be rendered invisible as far as possible in colour with cement to match the tile colour. The joints shall be perfectly straight and shall meet perfectly with the lines of adjoining rooms. All terrazzo tiles shall be the product of reputable tile manufacturers and shall be cast and pressed hydraulically in machines especially made for the manufacture of Terrazzo tiles. The machines used and method of manufacture shall be subject to the approval of the Engineer or his Representative. The minimum thickness of Terrazzo Matrix on top shall not be less than 1/2 inch thick in any part of the tiles. Tiles with Terrazzo Matrix less than the thickness stated above shall be rejected and the Contractor shall have to replace the tiles at his own cost and risk. Contractor shall, before bringing the tiles ensure that these conform to the specifications with regard to their colour and size of Marble Chips. All rejected tiles shall be immediately removed by the Contractor from the site. All Terrazzo tiles shall be wax polished before acceptance.

b) Chequerred Tiles:

Chequerred Terrazzo tiles for staircase and other specified locations shall be made to the same specifications as terrazzo tiles as specified in this Section. The exposed edges of Terrazzo tiles on steps shall have a Terrazzo Matrix on one edge of the tiles. The exposed edge shall project 1" from the finished face of the riser as shown on the drawing. Chequerred tiles shall be subject to the approval of the Engineer or his Representative. The tiles shall be 1" thick and the Terrazzo Matrix shall not be less than 1/2 inch.

c) Polishing & Finishing:

Complete curing, initial grinding or cutting and finishing of the tiles shall be done prior to the delivery on the site. All Terrazzo floor tiles shall remain in place after setting for not less than 1 (one) week unless otherwise approved. Final grinding, cleaning and polishing shall be done to the best standard and upto the satisfaction of the Engineer or his Representative.

d) Curing:

All Terrazzo floors and finishes shall be cured for a minimum of 7 days after laying by means of wet bags or sand or other approved methods.

e) Defects in Tiles and Tile laying:

The surface of all tiled floors shall be perfectly as per level and grade as shown in drawings or as directed and shall be executed by experienced workers in the field of Tile laying. A sample Panel of laid Tiles of each type shall be got approved by the Engineer or his Representative before commencement of the laying. All chipped or damage tiles installed by the Contractor shall be rejected and shall have to be replaced by the Contractor at his own cost and

risk.

f) Wall Bases: (Skirting)

Wall bases where specified in all areas with Terrazzo shall be as shown on drawings. All wall bases shall be made with cast-in-situ Terrazzo and the colour and size of marble chips used shall be such as to match with the terrazzo tile floors in each room or area. The minimum thickness of Terrazzo Matrix shall not be less than 1/2" thick. The height of wall bases shall be as shown on the finish schedule and the relevant drawings. The surface shall be perfectly smooth and polished to a high degree of finish. The top edge of wall base shall be perfectly straight. Sample of each type of wall bases shall have to be approved by the Engineer or his Representative before commencement of work of wall bases by the Contractor. All applicable Specifications pertaining to Terrazzo cast-in-situ as laid in this Section shall be applicable for cast-in-situ wall bases. All tiles shall be laid before the work of wall bases is started and no cast-in-situ Terrazzo of wall bases shall be allowed on the flooring to overcome defect in tile laying.

10.07 Glazed Ceramic Tiles:

Glazed tiles will be of size 6 inch x 6 inch or as directed by the Engineer and of best quality of local manufacturer white/colored shall be supplied by the Contractor. All sanitary and water supply pipes shall be in place before start of glazed tiles work.

The walls and floors on which the glazed tiles are required to be fixed shall be plastered with 1:4 cement mortar 1/2"-3/4" thick as base for the tiles and surface shall be thoroughly roughened. Before starting to fix the tiles the plaster shall be thoroughly wetted and cement slurry spread on the surface. Neat cement mixed with water in the form of thick paste shall be uniformly applied on the tiles-back and the tiles pressed on the wall so as to spread the cement paste uniformly under the tiles. The squeezed out slurry shall be wiped out of the edges. The tiles shall be laid course after course starting from bottom. No joint shall be more than 1/16" and all joints shall be uniform and continuous. The slurry shall be gently raked out from the joints when it is green. White or coloured cement of the same shade as tiles shall be applied in the raked out joint and finished slightly sunk with the tiles surfaces.

10.08 Marble Tiles in Flooring, Skirting, Dado and Steps

a. Material

Marble for use on the building shall be selected first quality marbles of type and colour as specified by the Engineer or his Representative marble shall be the best quality China Verona marble free from discolorations.

Anchors and Cramps shall be made of non-ferrous metal as detailed on the drawings and specified and directed.

Cement shall be white Portland cement meeting with the requisite British Standard Specifications.

Coloured marble shall be other than dark Green onyx marble.

Green Onyx: Where specified best quality of dark green marble shall be used meeting with the approval of the Engineer.

- b. Samples:
Samples of all types of marble for various areas shall be got approved by the Engineer or his Representative. Contractor shall have to match the marble brought to site as close to the approved samples as possible. The Engineer or his Representative has the right to reject marble pieces, which have unduly dark patches, or large unsightly veins which do not conform to the overall pattern and effect on the marble wall. Contractor shall also construct a Panel for each of the marble areas for the approval of the Engineer or his Representative before commencement of work. Engineer's discretion with regard to quality of marble shall be final and binding on the contractor.
- c. Workmanship:
The size of marble slabs and the jointing pattern shall be as shown on the drawings or as directed by the Engineer or his Representative. Joints between the marble slabs shall be filled smooth with white cement paste of the required shade of the marble slabs. The marble slabs before being laid shall be machine cut, dressed smooth and mirror polished and shall be free from cracks or any other discolorations, which in the opinion of the Engineer or his Representative is objectionable. All such defective and rejected marble slabs shall have to be replaced by the Contractor at his own cost and risk. The thickness of marble slabs shall be as specified.
- d. Selection of Marble:
The marble slabs shall be selected by the Contractor in the factory before these are brought to site for installation purposes which match the samples in the office of the Engineer. Marble pieces which do not meet with the approval of the Engineer or his Representative shall be removed and replaced by the Contractor at his own cost and risk, whether they have been installed or not.
- e. Installation:
Marble for floors, walls, shall be laid on a bed of mortar by workmen specialized in the marble work. All floors shall be perfectly level and joints rigidly conforming to the joint pattern. Any leveling of concrete floor or filling in of low spots by mortar for levelling shall be done by the Contractor at no extra cost to the owner. Wherever slope for drainage purposes is required the bed shall be pitched to slope. Marble slabs in walls and columns shall be properly anchored to the wall or column as well as between the slabs themselves by means of anchors and cramps as detailed on the drawings or as directed. Non-ferrous metal anchors and cramps shall be used. Anchors shall be rigidly bolted to the wall.
- f. Even Panels:
In each surface marble panels both horizontally and vertically shall be so divided that the sizes of all panels are equal. The sizes of panels in the pattern shown on drawings may be adjusted in each room with the approval of the Engineer or his Representative in order to have all equal sized panels of marble.
Before cutting the marble pieces for each space the Contractor shall take

actual physical measurements of the constructed portion so that even sized marble panels can be fitted at all places. Unequal panel sizes shall not be acceptable and shall be replaced at the cost of the Contractor. Joints between marble panels shall not be more than 1/16" and shall be filled in with white cement slurry as specified.

g. Kitchen Cabinet Tops:

Specially selected marble slab shall be used for counter tops as specified and directed. These marble slabs shall first be approved by the Engineer or his Representative before actual cutting and installation of marble slabs is undertaken. Counter tops upto 3'- 0" length shall be one piece marble slabs and for over 3'-0" long counters two marble pieces shall be used to obtain the required length of the counter. The cutting of holes in slab for sink and water taps where required shall be accurately done according to the actual size of sink and piping. The Contractor shall coordinate this work with the sanitary contractor. Marble slabs wherever indicated to be installed shall be mirror polished and finished before installation duly cut to the required size.

h. Finishing and Polishing:

All marble before being laid in the final position shall be finished and polished to a high degree of mirror finish by means of machine grinders in the factory. Where machine grinders cannot be used grinding and polishing by hand may be permitted by the Engineer or his Representative. All polished surfaces shall meet the approval of the Engineer or his Representative before acceptance.

10.08 **Cement Concrete Flooring:**

The materials for C.C. flooring shall be the same as already specified under other clauses of these specifications.

a. 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 shown on the drawings or as specified. 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 shall be determined on the basis of the production of concrete having required workability, density, impermeability, durability and required strength.

b. Mixing Concrete

The concrete ingredients shall be mixed in 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 not uniformly distributed and the consistency is not uniform. The concrete shall be uniform in composition or 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 charging operations.

Excessive over-mixing requiring the addition of water to preserve the required concrete consistency shall not be permitted. The concrete ingredients shall be mixed by volume in boxes made for this purpose and approved by the Engineer.

c. Construction

The base course of the floor shall comprise of stone in case of Car park garages and road pavement. 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 screened material with finer particles. The base course shall be blinded with sand and the whole surface watered. Over the well compacted base course, a layer of 1:2:4 concrete of the required class and thickness shall be laid in panels of the sizes as indicated on the drawings and as approved by the Engineer.

At places other than mentioned above, base course of required thickness and class of concrete shall be laid over a sub-grade compacted to 95% AASHTO density.

After the C.C. bed has been cured, as directed by the Engineer, it shall be roughened and well watered before floor finishing is laid. The floor finish shall comprise of cement concrete 1:2:4 nominal mix or of such proportion as specified or directed by the Engineer and of the required thickness shall be laid in alternate panels with butt joints to the required thickness as shown on the drawings and/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 floor concrete.

Freshly placed concrete floor portions as finished shall be protected to prevent loss of water by covering with damp hessian, waterproof paper, or other approved material, and shall be kept constantly damp for a period of 10 days or longer after concreting, as directed by the Engineer. The concrete shall be allowed to dry out slowly over a period of a few days after wet curing is completed.

10.09 **Measurement and Payment:**

All the items of work covered by this Section of the Specifications shall be measured by the Standard Method of measurements. The quantity of flooring will be ascertained by measuring length and breadth of actual area laid deducting any section of columns and other structures penetrating throughout the floor and shall be paid for at the individual item rates entered in the Bill of Quantities and in accordance with the applicable terms and conditions of the Contract.

SECTION - 11

11.0 WOODEN DOORS AND WINDOWS

11.01 Scope:

The work covered by this section of the Specifications consists of furnishing all plant, labour, equipment, appliances, and materials, and in performing all operations in connection with the provision and installation of all doors, windows shutters and frames complete in all respects in strict accordance with this section of the Specifications and the applicable drawings, and subject to the terms and conditions of the Contract.

11.02 Materials:

Material for the work included herein shall conform to the following requirements:-

Samples of the following materials

shall be delivered to the Engineer for testing and approval before delivery of these materials to the site:

- Corner section of each type of door.
- A Panel of each kind of wood.
- A Section of hollow metal steel door frame, if specified.

11.03 Grounds, Blocking and Nailing Strips:

Grounds, blocking, and nailing strips shall be provided as necessary to receive the work included herein and as required for the work of other trades:

- a) Except as otherwise shown or specified, ground, blocking and nailing strips shall be secured in place as follows:-
- 1) To steel - by means of 3/8 inch diameter bolts spaced not over three (3) feet apart.
 - 2) To brick - by use of cut nails spaced not more than 16 inches apart.
 - 3) To concrete blocks - by the use of cut nails spaced not more than 16 inches apart and driven directly into the block.
 - 4) To poured concrete - by means of 1/4 inch diameter galvanized expansion bolts spaced not more than 16 inches apart or by the use of Rawl Plugs one (1) inch long and galvanized at the same spacing.

11.04 Metal Door Frames (Other Than Aluminium Doors):

11.4.1 Specifications & Standards

The following British and American Standard specifications applicable are relevant and applicable for this section:

BS-1245	Metal Door frames (Steel)
BS-2994	Specification for cold rolled steel sections
ASTM -	B117
ASTM -	1735

11.4.2 Samples

Contractor shall submit complete sample of Door Frames showing joint, construction and hardware and hinges etc. along with manufacturer's catalogue and literature for approval of the Engineer.

11.4.3 Manufacturers

- A. Door frames shall be manufactured by reputable steel hollow metal fabricators approved by Engineer.
- B. Frames shall conform to British Standard Specification 1245 or equal.

11.4.4 Hollow Metal Steel Door Frames

- A. Door shall be of 18 gauge mild steel sheet and frame made of suitable sections as specified, to exact profiles with prime coat of grey colour and 3 coats of enamel paint.

Except as otherwise indicated, corners of frames shall be welded together and rounded.

Door frames shall be provided with steel sheet reinforcement for all hardware including door checks and closers. Reinforcement plates shall be at least as thick as diameter of screws used for securing hardware.

Frames shall rest on concrete slabs floor have temporary bottom spreader bars and be secured with concealed clip-angles and wall anchors.

- B. Frame Anchors:
Doors frames shall have not less than three (3) tee wall anchors and one (1) clip-angle type floor anchor per jamb as per manufacturer's recommendation.

Wall anchors shall be adjustable welded tee or strap anchors, of 8 inches length for masonry constructions.

Wall anchors at construction other than masonry as indicated shall be of special design for anchoring to column & R.C.C. walls. meeting with approval of the Engineer.

11.4.5 Installation

- A. All work shall be accurately set to established lines and rigidly fastened to the constructions. Frames shall be erected plumb and true and shall be braced during construction and until there is no danger of movement.
- B. In masonry walls, anchors shall be built-in during progress of brick masonry work. Space between backs of frames and masonry shall be grouted full of c.c. mortar (1:4) with anchors securely bedded in mortar joint.
- C. Frames shall be accurately fabricated, assembled and fitted and shall be free from defects affecting appearance and proper operation. Steel reinforcing channels where required shall be provided in each frame.
- D. Two PVC stoppers 1/4" dia to prevent door shutter striking metal frame shall be provided in each frame.
- E. Three hinges 5" long in each frame shall be provided.

11.05 Wooden Door Frames

The door frames shall be of Deodar wood. The timber selected for manufacture shall be of good quality, free from all defects and well seasoned. The frames shall be of the specified size and section and shall be finished smooth. The frames shall be secured perfectly in level and plumb and corners shall be perfectly at right angles.

The frames shall be provided with 6 flat MS holdfasts. The size of holdfasts shall be as specified or directed by the Engineer. The ends of holdfasts shall split and bent. Holdfasts shall be fixed to the door frames with proper size screws and shall be embedded in cement concrete class "C" for the full length of the holdfasts and the width of the wall. The holdfasts shall be cleaned to remove any dust-scale or rust etc., and shall be painted with two coats of red oxide paint.

11.06 Interior Wood Doors:

Interior wood doors shall, unless otherwise shown or specified, be of the paneled type or flush as indicated on the drawings or directed by the Engineer.

Paneled doors shall be constructed in accordance with the requirements part 1 of British Standard Specification No.459, with the additional requirements that panels in exterior openings shall be assembled with waterproof glue. Loose beads shall be provided in glazed wooden doors for holding glass panes of thickness and size as specified and shown in drawings or directed by the Engineer. Ends of louvers blades shall be let into edges of door stiles and glued and tacked in place. Flush doors shall be constructed in accordance with the requirements of British Standard 459.

11.07 Closet Doors:

Closet doors shall be 1-1/2 inches thick, unless otherwise shown and shall be either paneled or flush. If paneled they shall comply with the requirements of part 1 of British Standard Specification No.459 and if flush, they shall comply with the requirements as called for on the drawings.

11.08 Doors Shutters:

The shutters will be fixed to the frames with approved quality brass fittings. The frames will be secured with wrought iron clamps, or screwed pre-embedded and wooden pegs, bent and screwed to the frames at one end, cut and built into the brick work or block work on the other end or as directed:

- a) All doors and windows shutters shall be fabricated in a workmanlike manner in accordance with the drawings or as directed by the Engineer or his authorized representative.
- b) The door shutters to have solid core as shown on the drawings. It shall be built in sections properly jointed and glued together, both sides being covered with 3 mm thick plywood or as specified veneering and prepared for painting as specified.
- c) The arrangements of inner core for semi-solid shutters shall be approved by the Engineer or his authorized representative. It shall be so adjusted that

circulation of air is free and uninterrupted and minute holes to admit and exit atmospheric air, shall be provided on edges at suitable places.

- d) The two long edges of the shutters to be tipped with a solid sheesham lipping piece, not less than 1/2" being exposed, double tongued and grooved into the core, the plywood to meet the lipping piece by means of mitred joints.
- e) Each door shall be suitable to receive hinges and locks in the position shown.
- f) The rates shall include supplying fittings and screw nails etc. and hanging with hinges, clear or obscure glass of thickness as specified and painting etc. complete.

11.09 **Fitting, Hanging, and Trimming:**

Doors shall be fitted, hung, and trimmed as hereinafter specified and as indicated on the drawings. Doors shall have 1/16 inch clearance on side and top, unless otherwise directed by the Engineer-in-Charge and shall have 1/8 inch clearance at bottom. Doors 1 3/4 inches or more in thickness shall have the lock or latch edge beveled at the rate of 1/8 inch in 2 inches. Doors shall be hung and trimmed with hardware as specified. Locks with standardized cases shall all be installed at the same height. Knob locks and knob latches shall be located at height as directed by the Engineer. Dead locks shall have the centre of the locks at the same height as the centre of the knob locks.

11.10 **Hardware:**

Items of hardware specified herein shall be carefully fitted and securely attached and upon completion of the work got approved by Engineer or his Representative. Hardware shall be demonstrated to work freely, keys shall be fitted into their respective locks and, upon acceptance of the work, keys shall be tagged and delivered to the Engineer who will furnish a receipt.

11.11 **Measurement and Payment:**

- a. All wooden doors frames, finishing and hardware as specified hereinbefore as well as painting shall be paid for the rates entered in the Bill of Quantities appended to the contract and in accordance with the conditions of the contract.
- b. All wooden doors Shutters, finishing and hardware as specified hereinbefore as well as painting shall be paid for the rates entered in the Bill of Quantities appended to the contract and in accordance with the conditions of the contract.
- c. All wooden doors Architrave, finishing and hardware as specified hereinbefore as well as painting shall be paid for the rates entered in the Bill of Quantities appended to the contract and in accordance with the conditions of the contract.

SECTION - 12

12.0 TIMBER JOINERY AND HARDWARE

12.01 Scope of Work:

The work covered by this section of the Specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in connection with fabrication and installation of shelves, cupboards, paneling, doors, frames, shutters etc. as per size, thickness, dimension and details shown on the working drawings, complete in strict accordance with this section of the Specifications and the applicable drawings, finishing schedule, instructions of the Engineer and subject to the terms and conditions of the Contract.

12.02 Materials, Fittings and Samples:

i) Timber etc:

The entire timber conforming to BS No.881/589:1955 shall be from the heart of sound and full grown trees, it shall be uniform in substances, properly seasoned, straight in fibre, free from large loose or dead knots, twists, cracks, incipient decay. The scantlings of all timber shall be bright sound and square edged. The colour of the timber shall be uniform throughout. The timber shall be tested before use to ensure that the moisture content where allowed shall not exceed 10%. The Contractor shall pay for such tests. All timber before use shall be subject to the approval of the Engineer.

a) Soft Wood:

The timber of trees belonging to the botanical group Gymnosperms, commercial timber deodar of this group, with best of its kind available in Pakistan shall be used.

b) Hard Wood:

The timber of trees belonging to botanical group Angiosperms, commercial timber teak of the group shall be used.

c) Plywood:

Shall comply in all respects with BSS 1455:1948. The plywood shall only be obtained for doors; paneling and the like shall be of the thickness as specified. The grade shall be first quality. The face and back shall be free from end joints, dead knots, overlaps, patches and other defects. Edge joints in Veneers shall be well made. Isolated pin-worm holes shall be permitted provided they do not run along the plane of the veneer. The face and back shall be finished smooth for painting or polishing.

d) Formica and Chip-board:

Shall be first class quality of its kind in Pakistan from manufacturer approved by the Engineer.

e) Veneers:

Of selected quality shall be used. The veneers shall be carefully selected so that the grains shall be matching and running in the same direction. The cross banding shall not be less than 1/16 inch and the

combined thickness of cross banding and face veneer on each door shall not be less than 1/8 inch. The cross banding and face veneer shall be teak wood or as indicated. The face veneers shall be uniform texture and glued to core as specified hereinafter.

ii) **Hardware and Fittings:**

Hardware and fittings shall be heavy duty hardware of approved quality and manufacturer.

- a) Locks and Door Closer: shall be foreign make and as approved by the Engineer.
- b) Glue: shall conform to the requirement of BS.745 for cake or powder glue.
- c) Nails and Screws: Nails shall comply with requirements of BS.1202 and screws with the requirements of BS.1210.
- d) Holdfasts: shall be M.S. flat iron 1-1/2" x 1/4" and of length as specified in the drawings, or shall be as directed by the Engineer.
- e) Tower Bolt: shall be chromium plated brass of approved quality.
- f) Hinges: As specified on drawings or 4" size Heavy duty, brass screws (local) of approved quality to be used.
- g) All other fittings shall be best available foreign made or local as specified. Samples shall be submitted to the Engineer with for his approval. Cost of all hardware shall be included in the prices quoted by the Contractor in B.O.Q. for doors, windows, cabinets and cupboards etc. and no separate payment will be made.
- h) Hardware Schedule: Each flush shutter door and closet door shall be furnished to the extent not otherwise given in the item of work or shown on the drawings with the following:-
 - i) 4" brass butt full mortise hinges-3 pairs
 - ii) Mortise lock with knobs as above 1 No.
 - iii) Chromium plated brass made in one piece tower bolts 10" long of local manufacturer 2 Nos. for single leaf door and three 10" long tower bolt for two leaf door.
 - iv) Stainless steel push plates and kick plates.
Each closet door shall be fitted with the same hardware as described above for single shutter doors with the exception that instead of cylinder mortise lock they will have a Union night lock or approved equal with a stainless knob of local manufacture.
 - v) Best available door closer of approved size and design shall be provided as per drawing and as approved by the Engineer.

- vi) All the locks shall be master keyed and a ground master key shall be furnished for all the locks.
- vii) Suitable hold fasts as approved by the Engineer.

12.03 Flush Doors:

Flush Door shall be solid cored, covered on both side with commercial ply as specified in drawing. The doors shall be lipped and edges fitted and hung to the frames. The flush door shall be as obtainable from M/S Dawn or its equal approved by the Engineer and shall be of best quality and uniform texture.

12.04 Handrails Wooden:

Wooden handrail for staircase as shown on drawings or as directed shall be made of straight grain Deodar, accurately machined to detail and shop finished as specified. Rails shall be manufactured from stock requiring minimum of joints. Necessary joints shall be put together with at least two(2) hardwood dowels. Wooden handrail shall be provided on M.S. balustrades, the same being fixed with steel plates in the steps complete as shown in the drawings or as directed by the Engineer.

12.05 Cupboards/Ward Robes

These shall be of commercial ply shutters fixed on deodar wood frames all of sizes as shown on drawings and as directed and approved by the Engineer and shall include R.C.C. slab at top, both sides plastered and cement concrete base with plaster. Position and type of portions, shelves, drawer and brass pipe (1" dia) for hanging of clothes etc. shall all be provided as per drawing, directions and approval of the Engineer, complete in all respects with required hardware and painting inside and outside.

12.06 Kitchen Cabinets

a) Low Level Cabinets

These shall have R.C.C. slab at top finished with marble slabs, concrete base at bottom and R.C.C. shelf in the cabinet. The R.C.C. slab, shelf and the base shall all be finished with cement plaster, cabinets shall have drawers and commercial ply shutters fixed on deodar wood frames.

b) High Level Cabinets

These shall also be made of commercial ply shutters fixed on deodar wood frames. The shelf in the cabinet, its top, bottom and sides shall all be of commercial ply fixed on deodar wood frames as shown in drawings.

Both the above cabinets shall be as per drawings, instructions and approval of the Engineer and shall be complete with all the required hardware and painting etc.

12.07 Reception Counter

Counter shall be made of 1:2:4 R.C.C. slab at top resting on R.C.C. wall of thickness as shown in drawing and both finished with cement plaster on the inner faces. Marble slabs on top, sides (with grooves) and base of the counter shall be provided of size and thickness as per drawing and approval of the Engineer. Teak wood shelf of 1" thickness shall be provided inside the corner as shown in the drawing. The job of providing counter shall be complete in all respects including painting of shelf and finishing and polishing of marble etc.

12.08 Fabrication:

- a) The Contractor shall perform all necessary morticeing, tenoning, grooving, nothing, tonguening, housing, rebating and all other work necessary for the correct jointing. The Contractor shall also provide all metal plates screws, nails and other fixing that may be necessary or instructed by the Engineer for the proper execution of the joinery work specified. The Contractor shall also be required to carry out all works necessary for the proper construction of all framings, etc. and for the support and fixing in the building. All wood work shall be approved by the Engineer or his Representative before being fixed in position.
- b) Any Joinery which may show signs of defects arising from the unsound materials or defective workmanship before the expiry of the maintenance period shall be cut out and replaced at Contractor's own expense.
- c) All hold-fasts are to be cut to size and shall be made of 1/4" thick M.S. flat iron as shown on the drawing.
- d) Until and unless shown or directed otherwise all external frames joinery work including doors and windows frames shall be put together with a thick mixture of white lead and pure linseed oil and the joints shall be provided with hard wood pins.
- e) All doors, shutters shall be fabricated in workmanlike manner in accordance with the drawings or as directed by the Engineer.
- f) The doors shutters shall be solid or paneled as shown on the drawings or specified or as directed by Engineer. It shall be built in sections properly pointed and glued, and painted as specified.
- g) Each door shall be suitable to receive hinges and locks in the position shown.
- h) The rates shall include supplying all fittings and screws, nails and such like and hanging hinges clear or obscure glass of thickness as specified and polishing or painting etc., complete including lock, and other fittings, except door closer which if required shall be separately paid.
- i) Brass fittings are to be furnished and oxidized on exposed surfaces. Aluminium fittings are to be anodized on exposed surfaces. Chromium plated fitting are to be the best quality of their respective kind made locally and shall have a base of brass or copper.
- j) Brass oxidized fittings are to be fixed with brass screws, copper gunmetal or bronze .op
- k) Locks, handles, etc, shall be as directed and approved by the Engineer or his authorized representative.
- l) The whole of the iron, brass oxidized fitting must be of the best possible quality and workmanship. The Contractor shall submit samples for the approval of the Engineer and all such iron, brass and bronze mongery shall conform to these approved samples.

- m) Glazing wherever shown on drawings or given in B.O.Q. shall be best available glass of specification as described under glass and glazing.
- n) Paint and polish shall be carried out as specified in specification for Painting and Polishing.
- o) Anti-termite treatment of approved quality shall be applied to frames on the surface in contact with earth, or wall etc. as per directions of Engineer. Contractor's rates in BOQ for doors, Ventilators windows, shelves etc, shall include this item and no additional payment shall be made.
- p) 3 coats of approved quality enamel paint over a coat of oxide or approved quality wax or French polish shall be applied to the doors, windows etc. as per directions of the Engineer or as described in B.O.Q. or in drawings. No additional payment shall be made against this item and the Contractor's rates for joinery work shall include cost of this item.
- q) Formica facing over chip-board sheets if required, shall be done with appropriate adhesion and pressure to ensure proper joints.

12.09 **Measurement and Payment:**

The items of work acceptably fabricated, installed and executed as per this section shall be measured and paid for as under:

- i) Wooden hand rail shall be measured in running feet length of the hand rail fixed in position including M.S. balustrades, steel plates, fixing in position and painting etc. complete in all respects and shall be paid at the rate entered in BOQ.
- ii) Cupboards and Kitchen Cabinets acceptably completed in all respects shall be measured and paid in square feet of the front shutter area at the rate quoted in the BOQ.
- iii) The payment for the reception counter shall be made on lump sum as a complete job.

SECTION - 13

13.0 ALUMINIUM ANODIZED DOORS, WINDOWS AND VENTILATORS

13.1 SCOPE:

The work covered by this section consists of furnishing all labour, equipment, supplies and materials and in performing all operations in connection with the fabrication, construction and installation of anodized aluminium doors, windows and ventilators complete with all glazing fittings and fixtures in strict accordance with this section of the specifications, and the applicable drawings and subject to terms and conditions of the Contract.

13.2 Aluminium anodized doors, windows and ventilators where required are to be in sizes and pattern as shown on the drawings having a single glass pane contained in aluminium frames which in turn are contained within an aluminium frame designed so that one or more panels are moveable by sliding in windows and swing in doors in horizontal direction. The panels may also be fixed on top hung and swing, all as shown on drawings.

13.3 The Contractor shall submit shop drawings for all the doors windows, and ventilators to the Engineer and the fabrication shall be taken in hand only after his approval of such drawings. All the doors, windows and ventilators shall be manufactured by a reputable firm having an experience of not less than ten years in the line subject to the approval of the Engineer.

13.4 DEFINITION:

The definition given in BS-2900, BS-4643 and BS-3958 apply generally but, in addition, for the purpose of this specification the following definitions apply:-

Pivoted Hinges: An arrangement to properly swing the shutters of doors and windows where required with brass pivots provided at top and bottom with a thrust bearing at bottom for friction free operation.

Bearing Device: A suitable wheel or roller device to support the weight of a moving panel.

Glazing Gasket: PVC or synthetic rubber member, used between the glass and the frame and/or glass and a bead.

Hardware: Fittings attached to the door, window and ventilators which are used to operate and/or secure it.

Outer Frame: The metal frame which is fixed to the building structure or the door, window or ventilators surround and which contain the shutters and panels.

Panel: Movable or fixed glazed frame.

Stile: Vertical member of a panel or shutter.

Weather Stripping: A PVC or synthetic rubber material to improve resistance of the

closed window, door and ventilator to air infiltration and water penetration.

13.5 MATERIAL:

Aluminum: Extruded aluminum members shall be fabricated from designated treated alloys HE 9 TF, HE 9 TE, HE 9 TB, or HE 30 TF complying with the requirement of BS-1474. When ancillary members are formed from sheet materials, they shall be fabricated from designated alloys SIC, NS3 or NS4 complying with the requirements of BS-1470 in a temper suitable for the particular type of framing to be adopted.

The main elements of aluminium solid (not hollow) section outer frame shall be, at minimum tolerance, not less than 1/16" thick. Finishes to aluminium shall be anodized and comply with the requirements of BS-3987.

Weather Stripping: Weather stripping shall be made from materials known not to react with aluminium and such that any shrinking warping or adhesion to sliding, swinging or closing surfaces shall not impair the performance of the doors, windows or ventilators.

Glass: Glass shall be of the best quality available as per Pakistan BS-952 Glass thickness shall be according to British Standard CP-152 (Section 3.8) and anti shutter fitted shall not be less than 6 mm for doors and 6 mm plain clear or translucent for windows and ventilators or as per drawings.

Joint Sealing Materials: Joint sealing materials shall not harm adjacent material or finishes.

13.6 CONSTRUCTION:

In the case of doors, windows and ventilators not fully assembled and glazed by the manufacturer, the manufacturer shall provide instructions as to the manner of assembly.

Adjacent aluminium members shall not slide upon each other but shall be separated by a material that does not react with aluminium, and does not interfere unduly with the sliding or swinging.

The moving window panels shall be supported by bearing devices that facilitate the movement and prevent direct contact between the panels and the tracks.

The doors, windows and ventilators shall be capable of adjustment to assure proper fitness and operation.

The finished doors, windows and ventilators shall be free from all sharp edges, burrs and the like that might be hazard to the user.

It shall not be possible for a panel to become accidentally disengaged from the outer frame.

On all finished doors, windows and ventilators means shall be provided to prevent injury to the users' hands where the hand grip may meet or pass close to another panel during operation.

Joints in frames shall be made either by welding or by mechanical means (example are cleating and screwing). Where necessary, joints shall be sealed with material that does not react with aluminium. Joints may have flush, stepped or lapped surfaces.

Flush joints, formed by mechanical means may deviate from the same plane only within the limits set by the use of extrusion tolerance given in BS-1474. Welded joints shall be cleaned off smooth on surfaces visible when the doors windows and ventilators are open or closed and where they might interfere with glazing.

13.7 **HARDWARE:**

Hardware, including its fastenings, shall be of suitable materials resistant to atmospheric corrosion. If such materials or finishes used react adversely with aluminium they shall be separated from the aluminium by materials that do not react adversely with it.

13.8 **FASTENING AND FIXINGS:**

All screws, nuts, bolts, rivets, washers, other fastenings, used in assembly and fixing devices shall be of stainless steel or aluminium. Alternatively where these are permanently concealed they may be made from steel which has been finished by one of the following methods:-

- i) Zinc plated and passivated accordingly to B.S. 1706 clarification Zn3.
- ii) Hot-dip galvanized according to the requirements of BS.729.
- iii) Sheradized according to the requirements of BS.729 part-2 (not applicable to fixing devices).
- iv) Sprayed with metal coating according to BS. 2569, Part I. The fixing shall be capable of withstanding the design of the doors, windows and ventilators.

13.9 The limits of sizes for overall length and overall height may be as stated by the manufacturer, taking into account permissible deviations in sizes and squareness, but shall not be more than 1/12" on the overall lengths and heights.

13.10 **GLAZING:**

The glass shall be as specified in the relevant section and shall be framed on all four sides.

Glazing beads, gaskets, glass adopters and glazing compounds shall be of materials that do not react with aluminium finishes, glass or other glazing material.

Glazing beads and other members shall be stiff enough and fixed at a sufficient number of points to with-stand the design wind loading and to ensure safety in use.

The consideration shall be such that glazing or reglazing on site is possible without the need to remove the outer frame of unit from the buildings.

13.11 **SECURITY:**

Locking devices where required shall be designed so that they cannot be released from the outside by the insertion of a thin blade or other simple tool.

Normally, and unless otherwise directed by the Engineer, no door, window or ventilators panel shall be open-able or removable from the outside when it is locked in the closed position except by the use of special tools or by breaking a part of the door, window or ventilator.

Where directed by the Engineer locks may be key operated from the outside or

inside and supplied with removable keys.

13.12 PERFORMANCE:

Doors, windows and ventilators shall be backed with a performance guarantee free from any trouble for a period of at least ten years commencing after the expiry of period of maintenance.

13.13 SHOP DRAWINGS:

Contractor shall submit, to the Engineer shop drawings showing details of construction and assembly of the windows and the fabrication of doors, windows and ventilators shall not be started until the drawings have been approved.

13.14 SAMPLES:

A sample of each type of door, window and ventilator complete with hardware, accessories and other items, whether or not requested by the Engineer shall be submitted for his approval, marked with identification tags.

13.15 MEASUREMENT AND PAYMENT:

The doors, windows, and ventilators shall be measured nett between the outer edges of the aluminium frames and paid for at the unit rates entered in the Bill of Quantities, appended hereto, and in accordance with the Conditions of the contract. Unit rates for doors, windows and ventilators shall be inclusive of all anodizing, glazing and fly proof shutter with mesh etc., complete as specified.

SECTION - 14

14.0 FALSE CEILING

14.1 SCOPE OF WORK:

The works covered by this section of the specification consist of furnishing all plant, labor, equipment and materials and in performing all operation in connection with provision and installation of the False ceiling and related works, wherever required as per drawings, specification and as directed by the Engineer.

14.2 GENERAL:

Acoustical ceiling work shall be installed wherever indicated on the drawings or instructed by the Engineer. Shop drawings showing the mechanical suspension system, disposition of ceiling units to present form or pattern as approved and also showing the required grooving wherever required, details of molding at wall junctions at the periphery and other details shall be prepared by the Contractor within the rate of the item of the agreement the contractor shall get the shop drawings approved by the Engineer before undertaken this item of work.

14.3 MATERIALS:

a. Hangers:

The Hangers shall be of MS Flats as per standard suspenders supplied for Acoustic ceiling. All hangers, if not factory painted shall be painted with one coat of red lead paint and two coats of approved quality enamel paint. It is the responsibility of the Contractor to get the sample of hanger approved by the Engineer before using the same in the works.

b. Suspension Frames

These shall be the standard frames as provided by the manufactures for Acoustic ceiling with perforated aluminum units. Surface stove enameled and including mineral wool infill and glued black tissue paper inlay. Access panels and light fitting recesses shall be provided as required at site.

c. Acoustic Tiles of approved size manufactured from Boral Plastic Board gypsum board.

14.4 INSTALLATION AND WORKMANSHIP

Suspension System

The hanger as specified shall be evenly placed in position as indicated in drawing details, at the time of concreting of RCC roof and beams. Their lengths shall be properly adjusted to maintain the horizontal surface of the false ceiling. Wooden framing shall be nailed to these hangers for fixing acoustical tiles and light fixture over it. The jointing of Deodar wood battens to hangers shall be as per approved shop-drawing details. Acoustical tiles shall be a sound absorption co-efficient of 0.67 at 500 cycles per second (CPS).

14.5 FINISHING

After installation, dirty, soiled or discolored surface shall be cleaned up left free from defects and ready to receive any painted finishes, if required.

14.6 MEASUREMENT AND PAYMENT

Unless otherwise specification stated in the Bill of Quantities or herein, all the work involved within scope of this section of specification shall be deemed to be inclusive of but not limited to the following:

- i) Contractor's establishment charges, over head charge, profit, interest.
- ii) All other expenses, charges, taxes specification in Condition of Contract.
- iii) Labor and all costs in connection there- with.
- iv) Use of plant, equipment and machinery and all costs in connection therewith e.g. mobilization, demobilization, transporting, fuel, energy charges, grease, oil, installing, operating, storing, watching, returning, handling, maintaining, idle stand parking, removing damaged, destroyed, salvaged items.
- v) Material and goods e.g. marketing, selecting. Conveyance, loading, unloading, storing, watching, returning, handling, hoisting, lowering, cutting, jointing, fixing, wastage, removing damaged, destroyed, salvaged material.
- vi) The cost of all laboratory and field tests including sampling stipulated in these specifications.

The Cost of all works involved within the scope of this specification as per all the contract are covered only within the quoted rate of items of the BOQ.

Measurement for payment shall be made on the basis of the superficial area in sq.ft / Sq.mt. of false ceiling fixed in position and the work to be done shall include providing and fixing of hangers, battens, tiles, paints, labor etc. all complete in every respect as shown on the drawings, and to the entire satisfaction of the Engineer.

SECTION - 15

15.0 GLASS AND GLAZING

15.1 GENERAL REQUIREMENTS:

- A. Contractor shall examine all other Sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- B. Contractor shall coordinate his work with that of all other trades affecting or affected by work of this Section.

15.2 SCOPE

Contractor shall provide all labour, materials, equipment, transportation and services required to complete all glass and glazing work as shown on Drawing, as specified herein, or both.

15.3 SAMPLES

- A. Contractor shall submit samples of all materials specified herein and obtain Engineer's approval before ordering materials.
- B. Samples of each type of glass shall be submitted to the Engineer for approval. Size of glass sample shall be atleast 12 inch x 12 inch and shall bear the name of manufacturer, quality and weight or thickness on a printed label.

15.4 SPECIFICATIONS AND STANDARDS

- A. The whole of the glazing shall generally be executed in accordance with the recommendations of British Standard Code Practice CP 152. All glass shall comply with the appropriate section of BS-952.
- B. Except as otherwise indicated, all glazing shall be done in accordance with recommended practices and standards.

15.5 QUALITY AND LABELING

- A. Clear glass shall be flat-drawn clear sheet glass complying with B.S. 952 Section 1, Ordinary Glazing quality of the substances shown in Table-1. Clear plate glass shall comply with B.S. 952 Section 1, Table-3
- B. Wired Glass shall be of the best available quality with wire mesh embedded in glass meeting with Engineer's approval.
- C. All materials shall be free from defects impairing strength, durability and appearance. All glass shall be free from bubbles, pockets, chips, wavy surface or other defects.

15.6 MANUFACTURERS

Imported Glass from USA, Sweden etc. will be used.

15.7 SHEET GLASS

Glass shall be tinted, clear or wired as specified in the drawings. The thickness of sheet glass shall be according to the size of panel as given hereunder.

a)	Not exceeding 1 sq. ft.	2 mm
b)	Exceeding 1 sq. ft. but not exceeding 2 sq. ft.	3 mm
c)	Exceeding 2 sq. ft. but not exceeding 4 sq. ft.	4 mm
d)	Exceeding 4 sq. ft. but not exceeding 6 sq. ft.	5 mm
e)	Exceeding 6 sq. ft.	6 mm

15.8 GLAZING SEALANTS, COMPOUNDS AND TAPE

- A. **Liquid Polymer Sealant:** Non-sag gun grade liquid polymer sealant, as approved by Engineer. Colour shall be white, grey or manufacturer's standard colors as selected by Engineer.
- B. **Elastic Glazing Compound:** Knife grade, wood or metal type, as required & approved by Engineer. Colour shall be white, gray or manufacturer's standard colors as selected by Engineer. It shall conform to B.S.S. 544.
- C. **Glazing Tape:** Polyisobutylene type, at least 1/8" thick, as approved by Consultant. Colour shall be white, gray or manufacturer's standard colors as selected by Engineer.

15.9 PREPARATION OF SASH AND FRAMES

- A. Before beginning work, glazier shall inspect sash and frames to determine that other trades have completed preparatory work and that sash and frames are ready to receive his materials.
- B. Frames and Sash : shall be adjusted, plumbed and squared. All rivets, screws, bolts, nail heads, welds and other projections shall be finished flush in glazing rabbets. All corners and intersections shall be sealed and weathertight.
- C. Operable Sash : shall be fastened and kept stationery until glazing compounds, except non-setting types, have cured or set.
- D. Surfaces to receive glazing materials shall be free of dirt, dust grease, oil and other foreign materials and shall be painted or sealed before work under this Section is begun.

15.10 INSTALLATION

- A. Do not begin glazing until all cleaning and repairing of concrete surfaces has been completed.
- B. Do not begin glass installation until rebates and glazing stops have been primed and are thoroughly dry.
- C. All glass shall be clean cut. Nipping to remove flares or to reduce oversize dimensions will not be permitted. Glass shall be shop-cut to fit openings allowing required clearance. Openings to receive glass shall be perfectly square. Protect edges of glass from abrasion with ground or masonry.

- D. Cut glass accurately to fit openings. Sizes of glass indicated on the drawings are approximate only and the actual sizes required shall be determined by measuring the frames to receive the glass. Size of glass to permit required clearance and bite around full perimeter of glass as per standard practices.
- E. Apply glazing compounds and other materials in strict accordance with manufacturer's printed recommendations.
- F. Glass shall be set without springing: with proper clearances at all edges. Edge clearance and tolerance shall be in accordance with recommendations of the manufacturers.

15.11 PROTECTION

- A. All glass shall be protected from damage until acceptance of the building and if broken or defective, shall be removed and replaced with glass of specified type. Glazing subcontractor shall protect and replace glass until his work is completed. Contractor shall be responsible for protection of glass and the replacement of all damaged glass after glazing work is completed.
- B. Glass breakage caused by Glazing subcontractor in executing his work or caused during installation due to faulty work shall be replaced by him at no additional cost to the employer. Glass breakage caused by subcontractors because of negligence or any other reason shall be replaced at the expense of the Contractor.
- C. All glass shall be examined to detect any formation of staining and/or etching. Plaster, mortar, paint spatter, or any other coating shall be removed immediately after contact and shall not be permitted to collect or remain on glass surfaces.

15.12 CLEAN-UP AND CLEANING OF GLASS

- A. Remove all labels, excess glazing compounds, stains and spots from glass on completion of glazing.
- B. Remove all rubbish and debris from the site at the end of each days work. Clean compound smears and stains from adjacent surfaces as the work progresses.
- C. At the completion of the entire job, Contractor shall have all glass surfaces thoroughly cleaned and washed by window cleaners.

15.13 MEASUREMENTS AND PAYMENT

No separate payment shall be made for the work covered under this section of the specifications and all costs in connection with items of work as described in this section shall be included in the Contractor's item rate for the items of windows, fixed glazings, Doors, ventilators etc. in the Bill of Quantities.

SECTION - 16

16.0 ROOF TREATMENT

16.01 SCOPE:

The work covered by this section of the specifications consists of furnishing all plant, labour, equipment, appliances and materials and in performing all operations in connection with the execution of the work of roof treatment complete, in strict accordance with this section of the specifications and the applicable drawings and subject to the terms and conditions of the contract.

16.02 MATERIALS:

- a) Cement, aggregate and coarse sand shall be in accordance with the specifications for "Concrete".
- b) Clay tiles (Mangalore Tiles) as approved by the Engineer.
- c) Samples of all materials proposed for use under this section shall be submitted to the Engineer for his approval.

16.03 APPLICATION

After all the surface to be treated has been broomed, and cleaned, a 2" (50 mm) thick average screeding with cement concrete 1:2:4 shall be laid over R.C.C. roof slabs in alternate panels as approved by the Engineer. The screed shall be finished in proper slope and level and shall have smooth finish.

After the concrete of screed has been cured and has set and dried, it shall be cleaned thoroughly to ensure that it is free from dirt, sand and Grease etc. Roof Clay Tiles of red colour approved by the Engineer shall then be placed on the roof and grouted with cement mortar.

16.04 MEASUREMENT AND PAYMENT:

Works shall be measured net acceptably completed and as applied in position conforming to the drawings and the instructions of the Engineer.

Unit rate for the Roof treatment work shall be deemed to be inclusive of all detail of this item mentioned in the BOQ (Roof Screeding, Water Proofing Membrane with primer, polystyrene and preparatory works, like scrapping, scratching, cleaning, etc . complete as per drawings, specifications and direction the Engineer.

SECTION - 17

17.0 PAINTING, DISTEMPERING AND WHITE/COLOUR WASHING ETC.

17.01 SCOPE OF WORK:

The work covered by this section of the specifications consists of furnishing all materials, plant, labour, equipment, appliances and performing all operations in connection with surface preparation, mixing, painting concrete works, gates, frames steel works, steel and wooden doors, windows, ventilators, walls ceilings and all such surfaces 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.

17.02 GENERAL:

Except as otherwise specified, all painting shall be applied in conformity with BS CP 231 "Painting of Building as applicable to the work".

The Contractor shall repair at his own expense all damaged or defective areas of shop-painted metal work. Metal surfaces against which concrete is to be placed will be furnished shop-painted and shall be cleaned prior to being embedded in concrete.

Except as otherwise specified, all concrete and plastered surfaces are to be painted.

17.03 MATERIALS:

All materials shall be acceptable, proven, top-grade products and shall meet or exceed the minimum standards of reputable manufacturers as approved by the Engineer.

Colors shall be pure, non-fading pigments, mildew-proof, sun-proof, finely ground in approved medium. Colors used on plaster and concrete surfaces shall be lime-proof. All materials shall be subject to Engineer's approval.

All enamel paints and primers for wood and metal work will be the best available of its type and shall be approved by the Engineer prior to its procurement.

Unslaked lime, gum and marine blue shall be used for white washing.

DUROCEM a cement base heavy duty water proof coating manufactured by ICI or any equivalent approved by the Engineer shall be used for painting on the surface specified. The cement base water proof coating for concrete shall conform to ASTM C-109,C-67, D-822 and G-23.

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 shall be mixed and applied in accordance with his directions.

17.04 **SURFACE PREPARATION:**

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 scraping, chipping, blasting, wire brushing or other effective means as approved by the Engineer.

In the event the surface becomes otherwise contaminated in the interval between cleaning and painting, recleaning will be done by the Contractor at no additional cost.

Surfaces of stainless steel, aluminium, 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.

No work in this Section shall be allowed until all surfaces or conditions have been inspected and approved by the Engineer.

17.05 **APPLICATION:**

All paint and coating materials shall be in a thoroughly mixed condition at the time of application. All work shall be done in a workmanlike 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 surrounding air is below 10 Deg.C. 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 operations.

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 shall be completely painted prior to installation.

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.

All steel doors, windows and ventilators shall be painted with two coats of approved enamel paint over one coat of a redoxide primer as directed by the Engineer.

Oil bound distemper shall be applied to internal wall surfaces and white wash on ceilings as specified herein after.

For applying Durocem the surface shall be dampened with clean water immediately ahead of application. Durocem and clean water shall be mixed as per directions of the manufacturer. A heavy first coat at 20 lbs/100 sft (1 kg per sq.m) shall be applied. This shall be followed by a second brush coat at 10 lbs/100 sft (0.5 kg per sq.m) after the first coat has set. When finish coat has set, it shall be floated to uniform texture with a sponge float. The work shall include cleaning the surface, sand papering and smooth finishing, scaffolding, curing etc. complete as per the approval of the Engineer.

17.06 WHITE AND COLOUR WASHING:

The surfaces shall be well cleaned and brushed before white washing. The white washing material shall be prepared from un-slaked lime. The lime shall be dissolved in a tub with sufficient quantity of water and then well mixed and strained through a clean cloth. 4 kg clean gum boiled with 12 kg of rice for each cu.m of lime shall be added to the liquid lime along with a small quantity of marine blue as directed by the Engineer.

The mixture shall be in thoroughly mixed condition and shall be applied in three coats with a brush.

Each coat of white wash shall be allowed to dry, so that no sign of cracking shall appear on the surface and also white wash shall not come off readily on fingers when rubbed. The white wash when completed, shall form an opaque coat of uniform white colour, through which the old work does not show and shall present a smooth regular surface free from powdery matter. For colour washing approved quality of coloring matter shall be added to the liquid and thoroughly mixed by stirring.

17.07 DISTEMPERING:

Oil bound distemper of approved quality and shade shall be applied on internal wall surfaces where shown in drawing or directed by the Engineer.

17.08 EXECUTIONS:

17.09 SUBMITTALS

Colour samples shall be submitted on 6"x6" (150x150 mm) asbestos cement boards, showing each type of paint for Engineer's approval.

17.10 PRODUCT DELIVERY

Deliver materials in manufacturer's original unopened containers with labels intact and legible identifying brand names and contents.

17.11 JOB CONDITION

Observe manufacturer's recommended minimum and maximum temperature but do not apply paint or finish to any surface unless ambient temperature is 10 deg.C or above and less than 43 deg.C. No painting shall be done above 90% relative humidity.

Place drop cloths to adequately protect all finished work.

Remove and replace all items of finished hardware, device plates, accessories, including fixtures or other removable items.

The surface shall be prepared first before applying distemper by filling depressions with putty, rubbing, sand papering and cleaning. A priming coat shall first be applied of petrifying liquid of approved manufacture. Distemper shall be applied with broad stiff brush of approved make. Distemper shall be applied quickly and boldly. Each coat of distemper should first be got approved by the Engineer before applying the next coat.

17.12 MEASUREMENT AND PAYMENT:

Measurement of the work acceptably completed and specified herein as painting, distemping, and white/colour washing etc. will be made on the basis of actual area in square feet of the respective job including all preparatory work like scraping, scratching, sand papering, filling depressions with putty, priming and scaffolding etc. complete in all respect as directed by the Engineer. Payment under covered in this section shall be made as per unit rates entered in the BOQ. No payment shall be made for painting work on doors, windows, ventilators, steel grills, cabinets and cup boards steel ladders etc. for which the contractor shall make necessary allowance in his rates for such items.

SECTION - 18

18.0 COLOUR CREATING / SNOW CREATING

18.01 MATERIAL

Cement shall be of specified colour and approved make and shall conform to the latest specification for Portland cement. If cement of approved shade is not available the contractor may be allowed to make the coloured cement by mixing approved pigment.

18.02 Marble chips of approved quality shall be of the colour or colours mixed in particular proportion as specified in the schedule of quantities; and where it is not so specified these will be provided as per direction of the Engineer-in-Charge. The chips shall be of zero number unless otherwise, directed.

18.03 The marble powder shall be free from all dust and dirt and shall be of approved quality.

18.04 PREPARATION OF SURFACE

The surface of over which the colour create / Snow create is to be applied shall be well-hacked or roughened to form a mechanical bond. The surface must be well soaked with water. The water should be allowed absorbed into the surface to be rendered and the first coat applied when there is just a slight amount of moisture left on the surface. The thickness of the base coat shall be as specified in the schedule or quantities. The finishing cont of Colour create / Snow create shall be applied 48 hours after, applying the base coat.

18.05 The first coat shall be composed of ordinary Portland cement and sand in the proportion specified in the schedule of quantities. The coat shall be well pressed and deeply secured to the surface. The surface shall be well combed to provide at key for the following coat.

A minimum of 48 hours should elapse before the finishing coat is applied.

18.06 It shall be composed of marble chips, marble Powder and Snow create / Colour create / cement mixed with Pigment, in the specified proportion. Before applying the finishing coat the surface should be sufficiently wetted.

Where provided in the schedule of quantities grooves or required dimensions shall be made with special tools all over the surface to sub-divide it into blocks of the shown in the drawing or as directed by Engineer-in-Charge. The grooves must be uniform in depth and width throughout being taken out in the approved shape. The grooves must run horizontally and vertically to be exactly parallel and / or perpendicular to each other unless otherwise specified.

Where required in the schedule of quantities the surface of Snow creates Colour create shall be chiselled in an approved manner with sharp tools as directed by the Engineer-in Charge.

18.07 The surface must be cured for a period of 7 days in a suitable manner approved by the Engineer-in-Charge.

18.08 **MEASUREMENT AND PAYMENT:**

Measurement and Payment under covered in this section shall be made as per unit rates entered in the BOQ.

SECTION - 19

19.0 STEEL WINDOWS, VENTILATORS, GATES AND GRILLS.

19.1 SCOPE OF WORK:

The work covered by this section of the Specifications consists of furnishing, transporting and storing all plant, equipment, appliances labour and material and in performing all operations in connection with the fabrication, welding, erecting and painting of steel units complete in strict accordance with the drawings and/or as directed by the Engineer.

19.2 MATERIALS:

All materials shall be new of the best standard commercial quality and shall be approved by the Engineer.

All the angles, squares, sheets and channels etc., shall conform to BS 4360.

19.3 CAST IRON:

Cast iron should be of good grey metal, sound, free from all flaws such as pitting due to impurities or sand from the pattern, cold shuts (i.e., irregularities due to casting at too low temperature, blow-holes etc.). It should have a clean smooth surface, true to pattern.

19.4 WROUGHT IRON:

Wrought iron should be of good tough metal with an even silky fibrous grain which will be apparent if twisted and bent. A good iron must be neither cold short (i.e., brittle when cold due to production from an inferior core) nor hot short (i.e., a tendency to cracking at the surface edges when working at red hot due to the presence of sulphur).

19.5 DRAWINGS:

The Contractor shall prepare all necessary shop and erection drawings covering the steel to be furnished under these Specifications. No fabrication and erection shall be taken in hand until these drawings have been approved by the Engineer.

All work under this section shall be coordinated with the work to be done as specified under other sections of the Specifications.

The Contractor shall drill, tap, cut and fit the work included herein as required, to accommodate work of other trades in conjunction with it.

The Contractor shall furnish all information and instructions required for work by other trades.

Samples of material specified shall be submitted for approval when required by the Engineer.

19.6 FABRICATION:

All work shall be equal to the best modern practice in the manufacture and fabrication of structural steel notwithstanding any omission from these specifications

or Drawings. All fabrications shall conform to BS-449.

Before being laid out or worked in any way, the steel shall be straight and free from kinks and bends. If straightening is necessary it shall be done by methods that will not injure the metal. Shearing and cutting by torch or electric shall be performed carefully, and all portions of the Work which will be exposed to view after completion shall be finished neatly.

All holes shall be cylinder, unless otherwise shown on the Drawings, perpendicular to the member and clean cut without burred or ragged edges. Holes in the material shall be drilled to full size and shall be accurately and carefully placed. The length of bolts shall be in 1/4 of an inch variation, and when in the steel gate, the bolts shall extend at least 1/4 of an inch beyond the nuts.

19.7 **WELDING:**

Welding shall be done by qualified and licensed welders under the supervision of expert fabrication Engineers. All the welding shall be executed according to BS 538.

All defective and damaged works shall be rejected at the sole risk and cost of the Contractor.

Where welding is required in the works as per drawings or as required by the Engineer, the welding shall develop the full strength of the adjoining steel.

19.8 **ERECTION:**

The method of erection and propping the gates, frames, windows and ventilators shall be according to the Drawings or as directed by the Engineer. The engineer shall inspect and approve all the equipment, temporary works and other measures proposed to be adopted for the erection and safety of the steel sections. The contractor shall be responsible for the safety of damage to any person or to any part of the building while the work is in progress.

All steel sections shall be accurately assembled and erected as shown on the Drawings, on the scheduled dates in complete harmony and coordination with the progress of other construction works in the building. All of the material shall be handled carefully so that no part will be bent, broken or damaged otherwise. Hammering that will injure or distort the members will not be permitted.

Prior to erection of the steel, all shoe plates, down holding bolts etc., shall be fixed / grouted dead accurate in levels and alignment as per details shown on the drawings or as directed by the Engineer.

19.9 **HARD WARE:**

All required hardware like handles, locking devices where required, stays and latches etc. for windows and ventilator shall be provided. Samples of all items of hardware, accessories and other items requested by the Engineer shall be submitted for his approval.

19.10 **GLAZING:**

Glass shall be as specified and shall be framed on all four sides. Glazing beads, gaskets, glass adapters and glazing compound shall be provided as specified or approved by the Engineer.

19.11 STEEL GRILL:

Grill shall be of design and type shown in the drawings or of the pattern approved by the Engineer. M. S. Flats of approved size shall be welded to steel frame of similar section which shall be fixed/screwed to windows/ ventilator frames. Grills shall be installed on the inner or outer side of the frame as indicated and shall be painted with two coats of primer and three coats of approved quality enamel paint.

19.12 STEEL GATE:

Steel gate shall be manufactured of the type and design of steel grills described here-in-before. All the MS sections and plates shall be approved by the Engineer. Painting to gates shall be carried out after installation as described here-in-before.

19.13 CAULKING:

All fixed joints between various parts of windows and ventilator assemblies shall be buttered with caulking compound before the windows are assembled. All joints between windows and ventilators and surrounding masonry or concrete construction shall be caulked with approved caulking compound.

19.14 MEASUREMENT AND PAYMENT:

All the steel door, ventilators and gate shall be measured between top of the frame and finished floor level or bottom of frame vertically and between the outer edges of the frame horizontally and paid for at the unit rates entered in the Bill of Quantities and shall be inclusive of finishing hardware, glazing, painting etc. as specified and shown in drawings, complete in respects.

SECTION – 20

2.0 STRUCTURAL STEEL WORKS

20.1 SCOPE

This Section covers requirements of steels, steel work, fabrication, methods including precautions for erection of steel structures and other general requirements incidental to steel work.

20.2 GENERAL

The applicable requirements of this section as determined by the Engineer shall apply to all structural steel works under this contract. The work covered by this Section consists of all material, labour, plant, equipment and appliances including welding, bolts, nuts, washers, anchor bolts, embedded parts etc, fabrication and erection in accordance with the specifications and as per drawings and as directed by the Engineer.

20.3 DRAWINGS

20.3.1 Design and Working Drawings

These shall be prepared by the Engineer and supplied to the Contractor. These shall contain main dimensions, sizes of member & typical details of joints, list of material etc.

20.3.2 Workshop Drawings

- a) Before proceeding with the manufacture, or fabrication, Workshop drawings shall be prepared by the Contractor from the working drawings supplied, taking into consideration the following instructions:
- Fabrication in convenient sub assemblies and each shop assembly to be given an erection mark.
 - Milling (machining of bases of supporting plate) for erection without adjustments.
 - Provision of basic elements for/with erection devices.
 - Keeping with the requirements of computed strength of all connections and joints of structures not foreseen in the design and working drawings.
 - Other requirements having an influence on the technology of fabrication transportation and erection of steel structures.
 - Uniformity of elements and parts of the steel structures should be maintained for mass fabrication.
- b) Workshop drawings shall consist of two parts:
1. An erection scheme having the following information:

- Location of erection element in respect of these elements with each other or with the existing steel or reinforced concrete structures.
 - Erection joints showing erection welding thickness and lengths, bolts or rivet diameter and numbers.
 - Chart showing list of assembling marks having columns such as Mark, Description, Quantity, Weight of each Mark, Total weight and Remarks with grand total in the end.
 - Chart showing list of Erection Bolts, Nuts and Washer having columns such as size, quantity, weight and notes with grand total.
 - The mark for shop assemblies of each erection scheme shall have a different index for example scheme of trusses purlins etc. shall have Marks A1, A2, A3, onwards and another scheme of columns beams etc. shall have Marks B1, B2, B3 and onwards. While marking on the plans, elevations, sections and details the index shall be omitted.
 - The recommended scale of erection scheme is 1:50, 1:100, 1:200, for joints 1:5, 1:10 or 1:20.
 - Except in special cases all scheme drawings shall be made in single fairly thick lines.
 - Erection Scheme shall contain the following notes:
 - i) Erection shall be done using the erection welding and bolts of normal sizes and accuracy according to the joints of the scheme.
 - ii) Quality and type of electrode.
 - iii) Measures against unscrewing of bolts.
 - iv) Erection shall be carried out according to the standard for fabrication and erection of steel structures.
 - v) Painting instructions.
 - vi) References to design and working drawings.
2. A shop assembly drawing containing the following information:
- Each Shop Assembly (Mark) shall be drawn separately showing necessary lines, elevation sections with reference to axis, centre lines, location of holes, cleats, plates lugs etc .fully dimensioned with part numbers.
 - Bolts, holes and symbols.
 - Geometrical Setting out dimensions necessary for the assembly of an element. Location and details of joints as calculated by the Fabricators / Engineer.

- Instruction for welding, dimensions of weld (Seams) processing of edges, methods of welding, quality of welded material, length of welds on every element, requirements for welding and method of their control. Specification for Electrode selected according to specification of steel.
- Standards and quality of steel used.
- Parts List.
- Instruction for painting, primer and finish coats with derusting process.
- Recommended scale for assembly drawings are preferably 1:10 or 1:20 and for joints and details 1:1, 1:2 or 1:5.
- Notes for assembly drawings shall be as follows:
 - i) List of symbols for bolts and holes used.
 - ii) List of symbols for welds used.
 - iii) Edge distance (general).
 - iv) Welding thickness (general).
 - v) Material quality of steel used.
 - vi) Type and quality of electrodes to be used.
 - vii) Test for welding if any.
 - viii) Reference to related erection scheme drawings.
 - ix) Reference to design and working drawings.

20.4 MATERIAL

Except otherwise required or stated in the drawings the materials specifications shall conform to the following. Wherever necessary Contractor may use equivalent British Standard or other alternative material subject to approval of the Engineer. Material shall generally conform to the applicable requirement of ASTM A-6.

a) Structural Steel

- Structural steel for structures not requiring Welding shall conform to the requirements of ASTM A-7-66 (for bridges and buildings) or ASTM A-36-77.
- Structural steel for structures requiring welding shall conform to the requirements of ASTM A-36-77 or approved equivalent.

b) Sheet Steel

Sheet steel for structures where no welding is required shall conform to the requirement of ASTM A-366-62T (for Cold Rolled Carbon Steel Sheets commercial quality) or ASTM A-415-64 (Standard specifications for Hot Rolled Carbon Steel Sheets, commercial quality). For structures where welding is required sheet steel shall conform to the requirements of ASTM A-415-64 and steel plate to ASTM A-283-79 (Low and intermediate strength carbon steel plate) or A-514-77 (High-yield-strength, quenched and tempered alloy steel plate, suitable for welding as required).

- c) Filler Metal for Welding
Welding Electrodes for manual shielded metal arc welding shall conform to the specifications for mild steel covered Arc-welding Electrodes, AWS A 5.5 (latest edition). Equivalent locally manufactured electrodes by Pakistan Oxygen may also be used subject to the approval of the Engineer.
- d) Ordinary Bolts, Nuts and Washers
Bolts and nuts shall conform to the requirements of ASTM A-307-65 (Standard specification for low-alloy, carbon steel, externally and internally threaded, standard fasteners). Bolts shall be of Grade A for general application with square or hexagon heads as specified in the drawings. Turned bolts shall also conform to the requirements of ASTM A-307-65, except that the tolerance of the unthreaded portion of the bolt body shall be +0.0 - 0.15 mm of the diameter.
- e) Cut Washers
Shall be of structural grade steel and shall conform to the dimension of the manufacturer's regular standard for plain washers for the size and type of bolts used.
- f) Cast Iron
Shall conform to the requirements of ASTM A-48-64 (Standard specifications for Grey Iron Castings) or equivalent.
- g) Iron Pipe
Where iron pipe is called for, it shall be genuine wrought iron fully galvanized. All Threads to be cleaned and coated with rust resistant coating.
- h) Painting Materials
Paintings materials which include emulsions, epoxy based enamel paints, sealers, primers, wax, varnishes etc., shall be standard best or top brands produced for each particular kind of material required.

20.5 ALLOWABLE STRESSES

- a) Allowable stresses for steel shall be considered tabulated in Appendix A of specifications for the Design, fabrication and erection of structural steel for buildings; Part 5 of the Manual of Steel Construction published by the American Institute of Steel Construction.
- b) Allowable stresses for rivets, bolts and threaded parts as per table 1.5.2.1 of AISC specifications.
- c) Allowable stresses for welds as per table 1.5.3 of AISC specifications.

20.6 FABRICATION

- a) Straightening Material
Rolled material, before being worked upon, must be straightened within tolerances by ASTM specifications A6. Straightening, necessarily shall be done by mechanical means or by the application of limited amount of localised heat. The temperature of heated areas, as measured by approved methods, shall not exceed 1100 F for A514 steel or 1200 F for other steels. All material,

before and after fabrication shall be straight or curvilinear form as required free from twists.

b) Cutting

As far as possible cutting must be done by shearing. Oxygen cutting shall be done where shear cutting is not possible and shall preferably be done by machine. All edges shall be free from gauges, notches or burs. If necessary the same shall be removed by grinding.

c) Holes punching drilling

Holes shall be punched where thickness of the material is not greater than the diameter of bolt or rivet + 3mm. Where the thickness of the material is greater, the holes shall be drilled or sub-punched and the drill of all subdrilled holes shall be at least 2mm smaller than the nominal diameter of the rivet or bolt. Holes for A514-77 steel plates over 1/2" thick shall be drilled. Holes shall not be allowed to formed gas cutting process.

d) Welding

1. Maximum Thickness of fillet welds

- i) Not more than 1.2 times the lesser thickness of materials being welded.
- ii) At welding of rolled profiles along edges, which are curved, not more than the thickness of the edge minus the radius of the curve.

2. Minimum thickness of fillet welds.

Least thickness for calculation and designing requirements:

Thickness of thicker part	Upto 10 mm	11mm to 20mm	20mm to 30mm	31mm to 50mm	Above 50mm
Thickness of Weld for carbon steel.	4	6	8	10	12
Thickness of Weld for low alloy steel	6	8	10	12	-

- 3. Design length of a fillet weld shall not be less the 40 mm or 10 times thickness of fillet weld and not more than 60 times thickness of fillet weld.
- 4. Surfaces to be welded shall be free from loose scale, slag, rust, grease, paint or any other foreign matter except mill scale which withstands vigorous wire brushing.

e) Tolerances

- 1. A variation of 1 mm is permissible in the overall length of members with both ends finished for contact bearing. The bearing surface is to be prepared to common plane by milling.

2. Members without end finished for contact bearing which are to be framed to other steel parts of the structure shall have a variation from detailed length not greater than 3mm.
- f) Each piece of steel work after fabrication shall be distinctly marked before delivery to site in accordance with a marking plan for erection assembly.

20.7 SURFACE PREPARATION

- a) All steel work shall be cleaned free from loose scale, rust, dust, slag etc. by using suitable means. Sand blasting shall be carried out wherever so specified by the Engineer.
- b) Steel work to be encased in concrete or surfaces in contact with concrete or grout shall be given a cement wash.
- c) Machine finished surfaces shall be coated with rust preventive compound approved by the Engineer prior to removal from shop and immediately after finishing. Such surfaces shall be protected with wooden pad or other suitable means for transportation. Unassembled pins and bolts shall be oiled and wrapped with moisture resistant paper.
- d) All other surfaces of steel work shall be painted as specified hereunder.
 - Resin based special emulsion paint shall be manufactured by one of Pakistan paint manufacturers, as approved by the Engineer. The paint shall be composed of P.V.A. with pigment of Titanium dioxide with inert extenders, having viscosity of 70-75 K.U. at 25 deg. C and approximate specific gravity of 1.33. The paint shall have flat finish, smooth and free from brush marks and resistant to fungus growth.
 - Enamel paint and primers shall be Dulux as manufactured by M/S Imperial Chemical Industries Pakistan Ltd. or approved equal and shall be applied in accordance with the period instructions of the manufacturers.

No separate payment shall be made for painting of structural steel works. The Contractor shall include all the cost of labour, plant and material for this work in the price as mentioned in the Bill of Quantities.

20.8 ZINC COATING (GALVANIZING)

Where ever specified by the Engineer zinc coating shall be applied in a manner and or a thickness and quality conforming to the requirements of ASTM A-123-65, standard specifications for zinc (Hot galvanized) coating on products fabricated from rolled, pressed, and forged steel shapes, plates, bars and strips.

20.9 INSPECTION AND TESTS

- a) Manufacturer's Works Test certificate for all material used shall be furnished by the contractor for Engineer's scrutiny and approval. The contractor shall provide all necessary facilities to Engineer for inspection of steel structure work during fabrication and erection.

- b) Rolling tolerance of all shapes and profile according to AISC (American Institute of Steel Construction) shall be in accordance with the provisions of the American Society for Testing and Materials Designation A.6 These shall be checked by the Contractor before being worked upon and shall be rejected if found not within limits.
- c) The Contractor shall arrange for analysis and test of all material rolled locally at a testing laboratory selected by the Engineer, for which Contractor will bear all expenses.
- d) Nevertheless neither the fact that the materials have been tested nor that the manufacturers works test certificates have been furnished shall effect the liberty of the Engineer to reject after delivery, material found not according to these specifications.
- e) The inspection of welding shall be performed in accordance with the provisions of Section 6 of the code for Welding in Building Construction, DI. O-69 of the American Welding Society ("Structural Welding Code" AWS DI-1)
- f) Materials or workmanship not in reasonable conformance with the provisions of these specifications shall be rejected at any time during the progress of the work or the completion and erection at site.

20.10 ERECTION

- a) Bracing.
The frame of steel skeleton buildings shall be carried up true and plumb within the limits defined in section 7(h) of the AISC code of standard practice, and temporary bracing shall be introduced wherever necessary to take care of all loads to which the structure may be subjected including the equipment and the operation of the same. Such bracing shall be left in place as long as required for safety. Wherever piles of material, erection equipment and other loads are carried during erection, proper provision shall be made by the contractor to take care of the stresses resulting from such loads.
- b) Alignment & Bolting.
No riveting, permanent bolting or welding shall be done at site during erection until as much of the structure as will be stiffened thereby has been properly aligned. The threaded portion of each bolt shall project through the nut at least one thread.
- c) Painting after Erection.
Before painting of steel which is delivered unpainted is commenced, all surfaces to be painted shall be dry and thoroughly cleaned from all loose scale and rust. The specified protective treatment shall be completed after erection.

20.11 MEASUREMENT & PAYMENT

- a) General
 - i) The cost of all the works involved within the scope of this specifications as per all the drawings and conditions of contract are covered only within the quoted rate of items of the Bill of Quantities.

- ii) Unless otherwise specified and to the extent provided in the Bill of Quantities no separate or additional payment will be made for the following works, the cost of which shall be deemed to have been included in the quoted rate of the Bill of Quantities item.
- Providing nuts, bolts, screw, rivets, heads, filets welds and welding rods.
 - Galvanizing and prime coating steel work.
 - Painting Steel Work.
 - All embedded parts other than steel.

b) Measurement

- i) Items of work of structural steel for which the unit rates have been quoted on weight basis shall be measured net as acceptably supplied and installed at site as per drawings / workshop drawings and as per instruction of the Engineer. After measurement the theoretical weights shall be calculated from standard tables of section and weights in the manner followed in the preparation of workshop drawings. The cost of loading and unloading, transportation and handling of structural steel items shall be deemed to be included in the quoted unit rate of the related Bill of Quantities item.
- ii) Measurement of acceptably completed installation and erection works of Structural steel items supplied free of cost by the Employer will be made on the basis of number of tons of structural steel items erected and installed in position as shown on the drawings or as directed by the Engineer. The cost of loading and unloading, transportation and handling of structural steel items shall be deemed to be included in the quoted unit rate of the related Bill of Quantities item.

20.12 PAYMENT

Payment will be made for acceptable measured quantity of structural steel works on the basis of unit rate quoted in the Bill of Quantities and shall constitute full compensation for all the incidental works related to the item.

**ESTABLISHMENT OF UNIVERSITY OF TURBAT
TURBAT TOWN (South-West of Baluchistan)
IN DISTRICT KECH**

**CONSTRUCTION OF BOUNDARY WALL AROUND
GIRLS HOSTEL PHASE II**

Electrical Specification

Contents

SECTION-E-01-	GENERAL SPECIFICATIONS
SECTION-E-02-	LOW VOLTAGE CABLES AND WIRES
SECTION-E-03-	LOW VOLTAGE SWITCH BOARD/DISTRIBUTION BOARD
SECTION-E-04-	INTERNAL LIGHTING
SECTION-E-05-	WIRING DEVICES
SECTION-E-06-	CONDUITS AND PIPES
SECTION-E-07-	CABLE TRAY, LADDER AND TRUNKING
SECTION-E-08-	EXTERIOR LIGHTING FIXTURES
SECTION-E-09-	EARTHING SYSTEM
SECTION-E-10-	TELECOMMUNICATION CABLING SYSTEM.....
SECTION-E-11-	LIST OF APPROVED MANUFACTURER.....

SECTION-E-01
GENERAL SPECIFICATIONS

FOREWORD

This document is to describe the minimum requirements for the equipment and installations and to ensure that the Contractor is fully aware of his duties to perform the required works, in accordance with the terms of the Contract.

1.0 SCOPE OF WORK

The works related to the electrical system which are included in the scope of this Contract are shown on the Drawings, stated in the Particular Specifications, Bill of Quantities and explained in these specifications. The works shall broadly include but not limited to the following:

- | | | |
|-----|---|--------------------|
| 1. | Low Voltage Cables and wires | (Section – E - 02) |
| 2. | Low voltage Switch Board/Distribution Board | (Section – E - 03) |
| 3. | Internal Lighting | (Section – E - 04) |
| 4. | Wiring Devices | (Section – E - 05) |
| 5. | Conduits and Pipes | (Section – E - 06) |
| 6. | Cable tray, ladder and trunking | (Section – E - 07) |
| 7. | Exterior Lighting Fixtures | (Section – E - 08) |
| 8. | Earthing System | (Section – E - 09) |
| 9. | Telecommunication Cabling System | (Section – E - 10) |
| 10. | Approved manufacture List | (Section – E - 11) |

All material and equipment supplied by the Contractor shall be new and in all respects conform to the high standards of Engineering design, workmanship, performance and function as here in specified and fully meet the quality level and rugged requirements of the specifications.

The Contractor shall also be responsible to supply any other equipment not specifically mentioned in these documents but which is necessary for proper operation of the works / system, shall be considered to have been so specified and accordingly shall be provided by the Contractor as part of the Contract.

The Contractor shall be solely responsible for ensuring proper functional requirements of various equipment and shall also be responsible for furnishing any additional piece of equipment and for making modification in the equipment as desired and / or approved by the Owner or his representative, to achieve proper coordination with various equipment offered in the bid and also those installed by others.

Approval of the Contractor's supplied equipment / installation works shall not relieve the Contractor of any of his obligations or liabilities under the Contract, except insofar as provided under the conditions of the Contract.

2.0 RULES AND REGULATIONS

The entire electrical installation / work shall be carried out by licensed contractor, authorized to undertake such work under the provisions of Electricity Act 1910 and The Electricity Rules 1937 as adopted and modified up to date by the Government of Pakistan.

All works shall be carried out in accordance with the latest edition of the Regulations of the 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 for completing all formalities and submitting the test certificates as per prevailing rules and regulations and shall have the installation passed by the Government Electric Inspector of that region. All requirements of the Electric Inspector and the Electric Company shall be complied with.

3.0 STANDARDS

All works, equipment and materials shall conform to:

On the one hand:

The specification recommended practices, official standards and codes the non - restrictive list of which is given below.

International Electro-technical Commission (IEC)

British Standards (BS)

National Electric Code (NEC)

National Standards

In the event of conflict between standards, the most stringent shall prevail.

Whenever the electrical equipment to be installed, 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 these standards.

In addition, even if no mention is stipulated in this specification, it is implied that the equipment be tropical, if required, by the conditions of the site of installation.

In any case, the standards and codes to be taken into consideration are those in force at the date of delivery.

4.0 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:

- C
- a. Maximum outdoor ambient temperature : 45 degree C
 - b. Minimum Indoor ambient temperature : 0 degree C
 - c. Maximum relative humidity : 90 %
 - d. Minimum relative humidity : 26 %

4.2 Service Conditions

Equipment shall be designed and built for continuous service with a minimum of supervision and maintenance.

5.0 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 400 \pm 10%
- Phase 3, 4 wire system
- Frequency 50 Hz. \pm 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.

6.0 GUARANTEE

The Contractor shall furnish written grantee which should clearly state that the works he will carry out as well as the materials he will supply, meet with this specification and that compliance thereto constitutes an official clause, added by implication to the general conditions of his offer when signing the Contract.

Guarantee shall also be for replacement and repair of part or whole of the equipment which may be found defective in material or workmanship. The grantee shall cover the duration of Maintenance Period as defined in the conditions of the Contract. This guarantee shall not relieve the Contractor of his obligations and he will fully be responsible for the repair or replacement of any defective material in time, so as not to cause any undue delay in carrying out the repairs and/ or replacements.

The Contractor shall acquaint himself fully with the existing conditions and limitations at site and all works necessary to complete the project under the Contract, to be carried out by the Contractor.

7.0 EXCEPTIONS TO SPECIFICATION

Any exception or deviation from this specification or the codes and standards shall be listed separately in the Contractor's "List of Deviations". Any exception, which shall not be listed, shall not be considered later.

8.0 AVAILABILITY OF SPECIFICATIONS, DRAWINGS AT SITE

The Contractor shall assume at his own cost the permanent availability of this specification and drawings on site where applicable.

9.0 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 at once notify the Owner or his representative for receiving his instructions before proceeding with the works. If such defective or modified work is carried out by the Contractor on his own, he shall rectify the same at his own cost.

10.0 MEASUREMENT OF WORKS

The quantities set out in the bill of quantities are the 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 the site.

11.0 INSTALLATIONS DETAILS

The locations, routings, installation heights, detail etc. for electrical equipment are indicated 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 his representative.

12.0 DRAWINGS AND DATA

The Contractor shall provide dimensional outline drawings, arrangement drawings and technical data for the equipment offered, for the approval of Owner or his representative.

13.0 PRIOR APPROVAL OF SHOP DRAWINGS, MATERIALS AND EQUIPMENT

The Contractor shall provide shop drawings for the electrical installations showing the exact routes of all underground cables and ducts, the exact run of all conduits and trunking, draw-in and junction boxes, the number and size of wires in each conduit, the final connection arrangements at distribution boards and the details of ducts for the approval of consultant / Owner's

representative before commencing any portion of the works. All such working drawings shall be submitted in suitable number of copies as indicated in the particular conditions and within the periods stipulated below:

- a. Cable entry ducts into buildings:
Working drawings shall be submitted within two weeks of handing over the site.
- b. All other working drawings shall be submitted to the Engineer against signed receipt and dated within two months of signing the Contract. Should however the Contractor be obliged to install electrical conduits prior to this period then he shall submit the relevant working drawings at least two weeks prior to the proposed date of commencement of the work. The Contractor shall submit the program indicating the dates on which coordination in different sections will take place, together with the submission of the working drawings. The Engineer shall arrange to return to the Contractor at least one week prior to the commencement of concreting of the section, his comments or approval of the working drawings.

The Contractor shall supply detailed specifications, dimensional drawings, etc., of equipment that he proposes to supply and install.

Where this Contract requires the approval of Engineer to material and goods, the Contractor must seek to obtain this approval within eight weeks after signing of the Contract. No extension of time will be granted for non-availability of material or goods if this clause is not complied with. Approval of the Engineer does not relieve the Contractor of placing his orders in due time for the materials he needs to complete the Contract on time. The approved samples shall be retained on site for comparison with commodities used in works and removed when no longer required.

14.0 MATERIAL ORIGIN AND QUALITY

The material and equipment shall be purchased from Consultant / Owner's agreed suppliers.

The consultant / owner shall retain the right to at any time demand the indication of origin of the materials, and to eventually refuse products, the origin of manufacturing of which have not been previously agreed to without consideration of quality.

On specific agreement of the Owner, the materials may be delivered progressively to the field, but in such a manner as to allow sufficient time for their reception.

When choice of manufacturer is allowed for any particular commodity the Contractor shall obtain the whole quality required to complete the work from one manufacturer or obtain approval of any change in source of supply. He shall produce written evidence of sources of supply when requested to do so by the Engineer.

15.0 IDENTIFICATION OF EQUIPMENT

For each piece of 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.

16.0 MARKINGS

The contractor shall provide "Danger Boards "and" Shock Charts "wherever required to comply with the requirements of local Electricity Rules and according to normal practice.

17.0 FACTORY TESTS

All equipment supplied by and installed as part of the Contract such as distribution boards and like shall be fully tested at the manufacturer's works to the requirements of appropriate standards called for later in the particular specification.

The Contractor shall inform the Engineer in writing about the date and time of test of each equipment at least two weeks 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 referred to in

Clause 6.0. All test results in the form of certificate of test / test record certificates, signed by all the witnesses, for each item in the scope of Contractor's supply shall be supplied to the Engineer within seven days of the test date, and in any event before delivery to the site.

All expenses for carrying out the tests and witness by the Owner or his representative shall be borne by the Contractor and deemed to have been included in the tender bid.

18.0 STORAGE

The Contractor shall store the equipment in such conditions that it cannot be damaged, i.e., in a dry warehouse. As particular concerns; fragile components, these shall be stored on shelves in their original packing, fitted with identification labels so as to avoid unnecessary manipulation or handling.

The Contractor shall handle, store and fix each commodity in accordance with 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 when requested to do so.

19.0 LABOR AND STAFF OF CONTRACTOR

The Contractor shall provide / furnish and arrange for:

- Skilled and unskilled labor required for performing the works in accordance with the technical specifications and drawings within the agreed time schedule.
- Supervisory technical staff with appropriate experience and requisite expertise to ensure quality of work performed.
- Supervisory administration and clerical staff to ensure smooth functioning of the activities at site.
- Construction equipment, meggers, tools, etc.

The Contractor shall supply all labor, materials and equipment necessary for the installation of low voltage distribution boards, cables, lighting and power equipment, together with all other apparatus shown on the drawings and as detailed in the Particular specification.

20.0 SMALL INSTALLATION MATERIAL

The Contractor shall supply all small installation and consumable materials such as nuts, bolts, washers, shims, angles, leveling materials, insulation tape, solder, PVC strap-on or heat shrinkable type cable tags, cable ties, bushes, sealing compound, Avometer, electrical testing and measuring instruments, etc., and all such other material not listed in BOQ, required for complete installation as intended by the specification and scope of works.

21.0 INSTALLATION INSTRUCTIONS – GENERAL

The Contractor shall set out the works himself as per specifications and drawings and shall properly position the equipment on specified foundation / location. In general, the manufacturer's instructions for installation shall be followed. Any defect or faulty operation of equipment due to Contractor not following the manufacturer's instructions shall be corrected and repaired by the Contractor at his own cost.

22.0 ASSOCIATED CIVIL WORKS

The expression 'Associated Civil Works' shall mean civil work to be carried out by the Contractor under the direction of the Engineer in connection with the Electrical Service.

The Contractor shall prepare accurate drawings giving details of all holes, fixings, bases and other civil work requirements and shall be responsible for their accuracy. The cost of preparing shop drawings shall be considered to have been so specified in the tender price.

The following is a summary of the work to be carried out by the Contractor:

- a. The cutting and forming of holes for conduits or pipes, or conduit or pipe fixings through walls, floors, ceilings, partitions, roofs, etc., and making good after the work is sufficiently advanced.

- b. The building of concrete and / or brick ducts in floors, walls, etc.
- c. The formation of concrete bases, etc., for equipment
- d. Excavation forming for underground services of ducts and courses and then covers it.
- e. The cutting or forming of chases, recesses, etc., in floors, walls, etc., for conduits and fittings in and making good.
- f. Excavation for and laying of cable carrying pipes.
- g. The building in of brackets and supporting bars or other form of conduit or pipe suspensions.
- h. The painting of all pipes, tube and conduits etc. after fixing unless specified to the contrary.
- i. The providing and building in of sleeves through slabs and walls.

In general all required holes through walls, floors and beams for pipes and ducts will be left out by the Contractor during the process of building.

Where conduits, pipes or fittings are fixed to concrete or woodwork by means of saddles or clips, the Contractor shall himself execute the work necessary and the cost of such work shall be considered to have been so specified in the price.

Cutting, fitting, repairing, patching or plastering and finishing of carpentry work shall be done by craftsmen skilled 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 cut must be directed 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.

23.0 TESTING – GENERAL

Upon completion of installation, at least seven days notice is to be given of intention to perform any test. 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 Contractor.

The Contractor shall record all test values of the tests made by him on all equipment. Four copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams, etc.

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 and is to clean, set, calibrate and fully commission, demonstrate and hand over to the Owner the entire Contract works in a thoroughly complete and operational state to the satisfaction of the Engineer.

The acceptance - provisional or final- shall be made by the Owner. This reserves him the right to be represented or assisted by a representative or an organization (whether official or not) of his choice, which may decide on his behalf any repairs deemed necessary resulting from lack of observations of this specification, or of the rules and standards. In addition, he may judge the quality of the works and the materials supplied.

This remains in force in case of sub-contracting.

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.

23.1 Insulation Resistance Test

Insulation resistance test shall be made on electrical equipment by using a megger of 1000 volts for circuits between 250 and 500 volts. The insulation resistance of distribution boards, cables, etc., shall be as per relevant IEC, BS and Pakistan Electricity Rules.

The distribution boards shall be given an insulation resistance measurement test after installation, but before any wiring is connected. 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 under test is less than specified value, 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 insulation resistance readings shall be taken after the correction has been made 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.

23.2 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.

23.3 Switchgear

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 connections to give proper phase sequence.

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. Nameplates shall be checked for proper

designation of equipment served. Protective relays shall be tested and set at site prior to commissioning of the equipment.

23.4 Special Systems Tests

The special systems such as telephone, intercom, etc., shall be tested according to the procedures laid down in the respective sections of the technical specifications. However, any specific tests recommended by the manufacturer shall also be carried out as approved by the Engineer.

23.5 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.

24.0 ELECTRICAL CONNECTION

Electrical connection for each building shall be supplied by other but necessary arrangement coordination to be done by this Contractor.

25.0 SHOP DRAWINGS/ AS BUILT DRAWINGS AND SERVICE MANUALS

A record shall be kept both in hard and soft copies as the work proceeds of any work not in accordance with the working drawings, and upon completion of the work, the Contractor shall prepare the following drawings and forward them to the Engineer for approval:

- a. Duplicate prints of as built single line diagram of the main and sub main distribution network, indicating all cables, their size and type, and the rating of all protection devices such as circuit breakers, fuses, etc.
- b. Duplicate prints of as built/shop drawings of Lighting, Power, Telephone, Data and Queue Management systems, as applicable.
- c. Duplicate prints of as fixed control and wiring diagrams for the equipment installed as part of the Electrical Contractor works.

After these drawings have been approved, the Contractor shall supply two prints on paper of each and insert these in the operating and maintenance manual specified below.

The Contractor shall submit to Engineer for approval a sample of manufacturer instructions for installation, testing, commissioning, operation and maintenance manuals including manuals of spare parts and tools of the equipment. Upon acceptance, the Contractor shall supply three copies to the Engineer for forwarding to the Owner. These manuals should be in properly bound form. At least two copies of the documents shall be submitted in original. The installation instruction shall be submitted two weeks prior to commencement of installation of each equipment, and operation and maintenance instruction at the time of commissioning. If the Contractor fails to provide the documents, the Engineer shall withhold issuance of requisite certificates and deduct suitable amount from the payments to the Contractor.

26.0 WORK COMPLETION

The Contractor shall further make good, repair, replace all defective works and clear away on completion and leave all installations in perfect working order and to the satisfaction of the Owner or his representative.

27.0 PAYMENT

No separate payment shall be made for work involved within the scope of this section unless specifically stated in the Bill of Quantities or herein.

SECTION-E-02

LOW VOLTAGE CABLES AND WIRES

1.0 SCOPE OF WORK

The work under this scope consists of supplying, 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 Tender 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 lines and equipment.

The LV cables and wires with accessories shall also comply with the General Specifications for Electrical Works, Section E- I and with other relevant provisions of the Tender document.

2.0 GENERAL

All multicore 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 and cables including 16 sqmm and above shall be of 600/1000V. Power cables for main feeders, main to sub main feeders, power equipment, etc., armoured or unarmoured shall be of 600 / 1000 volts grade. Armouring 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 multicore 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 as given in General Specifications for Electrical Works, Section E-01 of these specifications. Cable should be capable of running 125% of full load current without any damage.

3.0 STANDARDS

LV Cables and Wires shall comply with Section - E -01, Clause 3. Particular reference shall be made to:

BS 6004	PVC insulated cables for lighting and power
BS 6746	PVC insulation for electrical cables
BS 6360	Copper conductors
BS 6500	Insulated flexible cords.
BS 6346	PVC Armoured Cables

Any other standard referred to in above standards or these specifications.

4.0 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.

All cables shall have phase identification colours on insulation of each core. The colour code for three phase circuits shall be red, yellow and blue for phase conductors and black for neutral conductor. Where insulated earth conductor is installed, it shall have green colour insulation.

Single phase circuits shall have insulation of red colour for phase / line, black colour for neutral and green colour for earth conductor.

All DC circuits shall have insulation of red colour for positive, black colour for negative and green for earth conductor.

The ends of each length of multicore armoured or unarmoured 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 steel 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 multicore 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 armoured 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 shall be provided for the complete cabling and wiring system without any additional cost unless specifically mentioned in BOQ. These shall include but not limited to the items such as saddles, clamps, fixing channels, connectors, cable joints (where necessary and

approved by the Engineer), clips, lugs, tapes, solder, identification tags, bushes, glands, etc.

5.0 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 1 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, labour, 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.

5.2 Conduit Wiring

The wiring through 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, preferably without the use of any lubricant. 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.

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., or alternatively by means of suitable fixing devices cast at site, e.g., concrete inserts.

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. It shall be ensured that conduit system is clear before cable is drawn in. 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 underground 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 Owner or his representative before use.

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

armoured cables are used, care shall be taken to ensure that the lay of the armour 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.

Cables of AC circuits, installed in PVC or steel conduit shall always be so bunched that the cables of all phases and the neutral conductor (if any) are contained in the same circuit. 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.

6.0 PAYMENT

Payment for all the items under this section shall be made at the rates entered in the BOQ appended to the contract and in accordance with the applicable conditions of the contract.

SECTION-E-03

LOW VOLTAGE SWITCH BOARD/DISTRIBUTION BOARD

1.0 GENERAL

1.1 Purpose

This section together with its appending document covers the minimum requirement for the design, construction and performance of factory built assemblies of LV switchboard.

1.2 Scope of Work

The work under this scope consists of supplying, installation, testing, connecting and commissioning of all material and services of the complete switchboard 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 others for exact route, location and positions of electrical lines and equipment.

1.3 Standards

Switchboards shall comply with the following relevant standards:

IEC 60027	Letter symbols to be used in Electrical technology.
IEC 60051	Direct setting electrical measuring instruments.
IEC 60073	Colour for indicator lights and push buttons
IEC 60158	LV Switch gear and control gear.
IEC 60185	Current Transformers.
IEC 60186	Voltage Transformers.
IEC 60269	LV fuses.
IEC 60439	Factory built assemblies of LV switchgear and control gear.
IEC 60529	Degree of protection provided by enclosures.
IEC 60617	Graphic symbols for diagrams.
IEC 60947-2	LV Switch gear and Control gear.
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.

1.4 Installation and Service Conditions

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 mentioned in the following section.

Transient voltage depression down to 80% of rated voltage shall not affect the performance of the equipment and dip voltage must be within permissible limit.

2.0 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 ϕ , 4 Wire.
- Frequency 50 Hz. \pm 2 Hz.
- Neutral system Solidly grounded.

Main characteristics of auxiliary supply system are:

- Control / Command system 24 VDC.
- Space heater system 230 VAC.

1.2 Ratings

The equipment shall be capable of carrying the specified current on a continuous basis of 24 hours / day, without exceeding the permitted temperature.

The current ratings of all equipment 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.

3.0 GENERAL REQUIREMENTS

3.1 Concept

The Switchboard shall be of standard, prefabricated metal clad cubicle(s), floor / wall mounting type, totally enclosed, dead front, dust tight and vermin proof requiring 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.

The Switchboard with all components and accessories shall be suitable for front operation only and shall:

- have a rated service short service breaking capacity, Ics at 400 VAC, conforming to IEC 60947-2 unless otherwise stated on the drawings.
- be provided with adequate clearance from live parts so that flash over cannot be caused by switching, vermin, pests, etc.
- have all components rated for insulation class 600-volt minimum.
- be designed for flush mounting of all instruments on the front side.

- have all incoming or outgoing connections from the top or bottom as required. Have the components mounted so as to facilitate ease of maintenance from the front. Have common lamp test facility for all lamps.
- have wiring diagram on the inside of door of the switchboard. Be labeled with nameplate on the front side of door.
- have arrangements for extension of switchboard in future.

3.2 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.

3.3 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 background, to be made from traffolite 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.

4.0 MECHANICAL DESIGN

4.1 General Construction

The switchboard shall be fabricated, welded; grinded, finished with angle iron framework and clad with 14 SWG MS sheet, to form a rigid, free standing / wall mounted, fronted assembly.

It shall be suitably divided into panels and compartments where necessary 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 be accessible during normal maintenance operations, shall be adequately protected and / or barred 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. Louvers shall be provided at the front of the panels.

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 unarmoured and armoured 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 colour 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 their respective 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.

Neutral Bus bar should be of same ampere rating as phase bar.

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 connectors shall be tinned plated connections and joints. Horizontal bus bars shall be of the same current rating throughout their length.

4.3 Earthing

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 colour. Earthing mass continuity between withdrawable parts and fixed frame shall be correctly ensured whatever the withdrawable part position.

Provision shall be made adjacent to cable termination for earthing cable armour 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.

5.0 MECHANICAL DESIGN

The enclosure of the LV Distribution Board shall be surface mounted, fabricated from electro-galvanized / zinc coated sheet steel.

The LV Distribution Board shall be fabricated with 16 SWG sheet steel surface mounting. All components shall be installed on a common component mounting plate made of 14 SWG sheet steel inside the enclosure and

protected from the front with screwed sheet steel front plate. The door and dead front covers shall be made of 14 SWG sheet steel. 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 distribution board shall be supplied complete with all installation materials as recommended by the manufacturer. The incoming and outgoing cable connections shall be according to the wiring requirements. If required, an adapter box for accommodating the cables and conduits may be provided. The box shall be of the same material and finish as the Distribution Boards.

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 of Distribution Board.

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 both the top and / or 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 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 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 colour RAL 7032 and then baked in oven. The thickness of powder coating shall not be less than 120 microns.

6.0 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 of the electrical system. All components should comply with IEC 60947-2. Typical specifications are given hereunder:

6.1 Moulded Case Circuit Breaker

These shall be three pole 400 / 500 volts rating shown on the drawings. The breakers shall have both time delay over current and instantaneous short circuit protection.

The MCCBs 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 conspicuously marked to facilitate connection and maintenance.

The breaker shall have quick make - quick break toggle mechanism with positive 'ON', 'OFF' 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.

6.2 Miniature Circuit Breaker (MCB)

The MCBs with current rating from 3 to 80 amperes 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 tropicalized.

The MCBs 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/TRIP positions.

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 MCBs shall be provided with bimetallic thermal element for overload protection and a magnetic element for short circuit protection.

6.3 Load Break Switches

Load Break Switches and contractors shall be of AC3 type for motor loads.

7.0 Power Factor Improvement Plant

The power factor improvement plant shall be used for improving the power factor of the system. The plant shall be automatic-cum-manual.

The power factor improvement 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, 400 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 4/3 stages. Each capacitor bank unit shall be 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 transformer with 5 amps secondary current, having suitable output burden and accuracy.
- 3 Nos. Instrument protection fuses.

7.1 Requirement of Capacitor Banks

According to IEC-6083 1 -1 and 60831-2.

Fully insulated, terminals to be shielded by a cover.

Dielectric: Plastic poly-propylene, impregnated.

Electrodes: Aluminium 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.

8.0 PARTICULAR COMPONENT REQUIREMENTS

8.1 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 / 1A 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.

8.2 Voltage Transformers

Voltage transformers shall comply with the requirements of IEC 60186 (or equivalent) and shall be of the same accuracy class as Current Transformers.

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.

8.3 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.

8.4 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.

8.5 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.

8.6 HRC Fuses

HRC Fuses shall be provided complete with fuse bases, fuse, etc. The fuses shall have a fusing factor as specified for class QI in accordance with BS 88 gG type.

8.7 Pilot Lamps

Switchboard shall be provided with LED type 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.

8.8 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.

9.0 INSTALLATION

The LV Switchboard shall be installed at location shown on the drawing. The Contractor shall ensure coordination with civil works for providing any openings, holes, etc. to avoid any breakage to completed works. 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 armour shall be connected effectively to ground.

The Switchboard body shall be connected to earth as per instructions given in section "Earthing" of these specifications. The Switchboard shall be tested and commissioned in the presence of the Engineer.

10.0 PAYMENT:

Payment for all the items under this section shall be made at the rates entered in the BOQ appended to the contract and in accordance with the applicable conditions of the contract.

SECTION-E-04

INTERNAL LIGHTING

1.0 SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete 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 route, location and positions of light fixtures.

2.0 GENERAL

The description of light fixtures in given Bill of Quantities, and stated on the drawings, and relevant material are described in this section. The determination of quality is based on certified photo-metric data covering the coefficient of utilization, light distribution curves, construction material, shape, finish, operation, etc.

The Contractor shall submit two samples of each and every light fixture specified and obtain approval of the Owner before purchasing. The quality and finishes of local make light fixtures (if mentioned in BOQ) shall be same as that of standard manufacturer. The accessories such as ballast, lamp / starter holders, starters, lamps, igniters, etc., for all type of light fixtures shall be of Philips make.

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.

3.0 STANDARDS

Lighting fixtures shall comply with Section E-1, Clause 3.

Particular reference shall be made to:

- IEC 60081 Tubular fluorescent lamps.
- IEC 60082 Ballast for tubular fluorescent lamps.
- IEC 60155 Starters for fluorescent lamps.
- IEC 60400 Lamp holders and starters holders for fluorescent lamps.
- IEC 60566 Capacitors for use in Tube Rods
- IEC 60598 Luminaries.
- IEC 62031 LED modules for general lighting-Safety requirements.
- IEC 62384 DC or AC supplied electronic control gear for LED

modules

performance requirements.

Any other standard referred to in above standards or these specifications.

4.0 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, 1224 / 610 mm long, for TL 28 / 14 watts respectively or as per design drawings/BOQ. The fluorescent colour shall be warm / cool white characteristics with an average output of 3350 lumens (+5%) for 28 watts and 1350 lumens (+5%) for 14 watts after 100 burning hours. The ballast shall be electronic type for 28 / 36 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, derusted, 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 14 SWG copper conductors shall be provided.

The light fixtures shall be furnished with perspex 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. Shop drawings shall be submitted for approval of Engineer.

5.0 LED Light Fixtures

The light fixture shall be as stated on drawings and bill of quantities. The light fixture shall be finished in standard colors unless otherwise stated on drawings or directed by Engineer. All LED light fixtures shall be of international standard and quality. The type of fixtures with manufacturer catalogue reference is 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 light fixtures shall be Light Emitting Diodes with driver and shall be supplied and installed according to the wattage as indicated on drawings.

Weather proof light fixture shall comprise of cast aluminum body and gasketed clear glass cover secured to the body by means of galvanized nuts / screws to give a weather proof and water tight fit. The gasket shall be weather resistance type.

The LED light fixtures shall be supplied complete with driver and all accessories as per light fixture schedule and shall be installed in accordance with manufacturer's recommendations and sound engineering practice.

6.0 INSTALLATION

6.1 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 terminal box and the fixture shall be carried out with 3 core 0.75 sq. mm and 1 sq. mm copper conductor, PVC / PVC cable respectively for circuits protected by 10 amps and 15 / 20 amps MCBs. 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.

6.2 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. For light fixtures on installation on false ceiling, the installation method detail

shall be coordinated with ceiling design and submitted for approval of Engineer. 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.

6.3 LED/CFL Light Fixtures

The LED and CFL 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 accordance with manufacturer's recommendations and in coordination with ceiling installation.

6.4 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.

The Contractor shall essentially use the standard products of a manufacturer, regularly engaged in the manufacturer of the product and shall meet the requirement of the specifications.

SECTION-E-05

WIRING DEVICES

1.0 SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete switches, switch sockets, etc., and miscellaneous items 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 others for exact route, location and positions of electrical lines and equipment.

The wiring accessories shall also comply with the General Specifications for Electrical Works, Section – E - I and with other relevant provisions of the Tender document.

2.0 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.

3.0 STANDARDS

Wiring accessories and miscellaneous items shall comply with Section - E-1, Clause 3.

Particular reference shall be made to:

- BS 67 Ceiling roses.
- BS 1363: 1984 13A fused plugs and un-switched socket outlets
- 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.

Any other standard referred to in above standards or these specifications.

4.0 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.

For locations where switches and fan speed regulators are installed together, single switches shall be grouped and fixed on 3 mm thick plastic sheet screwed to a sheet steel box of appropriate dimensions.

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.

4.2 Switched Socket Outlets

Switched socket units shall be of flat pin type and conform to BS 1363, 13A for fused plugs and socket outlets. 2 and 3 Pin rated for 10 Amps. Supply as specified in the bill of quantities.

3 Pin 10 Amps. Sockets shall be molded 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 speed regulators 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-rust 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 10 Amps. 250V AC. It shall have white plastic moulded 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 multicore PVC insulated and PVC sheathed cable.

4.5 Fans

4.5.1 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 Schedule 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.

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.

4.5.2 Ceiling Fan

The ceiling fan shall consist of 56" three blades and operate on 250V $\pm 10\%$ tolerance, 50Hz and RPM of 315. The ceiling fan should be robust in construction with die cast body parts. The stator and rotor laminations should be from silicon steel. The blades should be stove enameled made from aluminium alloy sheets to give ensure maximum air displacement. Winding slots should be insulated by polyester sheets. Stator windings must be pure copper.

SECTION-E-06

CONDUITS AND PIPES

1.0 SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete Conduits and Pipes 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 others for exact route, location and positions of electrical lines and equipment.

The Conduit and Pipes with accessories shall also comply with the General Specifications for Electrical Works, Section E-01 and with other relevant provisions of the Tender document.

2.0 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, bushings, bends, inspection / pull boxes, round boxes, etc., necessary for the completion shall be similar to that of conduit or pipes. All the accessories shall be supplied by the Contractor without any extra cost and deemed to have been included in the price of conduits / pipes.

3.0 STANDARDS

Pipes and Conduits shall comply with Section - E-01, Clause 3.

Particular reference shall be made to:

BS 31	Steel Conduit and accessories
BS 1378	Galvanized Iron Pipes and accessories.
BS 3595	PVC Pipes and accessories.
BS 4607	PVC Conduits and accessories.

Any other standard referred to in above standards or these specifications.

4.0 MATERIAL

4.1 PVC Conduits, Pipes and Accessories

The PVC conduits and accessories for lighting and power circuits shall be furnished by the Contractor as shown in the drawings or given in

BOQ. 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. 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 sharp 90 degree bends and tees will not be allowed for concealed wiring.

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 (working pressure - 12 Kg / cm), unless otherwise stated on Drawings or Bill of Quantities. Where pipe changes direction, manufactured smooth bends shall be used. For jointing of pipe, all precautions and procedures recommended by manufacturer shall be followed.

4.2 Steel Conduit and Accessories

All conduits shall be of heavy gauge 16 SWG steel, manufactured and tested in accordance with latest relevant standards.

The conduit shall be protected by two base coats of red oxide anti-rust 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-rust 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.

4.3 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.

4.4 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 a white plastic sheet of appropriate size fixed to the box by means of galvanized screws.

4.5 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.

4.6 Cable Trunking

Where required, wiring shall be run in hot-dipped galvanized (after fabrication) sheet steel cable trunking of the specified gauge complete with all fittings and accessories, manufactured and installed in accordance with BS 4678/NEMA. The trunking shall be constructed with return flanges. Trunking covers shall be secured by anchored turn-buttons and locking bars and minimum length of individual sections shall be 2.44-m. The trunking shall be suspended/supported from the structure at maximum 2-m intervals with straps and hangers fabricated from minimum 6-mm dia HDGF bars, or supported by angle-iron brackets.

Conduit drips from the trunking shall also be supported with hangers. Factory made connectors shall be used at joints.

Junctions (tee and 4-way) in multi-compartment trunking shall be double depth to avoid reduction in cabling space. Cable in vertical runs shall be supported by pin racks, prongs or bridging pieces. Fire barriers shall be provided at each floor level. Allowance for expansion shall be incorporated.

Bonding links shall be provided at each joint and secured by screws, nuts and shockproof washers. The bonding links shall make contact with the metal of the trunking of fitting, and continuity shall not depend on contact through the screws or on removal on site paint finish from ferrous metal.

5. INSTALLATION

5.1 PVC Conduits - Concealed

The conduit shall be installed concealed in roof, wall, column, etc. At all joints and bends, PVC jointing solution as manufactured by Pakistan PVC Limited or approved equivalent 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. In the reinforced cement concrete (RCC) work, the conduit shall be laid before

pouring of concrete. Under no circumstances shall chases be made in the RCC structure for concealing conduit and accessories, after pouring of concrete. The concrete shall be supported on top of bottom reinforcement of slab and shall be firmly secured by tying to the reinforcing steel in order to avoid being disturbed during pouring of concrete.

All outlet boxes to be firmly supported and installed such that they finish flush with the soffit of slab of beam.

Where conduits have to be concealed in cement concrete (CC) work after concreting, or in block masonry, chases 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 32 mm covered 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 chasing and cutting.

The termination of conduits at or near the Switchboard / Distribution Board is shown diagrammatically on the drawing. The exact final locations of the termination shall be coordinated with the Switchboard / Distribution Board to be installed. Any extension of conduit near the Switchboard / Distribution Board to suit the site condition shall be made without any extra cost. 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 wiring is carried out. Any obstruction found shall be cleared by use of cutting mandrel or other approved device and the conduit shall be cleaned out before the installation of cable.

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.

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 Steel and G.I Conduit

The minimum size of conduit shall be 25 mm. The use of solid or inspection elbows, bends or tees will not be permitted and 120 degree bends shall be limited to one between any two drawn-in boxes.

Conduit coupling joint shall not be used where conduit enter spout entry boxes. Conduit running, joints shall not be used where conduit enter conduit boxes or spout entry boxes.

Equipment that is required to be removed for maintenance shall be provided with conduit unions in all conduits that enter such equipment. The use of conduit nipples shall be avoided as far as practicable.

All conduits shall be cut square and reamed at the end. All conduit ends and the inside of conduits shall be clean and free from burrs.

Where bushed spouts or tapped holes are not provided at conduit termination, the conduit shall be terminated in a flanged socket and a smooth bore brass hexagon bush, with a lead washer fitted between the flanged socket and the equipment or box.

All exposed threads and parts where the galvanizing has become damaged shall be thoroughly cleaned and painted with galvanized paint. The exposed conduit ends shall be capped to protect threads from being damaged before installing cables.

Repair painting shall take place before any making good on site or buildings is carried out. The entire conduit system shall be checked for continuity. Any observation found shall be removed without damaging the installation.

The conduit system shall be installed empty with a 16 SWG steel wire drawn through the conduits for pulling of cables. Joints in underground conduits shall be avoided or reduced to the absolute minimum.

Where adjustable dies are used they shall be so adjusted that threads cut with them shall be the same depths as machine made threads.

The use of manufactured bends shall be avoided and instead smooth bends shall be provided by using approved type of bending tools.

Flexible steel conduits shall be installed at all points' locations where flexible connection is required, as directed by the Engineer. The flexible conduits when used shall be protected by external PVC sheath, resistant to oil damages.

G.I. pipes for underground installation shall be given bituminous paint coating and wrapped with suitable paper or cloth before installation.

5.3 Fixing of Conduits and Fittings

Conduits in buildings shall be fixed with galvanized distance saddles. Where a number of conduits follow a single route they may be fixed to mild steel brackets.

Conduits shall be supported on both vertical and horizontal runs as follows:

- Conduits size 20 mm and 25 mm maximum spacing of fixing 1000 mm.
- Conduit sizes larger than 25 mm spacing of fixing 1500 mm.

All conduit boxes that support fittings shall be securely fixed. All conduits shall be fixed 150 mm before and after every right angle or off set. All conduit fittings and equipment shall be fixed true and line able.

All conduit bends shall be made with an approved conduit bending machine or hickory. The radius of curvature of the inner edge of any bend shall not be less than the following table:

Conduit size	Radius
20 mm (3/4")	Not less than 130 mm.
25 mm (1")	Not less than 150 mm.
32 mm (1-1/4")	Not less than 200 mm.
38 mm (1-1/2")	Not less than 255 mm.
50 mm (2")	Not less than 305 mm.
70 mm (2-1/2")	Not less than 380 mm.

82 mm (3")
100 mm (4")

Not less than 460 mm.
Not less than 610 mm.

Underground conduit stud-up or kick pipe through concrete envelope shall be extended a minimum of 150 mm above grade and adequately braced to prevent shifting during concrete pouring work. The concrete envelope shall extend at least 76 mm above grade.

Under floor conduit installation shall be at a minimum depth of 120 mm from finished floor level. The G.I. pipes / conduits shall be installed at a minimum depth of 1000 mm measured from the top of size to the finished road level.

5.4 Location of Conduits and Fittings

Before conduits are installed, confirmation shall be obtained that the conduit may be installed in that position.

Particular attention shall be given to the location of conduits to prevent the infringement of headroom and access ways.

Conduits shall be located to avoid obstructions, furnaces, hot lines and other places of high temperature.

Conduit shall not be located more than 150 mm (6") where it runs parallel to or crosses hot surfaces. Underground conduit runs shall be kept to minimum in both number and length. Conduits shall not be recessed in fair brick work.

Draw boxes shall be so positioned to enable the cables to be drawn in easily. The boxes shall not be located in the comers or other such locations and shall be positioned to avoid tight bends, bending and cable kinks.

Conduits shall not generally be installed having a greater length 12,000 mm (40 feet) between draw-in boxes.

Conduit entries shall wherever possible be located in the bottom of boxes and equipment etc.

SECTION-E-07

CABLE TRAY, LADDER AND TRUNKING

1.0 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections E-01, apply to this Section.

2.0 SUBMITTALS

General: Submit the following according to the Specification Sections E-01.

Product data for each component. Show tray types, dimensions, and finishes. Determine the sizes of the cable trays based on the number and size of cables laid on the cable trays plus 20% space for future growth. Cables laid on cable trays shall be spaced twice their overall diameter (consider the largest cable as reference). In case of discrepancy with the contract documents this clause shall prevail, unless approved by the Engineer otherwise.

Shop drawings detailing fabrication and installation of cable tray, including plans, elevations, sections, details of components, and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice plate's connectors, expansion joint assemblies, straight lengths, and fittings.

Co-ordination drawings, including floor plans and sections drawn to accurate scale. Show accurately scaled cable tray layout and relationships between components and adjacent structural and mechanical elements.

3.0 QUALITY ASSURANCE

Manufacturer Qualifications: Select a firm experienced in manufacturing cable trays which has a record of successful in-service performance.

Single-Source Responsibility: All cable tray components shall be the product of a single manufacturer.

4.0 SEQUENCING AND SCHEDULING

Co-ordination: Co-ordinate layout and installation of cable tray with other installations.

Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Engineer.

5.0 CABLE TRAYS

The cable tray system shall be of one manufacturer and shall include factory made trays, tray fittings, connections and necessary accessories and supports to form a complete tray support system.

The cable tray system shall include the following factory made tray elements. Straight trays and ladders, fittings and horizontal and vertical bends of various angle crosses, tees, wyes, reducers, vertical riser elements, connectors and all necessary fixing accessories.

Cable trays shall be constructed from mild steel of minimum thickness 16 gauge (1.5 mm). Trays in excess of 300 mm width shall be of minimum thickness 14 gauge (2.0mm).

Insert elements, bolts, screws, pins etc., shall be mild steel cadmium plated.

- a. Tray work shall have oval perforations. Ladder type trays shall be used as required and/or approved by the Engineer.
- b. All trays (straight and fittings) to be heavy duty returned flanged type unless specified otherwise.
- c. Tray component are to be accurately rolled or formed to close tolerance and all edges rounded. Flanges are to have full round smooth edges.
- d. Ladder racks of widths up to and including 300mm shall be constructed from rolled steel sections of minimum thickness 16 gauge (1.5 mm). Ladders in excess of 300 mm width shall be C Section construction with a minimum thickness of 14 gauge (2.0mm). the rungs shall be spaced at a maximum 300 mm.
- e. Unless indicated otherwise on drawings, cable trays shall be used in the range 150 mm to 900 mm wide, in fire preferred standard sizes: 150, 300, 450, 600 and 900 mm.
- f. Other sizes shall be used where specified or previously agreed with the Engineer.
- g. Flanges shall be a minimum of 50 mm deep.
- h. Minimum radius at side rails, horizontal and vertical tees and crosses shall be in accordance with the Manufacturer's standard.

Perforated, heavy duty, return flange type, in 2.5m nominal lengths Hot dip galvanized after completion of bending and drilling, complete with all necessary purpose made bends, tees, supports and the like. Width shall be such as to permit adequate access for installation and maintenance of cables and per the requirements and as per local regulations.

6.0 CABLE TRUNKING

Where required, wiring shall be run in hot-dipped galvanized (after fabrication) sheet steel cable trunking of the specified gauge complete with all fittings and accessories, manufactured and installed in accordance with BS 4678/NEMA. The trunking shall be constructed with return flanges. Trunking

covers shall be secured by anchored turn-buttons and locking bars and minimum length of individual sections shall be 2.44-m. The trunking shall be suspended/supported from the structure at maximum 2-m

intervals with straps and hangers fabricated from minimum 6-mm dia HDGF bars, or supported by angle-iron brackets.

Conduit drips from the trunking shall also be supported with hangers. Factory made connectors shall be used at joints.

Junctions (tee and 4-way) in multi-compartment trunking shall be double depth to avoid reduction in cabling space. Cable in vertical runs shall be supported by pin racks, prongs or bridging pieces. Fire barriers shall be provided at each floor level. Allowance for expansion shall be incorporated.

Bonding links shall be provided at each joint and secured by screws, nuts and shockproof washers. The bonding links shall make contact with the metal of the trunking of fitting, and continuity shall not depend on contact through the screws or on removal on site paint finish from ferrous metal.

7.0 EXAMINATION

Examine surfaces to receive cable tray, cable trunking and cable ladder for compliance with installation tolerances and other required conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

8.0 WIRING METHODS

Use cable tray of complete with manufacturer's recommended covers, barrier strips, dropouts, fittings, conduit adapters, hold-down devices, grommets, and blind ends.

9.0 INSTALLATION

- a. Install cable tray, cable trunking and cable ladder level and plumb according to manufacturer's written instructions, rough-in drawings, the original design, and referenced standards.
- b. Remove burrs and sharp edges of cable trays.
- c. Make changes in direction and elevation using standard fittings.
- d. Make cable tray connections using standard fittings.
- e. Locate cable tray above piping except as required for tray accessibility and as otherwise indicated.
- f. Fire stop penetrations through fire and smoke barriers, including walls, partitions, floors, and ceilings, after cables are installed.
- g. Working Space: Install cable trays with sufficient space to permit access for installing cables.

10.0 GROUNDING

Connect cable trays, cable trunking and cable ladder to ground as instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors.

11.0 CLEANING

Upon completion of installation of system, including fittings, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes, including chips, scratches, and abrasions.

SECTION-E-08

EXTERIOR LIGHTING FIXTURES

1.0 Street Light Fixtures

The street light fixtures shall be according to the BOQ. The fixture shall consist of weather proof, IP-66 rated light weight pressure die-cast aluminum housing, grey stove enameled outside and colored by a molded acrylic cover.

The fitting shall contain a tray carrying all electrical gear. This tray is made of white stove enameled aluminum sheet. The fixture shall have porcelain lamp holder and capacitor.

The ballast shall be polyester resin filled, totally enclosed and shall have leak proof body. The voltage of the lamp and ballast, and a wiring diagram and other relevant data shall be printed on the body of ballast.

The ballast shall be provided with insulated wires. The voltage of the lamp and type of fixture shall be as specified in Bill of Quantities. Light pole of required sizes as mentioned in the BOQ shall be in and out galvanized with all accessories like base plate, nut, anchor bolts, washer (all accessories shall be galvanized) with grey paint over two coats shall be installed as per BOQ.

The Luminaries shall be dust and jet proof, corrosion resistant and resistant to exhaust gases and cleaning detergents.

The single lamp Luminaries shall be designed to house high-pressure sodium lamps. The complete assembly shall provide the required light distribution pattern.

The Luminaries shall be made of pressure aluminum and silicon alloy. The exterior shall be totally smooth. The copper content shall be less 0.05% to prevent inter-crystalline corrosion.

The mirror reflects shall be of either the high-grade anodized aluminum (99.9%) type, or a white lacquered reflector type, rigidly fixed to the body and easily replaceable.

The control gear shall be within the fixture. The lamp and control gear shall be mounted in two different and isolated compartments.

Each luminaries optical compartment or unit shall be protected by a high impact resistant clear glass protector and shall be dust-and watertight to the recommendation of IEC publication No. 144 or approved equal. The protector shall be smooth to reduce to a minimum dirt accumulation and have and maintain a coefficient of transmission of the order of 88% or better. The front glass shall be provided with corrosion resistant hinges and quick closing devices for easy access for lamp replacement. The lamp socket shall be made of high-grade porcelain and be provided with a locking system to prevent loosening of the lamp.

The materials chosen shall be able to withstand without damage or ageing alteration in their structural or physical properties the server local environmental conditions in addition to the heat emitted by the lamp.

A suitable terminal block shall be provided to allow connection of the internal wiring and supply cables. Provision shall be made to facilitate maintenance, and easy disconnection and quick replacement of individual components.

The exposed metallic parts of the luminaries shall be factory finished, store enameled with a suitable corrosion resistant paint capable of resisting the heat emitted by the lamp during continuous operation.

The high pressures sodium lamp shall be designed to achieve a long life. The lamps shall have a clear finish and shall have a bayonet-mounting base.

A complement of new lamps of the correct wattage, shapes and rating shall be provided with the luminaries.

2.0 LIGHTING POLES & ACCESSORIES

2.1 CONSTRUCTION REQUIREMENT

Lighting poles sizes and dimensions shall be as mentioned in the BOQ and as per the drawing. The poles shall be round conical in shape cross section continuously tapered and longitudinally welded. The welding shall be complying with BS 5135; no circumferential weld shall be accepted. The pole shaft shall be fabricated from high strength structural steel, hot dipped galvanized as per BS 729 / ISO 1416 / 91121. The steel used for fabrication shall be minimum yield strength of 3600 kg per sq cm.

Epoxy paint ultra built liner should be applying over the proper galvanizing for extra protection.

The manufacturer shall provide written guarantee that the galvanizing treatment shall be adequate for 15 years of service.

Scratches, marks, dents or other damages to poles and fittings will be the cause of rejection. Any marks or stains resulting from wrapping materials shall be removed.

2.2 IDENTIFICATION OF POLE

For each piece of pole, identification label shall be fitted in front side. The label should mention the height of pole, year of manufacturing and company name. The label shall have block letter 7mm high, black on white background of trifoliate and fixed with screws.

1.3 CABLE CONNECTION BOX

Electrical Class: Class-II

- Protection: IP- 44
- Cable connection box with 4 Amps fuse for controlling of

lighting fixtures.

- Fitted with line-neutral circuit including 4 Amp 10x38 Gg curve fuse.
- The box shall be suitable up to 4 core 35 sq mm cable.

SECTION-E-09

EARTHING SYSTEM

1.0 SCOPE OF WORK

The work under this scope consists of supplying, installation and commissioning of all material and services of the complete earthing system 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 route, location and positions of the electrical lines and equipment.

The Earthing system with accessories shall also comply with the General Specifications for Electrical Works, Section E-01 and with other relevant provisions of the Tender document.

2.0 GENERAL

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.

3.0 STANDARDS

The latest editions of the following standards / codes shall be applicable for the materials covered within the scope of this specification:

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.

4.0 MATERIAL

4.1 Earth Rod Electrodes

Drive extensible rods of minimum 20 mm diameter of earth rod into the ground, either manually or by power driven hammer, to a suitable depth to obtain low resistivity 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. The cost of earthing leads deemed to have been included in the price of earth electrode & no separate pavement shall be made for it.

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 by the Contractor without any extra cost.

The specifications for single core PVC insulated cables used as E.C.C. shall be same as those given in Section-E-02 of these specifications. PVC insulated cables when used as E.C.C. shall be green.

1.0 INSTALLATION

Complete earthing systems as shown on the drawing shall be installed by the Contractor. The earthing system shall give earth resistance, including resistance of soil, earth leads and E.C.C. equal to less than one ohm, this without ground pits water spraying.

The earthing system shall be loop connected with earthing cables at least 300 mm away from telephone cables. The concept of the main loops and the way they are connected shall be such that equipment / apparatus can be easily removed without requiring a complex disconnection operation nor risking interruption of / or damage to the loop itself. 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 armours are not permitted as grounding 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 LV Switchboard, LV Distribution Board or any other 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 in general run in cable trench or in conduits / pipes 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 1 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 G.I. 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. The body of all Switchboards shall be connected to earth by specified size of E.C.C. All metal work shall also be connected to earth by specified size of E.C.C.

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-E-10

TELECOMMUNICATION CABLING SYSTEM

1.0 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

2.0 SYSTEM DESCRIPTION

The proposed cabling system (Passive Equipment only) 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 25 years. The contractor Installers (labor) and engineers must be trained and certified by this vendor to design and install cabling system. Active part (Switches) are the part of Client IT personal).

3.0 DATA CABLING SYSTEM

A Main Data rack (For Data Backbone) 42U shall be provided at the Computer room at Ground floor of the Building. The rest of the floors IDF racks called 12U are located as marked in drawings. The cable run from the IDF to the associated Data outlet is limited to 90m. The Main data backbone fiber cabling rack shall be placed in IT room, which feeds backbone fiber from data rack to each floor IDF and connected in Fiber patch panel in each IDF.

Wiring system used shall be star topology i.e. each data outlet is connected directly to the IDF (Intermediate Distribution Frame) IN Cat-6 RJ45 24 port patch panel.

Vertical runs between floors extending from the Main Data Rack to IDF to each IDF using multimedia fiber optic installed on separate containment as mentioned in drawing.

Data 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, patch cords, wire management, floor distributors (racks/cabinets).

The Data 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 to the Project.

The design shall fully comply with TIA/ EIA 568B & ISO 11801 in a full star topology configuration.

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 500MHz 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.

The cables required from the Data Cabinet to the Data Outlet must be 4-pairs UTP Category 6 copper cables for Data.

4.0 SCOPE

The contractor shall carefully examine all of 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. Also authorization letters from principal/ manufacturer, system integrator and warranty letter of 25 years should be provided at the time of submittals approval.

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 from manufacturer.

The LAN cabling system shall meet the emerging TIA/EIA 568A/B and ISO/IEC 11801 Category 6, Class EA specifications and shall support Gigabit Ethernet, Sonet/asynchronous transfer mode (ATM) at rates (minimum of) 1 Gbits/seconds and analog broadband video in addition to existing and multimedia technologies.

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 IT dept of the client, engineer, design, supply, install, test and commission the Cabling System. The Contractor should submit the Fluke test and OTDR Test as well. 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 ten years.

The Vendor must have completed a project with a minimum of 600 points or higher of Category 6.

5.0 SUBMITTALS

Product Data: Submit manufacturer's data on signal transmission media and components.

Shop & As Built Drawings: Submit softcopies of layout drawings of computer cable distribution system and accessories.

Wiring Diagrams: Submit data transmission wiring diagrams for computer system, including rack and terminal connections.

6.0 QUALITY ASSURANCE:

Manufacturer's Qualifications: 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 10 years.

Installer's Qualifications: Firms with at least 10 years of successful installation experience with projects utilizing systems and equipment similar to that required for this project.

Co-ordinate 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.

7.0 COPPER & FIBRE OPTIC CABLE AND CONNECTORS

Unshielded twisted-pair 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 unshielded twisted-pair 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.

Computer cabling System 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 TIA / EIA 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 Gbps), including 10 Gbps 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 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 colour coded as provided hereunder, colour contrast being such that each pair in the cable is easily distinguishable from every other pair.

Conductor Identification	Coloured 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

8.0 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 light)	69

Frequency (MHz)	250
Max. Attenuation @ 250 MHz (dB)	32.1
Worst case NEXT @ 250 MHz (dB)	38.3

9.0 HORIZONTAL CABLING DISTANCES

The maximum horizontal portion of a cabling system from work area information outlet to a mechanical termination at the patch-panel in the wiring closets must not be more than 90 meters. The cable run must be free of bridges, taps and splices.

Both ends of the cable shall be labeled for identification, i.e., at the patch panel and work area information outlet according to EIA/TIA 606 administration standards for the Data cabling of commercial buildings.

The horizontal cabling system shall be correctly designed and the work area outlets in each shown or required location shall be correctly mapped to an appropriate wiring

closet. The star topology shall be applicable to every individual unit of the transmission media.

10.0 FIBRE OPTIC & UTP CABLING

The backbone cabling interconnecting distribution cabinets to the main Central distribution cabinet shall be of multimode fiber cable 60/125 microns; 12-core and 6 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/ switches mounted on the wiring closets (IDF).

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.

All of the fibers in the backbone shall be terminated with LC type connectors or (as required) by IT specialists of client 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 unterminated, 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 be responsible to ensure the approval with client IT dept also.

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 company 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.

Logical labeling should be as per ANSI/TIA/EIA-606. Labels should be ring and printed type. No labels should be written by hand.

11.0 OPTICAL FIBRE CABLE TECHNICAL SPECIFICATION

Fiber optic cables within the premises shall use multimode, graded-index. Fibers must comply with TIA/EIA 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 colour coded to facilitate individual fiber identification. The coating shall be mechanically strippable.

Core	60 $\mu\text{m} \pm 3 \mu\text{m}$
Core Non-Circularity:	<6%
Core/Cladding Concentricity Error:	<3.0 μm
Numerical Aperture:	0.200 \pm 0.015
Cladding diameter:	125 $\mu\text{m} \pm 1 \mu\text{m}$
Cladding Non-Circularity:	<2.0%
Coloured Fiber Diameter:	250 $\mu\text{m} \pm 15 \mu\text{m}$
Buffering Diameter:	890 mm \pm 50 mm
Minimum Tensile Strength:	100,000 psi
Fiber Minimum Bending Radius:	.75 in. (1.91 cm)
Cable Minimum Bending Radius:	
During Installation:	20 times cable diameter
After Installation:	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)

12.0 DATA OUTLET

The Contractor shall provide the identification labels at each and every information outlet with clear information of its connection. (TR, IDF no, patch panel number and port number). The labeling shall be on the faceplate of the information outlet according to TIA/EIA 606 Administration Standard.

The contractor has to provide clear identification labels for Data. In the process of installing the information outlets, if the Contractor envisages difficulty in mounting the outlet at planned location as indicated in its design/engineering drawing, the contractor shall notify the Company of this, the contractor shall not make its own discretion in modifying or changing any information provided in the approved design drawings.

The type of information outlets shall be of modular RJ45 of approved or as required 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 or higher.

The 8 position/8 conductor outlets shall meet the category 6 transmission requirements or higher 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. It should be tool less RJ-45 connects 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 ethylene 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 6 transmission performance requirements.

13.0 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 5-ft. [1.5 m] on the network switches side, 10 ft. [3.05 m] on the workstation side or as per site requirement.

The patch cable shall meet the requirements warranted to meet ISO/IEC 11801, EN 50173 and EIA/TIA 568A/B category 6 or higher 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 as frequency ranges up to and potentially beyond 100/250 MHz

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 higher standards. The Contractor supplied cord shall be of factory crimped modular plug at both ends.

14.0 PATCH CORD ORGANIZER

The Contractor shall supply and install sufficient patch cord organizers 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 patch cord organizers shall support the requirements of routing cords in both horizontal and vertical pathways.

15.0 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 shall meet the clients 'IT dept' requirement and 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 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 the 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 TIA/EIA 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 TIA/EIA 568A/B commercial/ residential building Cabling System standards.

When the patch panels are tested in accordance with the appropriate test methods described in TIA/EIA 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 cable conductors shall be terminated as described in TIA/EIA 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" rack with cable ties as well as at the patch panels.

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 package must include frame mounting screws, labels, cable ties and instruction sheet.

17.0 VOICE CABLING SYSTEM

A main Distribution board (MDF) shall be provided at the Computer room of the Building. The telephone junction boxes are located as marked in drawings.

Wiring system used shall be star topology i.e. each telephone outlet is connected directly to the associated floor distributor IDC connectors.

Telephone system (Horizontal cables) shall be supplied installed and tested complete in place as given in drawings including but not in a way of limitation, cables, socket outlets, 110 wiring block 19'' cross connect type, connectors, telephone junction box and main distributor frame.

The telephone 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 to the Project.

The design shall fully comply with TIA/ EIA 568B & ISO 11801 in a full star topology configuration collapsing in the MDF.

18.0 SCOPE

The contractor shall carefully examine all of 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 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, labour, 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 10 years. Also Fluke testing of all cabling from RJ45 to Patch Panels. Also contractor shall submit the backbone and Rack shop drawings before commencement of work.

19.0 SUBMITTALS

Product Data: Submit manufacturer's data on signal transmission media and components.

Shop Drawings: Submit layout drawings of telephone cable distribution system and accessories.

Wiring Diagrams: Submit data transmission wiring diagrams for telephone system, including TJB and terminal connections.

20.0 TELEPHONE CABLING

Vertical runs between floors extending from the MDF to each TJB using 25 pair CAT 5 cables installed on cable tray as specified in drawings.

Horizontal runs from an IDC to the telephone outlet using 4 Pair CAT 6 cables. Wiring system used shall be star topology i.e. each telephone outlet is connected directly to the associated floor distributor (TJB) 19" modular type rack mounted..

The voice backbone cabling system shall meet the TIA / EIA 568A/B-5 and ISO 11801 Category 6, Class D specifications.

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.

21.0 IDC WIRING SYSTEM

The IDC blocks shall be used for the voice cross connect and should be rack mountable type. (MDF Rack) and for Cat-5 multipair backbone connecting in each floor TJB Rack.

Shall be capable to terminate 22-24 AWG solid conductors or 22-24 AWG stranded conductors. Shall be made of high-impact UL 94V-0 rated thermoplastic.

Maximum insulated conductor outside diameter 0.05"

Complete kit includes connecting blocks labels and label holders shall be used.

The IDC connectors must be color coded to meet both T568A and T568B wiring Configuration.

The IDC connector on the back of the patch panel shall support 22 to 25 AWG solid conductors' cables.

23.0 QUALITY ASSURANCE:

Manufacturer's Qualifications: 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 10 years.

Installer's Qualifications: Firms with at least 10 years of successful installation experience with projects utilizing systems and equipment similar to that required for this project.

Co-ordinate 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.

SECTION-E-11

LIST OF APPROVED MANUFACTURER

* All Equipment shall be procured from Principal Authorized agents / distributors / resellers.

The Bidder shall fill name of only one manufacturer for each equipment/material on which the tender is based. He shall be bound to supply the equipment from the same manufacturer. In case, the Bidder gives names of more than one manufacturer against any equipment, the Engineer / Owner can ask the Bidder supply the equipment from any one of them.

At the evaluation stage if it is noted that any material offered by the bidder does not meet the specification requirements, the Engineer / Owner reserves the right to ask the bidder to replace his choice of equipment supplier meeting the required quality and specification requirement.

During the execution stage if the material from any supplier is found defective / substandard the Engineer / Owner reserves the right to ask the successful bidder to replace his choice of manufacturer / supplier for that particular equipment.

Any change in manufacturer / supplier shall only be entertained if there is sufficient reason that adhering to the original choice of manufacturer / supplier shall be detrimental to either the project quality or project timeline. Proper approval shall have to be sought for change in the choice manufacturer / supplier at least 1 month before the equipment is to be procured.

Samples of all equipments shall have to be got approved prior to their procurement. The bidder has to sign and stamp all pages of Annexure-1. Any deviation from the BOQ / Specification shall be listed in a separate sheet to be labeled as Annexure-2 containing the details of the deviation including the deviating BOQ item number.

S.No.	Manufacturer / Supplier	Country Of Origin
-------	-------------------------	-------------------

(To be filled in by the Bidder)

LOW VOLTAGE (LV) PRODUCTS

LV Switchboards / Distribution Boards/ PFI Panels

- | | | |
|----|----------------------------|----------|
| a. | Pak Electron Limited (PEL) | Pakistan |
| b. | Siemens | Pakistan |
| c. | Schneider Electric | Pakistan |
| d. | ABB | Pakistan |
| e. | Libra Engineering | Pakistan |
| f. | Electrech | Pakistan |
| g. | Hussain & Co. | Pakistan |

Circuit Breakers

- | | | |
|----|-----------------------|---------------------------------|
| a. | Schneider Electric | France / Italy |
| b. | Terasaki | Japan / Malaysia /
Indonesia |
| c. | ABB | Germany / Italy |
| d. | General Electric (GE) | USA/UK |
| e. | Siemens | Germany |

Load Break Switches, Changeover Switches

- | | | |
|----|----------------|---------|
| a. | Socomec | France |
| b. | Kraus & Naimer | Austria |

Push Buttons, Switches, Etc.

- | | | |
|----|--------------------|---------------------------------|
| a. | Schneider Electric | France / Italy |
| b. | Maruyasa | Japan / Malaysia /
Indonesia |

LV Cables & Wires

- | | | |
|----|-----------------|----------|
| a. | Pakistan Cables | Pakistan |
| b. | Pioneer Cables | Pakistan |
| c. | Newage Cables | Pakistan |
| d. | Allied Cables | Pakistan |
| e. | Fast Cables | Pakistan |

Cable Glands, Lugs, Terminals and Accessories

- | | | |
|----|-----------------|----|
| a. | Cembre | UK |
| b. | Hubbell / Hawke | UK |

PVC Conduits and Accessories

- | | | |
|----|----------------|----------|
| a. | Galco | Pakistan |
| b. | Civic | Pakistan |
| c. | Dadex | Pakistan |
| d. | Jeddah Polymer | Pakistan |

Back Boxes

- | | | |
|----|------------------|----------|
| a. | Hussain & Co. | Pakistan |
| b. | Ezzi Engineering | Pakistan |
| c. | Electroline | Pakistan |

Switch & Socket Outlets / Floor Boxes

- | | | |
|----|------------------------------|-----------------------|
| a. | Clipsal (Schneider Electric) | Australia / Hong Kong |
| b. | M.K. | UK |
| c. | Legrand | UK |
| d. | ABB | Germany |

FAN & Accessories

- | | | |
|----|------------|----------|
| a. | Pak Fan | Pakistan |
| b. | GFC Fan | Pakistan |
| b. | Millat Fan | Pakistan |

Lighting / Street Lighting Fixtures /Poles

- | | | |
|----|-------------------|---------------------|
| a. | Philips | Pakistan/Netherland |
| b. | General Electric | UK |
| c. | Cree | USA |
| d. | Pierlite | Australia/UK |
| e. | Al Babtain (Pole) | Saudia Arabia |
| f. | Mitas | Turkey |

Diesel Generator Set

- | | | |
|----|-------------|-----------|
| a. | Caterpillar | USA / UK |
| b. | SDMO | UK/France |
| c. | Cummins | UK |
| d. | F.G. Wilson | UK |
| e. | Volvo | Sweden |

Power Factor Improvement Capacitors & Controllers

- | | | |
|----|-------------|----------------------|
| a. | Nokian | USA / France / Italy |
| b. | Amber | Pakistan |
| c. | Technologic | Italy |

Contactors

- | | | |
|----|------------------------------------|----------------|
| a. | Telemecanique (Schneider Electric) | France / Italy |
| b. | National | Japan |
| c. | ABB | Germany |

LOW CURRENT PRODUCTS

Telecommunication & Data Communication System
(Passive Equipment)

- | | | |
|----|-----------|--------------|
| a. | Schneider | France/Italy |
| b. | 3M | UK |
| c. | Panduit | UK |

**ESTABLISHMENT OF UNIVERSITY OF TURBAT
TURBAT TOWN (South-West of Baluchistan)
IN DISTRICT KECH**

**CONSTRUCTION OF BOUNDARY WALL AROUND
GIRLS HOSTEL PHASE II**

Plumbing Specification

Contents

SECTION-15140-	DOMESTIC WATER PIPING
SECTION-15145-	DOMESTIC WATER PIPING SPECIALTIES
SECTION-15150-	SANITARY WASTE, VENT AND STORM PIPING
SECTION-15155-	DRAINAGE PIPING SPECIALTIES
SECTION-15410-	PLUMBING FIXTURES
SECTION-15441-	DOMESTIC WATER PUMPS
SECTION-15450-	POTABLE WATER STORAGE TANKS.....
SECTION-15485.33-	SOLAR WATER HEATERS

Sect.15140 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.02 SUMMARY

- A. This Section includes domestic water piping inside the building.

1.03 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. PEX: Cross-linked polyethylene plastic.
- C. PVC: Polyvinyl chloride plastic.
- D. PPR: Poly propylene Random

1.04 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with 125 psig (860 kPa) unless otherwise indicated.

1.05 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Samples:
- C. Field quality-control test reports.

1.06 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components
- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Refer Approved List of Manufacturers.

2.02 PIPING MATERIALS

- A. The pipe materials shall as stated below.

2.03 DOMESTIC COLD WATER BELOW AND ABOVE GRADE

1. Polypropylene pipes and pipe fitting PN20 to DIN 8077 for pipe size upto 110mm dia.
2. uPVC pipes to BS 3505 with Class E with solvent welded fittings to BS 4346 for pipe sizes above 110mm dia.

2.04 DOMESTIC HOT WATER PIPING

1. Polypropylene pipes and pipe fitting PN20 to DIN 8077 for pipe size upto 110mm dia.
2. cPVC Sch 80 pipes with solvent welded fittings for pipe sizes above 110mm dia.

2.05 IRRIGATION PIPES

1. uPVC pipes to BS 3505 with Class D with solvent welded fittings to BS 4346 for all pipe sizes.

2.06 VALVES

- A. Balancing and drain valves are specified in "Plumbing Specialties."
- B. Generally, all valves of the same type shall be of the same manufacturer. All gate, globe, angle, and swing check valves as a group shall be of the same manufacturer. All valves 50 mm and smaller shall be threaded and have bronze bodies.
- C. All valves 65 mm and larger shall be Cast iron type and shall be flanged (or grooved for grooved coupling joints).

- D. For PPR piping use PPR Coated valves of the same piping material and manufacturer.
- E. Each valve shall be marked (engraved, stamped, or cast on each valve or metal tag, permanently attached to the valve) at the factory with the following minimum information
 - 1. Manufacturer's Name.
 - 2. Catalogue or Figure No.
 - 3. Size and Pressure Class.
- F. Arrows to indicate direction of flow on check, globe, angle, non-return, and eccentric plug valves.

2.07 GATE VALVES

- A. [Size 50 mm and Smaller]. Furnish bronze valves with screwed-in bonnet, non-rising stem, solid wedge disc, and threaded ends. Pressure rating PN20.
- B. [Size 65 mm and Larger]. Furnish Iron Body Bronze Mounted (IBBM) valves, i.e. cast iron body bronze trim valves, with bolted bonnet, non-rising stem, solid wedge disc, flanged ends, and renewable seat rings.

2.08 GLOBE VALVES.

- A. [Size 50mm and Smaller]. Furnish valves designed for minimum PN20 working pressures.
- B. [Size 65 mm and Larger]. Furnish valves designed for minimum PN16 working pressure.

2.09 CHECK VALVES

- A. [50 mm and smaller]. Furnish swing valves designed for minimum PN20 non-shock working pressures. Valves shall have renewable discs and side plugs, integral seats.
- B. [Size 65 mm and Larger Water Check Valves]. Valves shall be silent type spring loaded of the double door or wafer style. Valves shall be designed for minimum PN16 non shock water working pressure.

2.010 RELIEF VALVES.

Domestic Water Temperature and Pressure Relief Valve.

- A. On hot water storage tanks provide an ASME rated thermostatic, self-closing, temperature and pressure relief valve, located in the relief valve openings of tanks. Valve shall have a minimum thermal discharge capacity

equal to the input capacity of the heater standard pressure setting of 600 kPa and standard temperature setting of 100 - 140 degrees C. Relief valve pipe to discharge to floor drain.

2.011 BALL VALVES.

- A. [Size 50 mm and Smaller]. Valves shall be standard port, 2-piece construction with screwed ends. Valves shall be designed for minimum PN25. Valves shall have bronze or brass body, stainless steel ball, steel handle with vinyl grip.
- B. [Size 65 mm and Larger]. Valves shall be standard port, BS 5159 with flanged ends. Valves shall be designed for minimum PN16 working pressure. Valves shall have steel body, chrome or nickel plated steel or stainless steel ball.

2.012 Float Valves

- A. Float valves shall be installed as indicated in the drawings to provide consistent level control in reserve supply water storage tanks. The valve shall meet the requirements of the Water Byelaws for air gaps and shall be constructed throughout in approved materials and shall prevent back siphoning. Bronze equilibrium float valves 80 and above shall be flanged end, flat faced and drilled to suit BS4504 PN16.
- B. Bronze equilibrium float valves upto 50 shall be screwed end BS2779 parallel and shall be provided complete with back nut.
- C. Floats for valve sizes 80mm and above shall be of copper.

2.013 Solenoid Valves

- A. Electrically operated solenoid valves shall be single phase 220V and shall be rated for the system pressure

2.014 Bib Taps

- A. Bib-cocks shall be in accordance with BS 1010: 1973. They shall be provided with hose union nosepiece and hand wheel operated.

2.015 Automatic Air Valves

- A. Automatic air valves shall have a bronze body with bolted cover and a 9mm top outlet.

2.016 Strainers

- A. Up to and including DN50 strainers shall be manufactured from bronze and shall be of the 'Y' type with bolted cap, PN25 temperature/pressure rating.
- B. Strainers above DN50 shall be manufactured from cast iron and shall be of the 'Y' type with bolted cap, PN16 temperature/pressure rating and shall be complete with drilled and tapped caps complete with drain cocks.
- C. Strainers shall be provided with a medium grade screen sized such that in their clean condition the maximum pressure drop at the design flow rate shall not exceed 6kPa.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Excavating, trenching, and backfilling are specified in Section "Earthwork."

3.02 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Grooved joints may be used on aboveground grooved-end piping.

3.03 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
 - 2. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
 - 3. Drain Duty: Hose-end drain valves.
- B. PPR Coated PN-25 rated ball, butterfly, and check valves may be used in matching piping materials.

3.04 PIPING INSTALLATION

- A. Install domestic water piping level without pitch and plumb.
- B. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

3.05 HANGER AND SUPPORT INSTALLATION

- A. Install supports according to Division 15 Section "Hangers and Supports."
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- D. Install hangers for PVC/cPVC/PPR and PE piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 2 (DN 50) and Smaller: 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 - 3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 - 4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 - 5. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
- E. Install supports for vertical PVC/cPVC/PPR piping every 48 inches (1200 mm).

3.06 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to water pressure of 150 psi or 50 psi above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

END OF SECTION 15140

Sect.15145 - DOMESTIC WATER PIPING SPECIALTIES

PART 4 - GENERAL

4.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.

4.02 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 1. Balancing valves.
 2. Strainers.
 3. Outlet boxes.
 4. Hose stations.
 5. Hose bibs.
 6. Drain valves.
 7. Water hammer arresters.
 8. Air vents.
 9. Flexible connectors
 10. Flow Sensing Devices
 11. Puddle flanges

4.03 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

4.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 5 - PRODUCTS

5.01 BALANCING VALVES

- A. Refer Section 15140

5.02 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers :

1. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch (0.51 mm) .
 - b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch (1.14 mm)
6. Drain: Factory-installed, hose-end drain valve.

5.03 HOSE BIBBS

- A. Hose Bibbs :

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
8. Finish for Service Areas: Rough bronze, or chrome or nickel plated.
9. Finish for Finished Rooms: Chrome or nickel plated.
10. Operation for Equipment Rooms: Wheel handle or operating key.
11. Include operating key with each operating-key hose bibb.

5.04 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4 (DN 20).
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 (DN 20) threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves :

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig (1380-kPa) minimum CWP or Class 125.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 (DN 6) side outlet with cap.

5.05 WATER HAMMER ARRESTERS

A. Water Hammer Arresters :

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Metal bellows / Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

5.06 AIR VENTS

A. Bolted-Construction Automatic Air Vents :

1. Body: Bronze.

2. Pressure Rating: 125-psig (860-kPa) minimum pressure rating at 140 deg F (60 deg C).
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 (DN 15) minimum inlet.
6. Air vents shall be installed on all coils and all other high points required for efficient operation and venting of system.

7. Air vents shall be provided at all high points in the pipework, whether indicated on the drawings or not.
8. Large diameter automatic air vents shall be provided at all primary venting positions, such as plant rooms and at the head of vertical risers.
9. Air bottles shall be provided at all venting points.
10. The Sub CONTRACTOR shall be responsible for the design and positioning of all air vents.

5.07 PUDDLE FLANGES

- A. Where pipework passes through the external walls of the buildings or trenches below ground level, the CONTRACTOR shall supply and cast or built puddle flanges into the structure.
- B. Puddle flanges are to be manufactured from the same material as the pipework of which they form a part.
- C. Each puddle flange shall comprise a length of pipe, flanged or screwed at end according to diameter with an undrilled slip on flange welded on the outside at a point where it will be located mid way in the thickness of the wall. The puddle flange is to be painted externally with two coats of bituminous paint before being built into the structure.

PART 6 - EXECUTION

6.01 INSTALLATION

- A. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install Y-pattern strainers for water on supply side of each pump.
- D. Install water hammer arresters in water piping according to PDI-WH 201.
- E. Install air vents at high points of water piping. [Install drain piping and discharge onto floor drain.]

END OF SECTION 15145

Sect.15150 - SANITARY WASTE, VENT AND STORM PIPING

PART 7 - GENERAL

7.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

7.02 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.

7.03 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. TPE: Thermoplastic elastomer.

7.04 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa) .
 - 2. Sanitary Sewer, Force-Main Piping: 150 psig (1035 kPa).
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events.

7.05 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
 - 1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
 - 2. Drainage System: Include plans, elevations, sections, and details.
- C. Field quality-control inspection and test reports.

7.06 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 8 - PRODUCTS

8.01 PIPING MATERIALS

- A. Piping materials shall be as under.

8.02 ABOVE GROUND SOIL, WASTE AND VENT PIPE

- A. Plastic pipes shall be extruded un-plasticized PVC (UPVC) conforming to the following British Standards:
 - 1. Pipes 32mm to 40mm diameter : uPVC pipe with Rubber ring push fit joints or solvent joints (as approved by consultant) as per BS 5255
 - 1. Pipes 82mm to 160mm diameter: uPVC pipe with solvent weld or Rubber ring push fit joints (as approved by consultant) as per BS EN 1329.

8.03 BELOW GROUND SOIL AND WASTE PIPE

- A. uPVC conforming to the following British Standards:
 - 1. Pipes 110mm and 300mm diameter: uPVC pipe with solvent weld fitting as per BS 4660 (BS EN 1401)
 - 2. Pipes larger than 300mm diameter: to BS 3506.

8.04 STORM WATER PIPE

- A. Plastic pipes shall be extruded un-plasticized PVC (UPVC) conforming to the following British Standards:

1. uPVC pipe with solvent weld joints (as approved by consultant) as per BS EN 1329.

8.05 CONTENSATE DRAIN PIPING (ABOVE AND BELOW GRADE)

- A. uPVC conforming to the following British Standards:
 1. Pipes 20mm and 300mm diameter: Upvc class 'E' pipe with solvent weld fitting as per BS 3505 (EN 1401).
- B. All pipes and fittings shall be marked with the Kite Mark of the standard to which they are manufactured.
- C. Unless specifically stated otherwise, pipes and fittings for drainage works shall be suitable for rubber ring pressure joint. Sealing rings to be rubber to BS 2494 Part 2.
- D. Alternatively pipes are acceptable only if approved by consultant.

8.06 SPECIAL PIPE FITTINGS

8.07 ENCASEMENT FOR UNDERGROUND PIPING CROSSING DRIVEWAYS

- A. All Drainage pipes crossing driveways and subjected to heavy traffic shall be provided in concrete encasement.

PART 9 - EXECUTION

9.01 EXCAVATION

- A. Refer to "Earthwork" for excavating, trenching, and backfilling.

9.02 PIPING INSTALLATION

- A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- B. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- C. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees.

Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- D. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
- E. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2 DN 50 and smaller; 1 percent downward in direction of flow for piping NPS 3 (DN 75) and larger.
 - 2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- F. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- G. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- H. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction or Consultant.

9.03 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 15 Section "Hangers and Supports." Install the following:
- B. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 - 3. NPS 4 and 5 (DN 100 and 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 - 4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 - 5. NPS 8 to NPS 12 (DN 200 to DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.
- C. Install supports for vertical PVC piping every 48 inches (1200 mm).

9.04 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Equipment: Connect drainage piping as indicated.

9.05 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

9.06 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 15150

Sect.15155 - DRAINAGE PIPING SPECIALTIES

PART 10 - GENERAL

10.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

10.02 SUMMARY

- A. This Section includes the following drainage piping specialties:
 1. Cleanouts.
 2. Floor drains.
 3. Trench drains.
 4. Channel drainage systems.
 5. Roof drains.
 6. Manhole Covers
 7. Miscellaneous drainage piping specialties.

10.03 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PUR: Polyurethane plastic.
- H. PVC: Polyvinyl chloride plastic.

10.04 SUBMITTALS

- A. Product Data: For each type of product indicated above.
- B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
- C. Field quality-control test reports.

- D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

10.05 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

10.06 COORDINATION

- A. Coordinate size and location of concrete bases.
- B. Coordinate size and location of roof penetrations.

PART 11 - PRODUCTS

11.01 CLEANOUTS

- A. Plastic Floor Cleanouts:
 - 1. Size: Same as connected branch.
 - 2. Body: PVC.
 - 3. Closure Plug: PVC.
 - 4. Riser: Drainage pipe fitting and riser to clean out of same material as drainage piping.
 - 5. Finish: Stainless steel cap

11.02 FLOOR DRAINS

- A. Plastic Floor Drains:
 - 1. Standard: ASME A112.6.3.
 - 2. Material: PVC.
 - 3. Outlet: Side
 - 4. Sediment Bucket: Not required.
 - 5. Top or Strainer Material: Stainless steel <Refer Architect finishes schedule>.
 - 6. Top of Body and Strainer Finish: Stainless steel.
 - 7. Top Shape: Square. <Refer Architect finishes schedule>.
 - 8. Trap Material: Plastic drainage piping.
 - 9. Trap Pattern: Standard P-trap.
- B. Funnel floor drain where specified on drawings shall include a nickel bronze funnel secured to the grating

11.03 TRENCH DRAINS

A. Trench Drains :

1. Standard: ASME A112.6.3 for trench drains.
2. Outlet: Side.
3. Grate Material: Cast Iron/PVC. <Refer Architect finishes schedule>.
4. Grate Finish: Epoxy coated for cast iron <Refer Architect finishes schedule>.
5. Dimensions of Frame and Grate: Refer drawings
6. Top Loading Classification: As mentioned on MEP drawings and BOQ.

11.04 CHANNEL DRAINAGE SYSTEMS

A. Catch Basins :

1. Description: 300 x 300 concrete body, with outlets in number and sizes indicated.
2. Top Grate: Cast Iron with Epoxy coating

B. HDPE or PE Catch Basins (optional):

1. Description: 12-inch- (305-mm-) square body, with outlets in number and sizes indicated. Include PE slotted grate 11-3/4 inches (298 mm) square by 1-1/8 inches (28.6 mm) thick.

11.05 ROOF DRAINS

A. Plastic Roof Drains:

1. Standard: ASME A112.21.2M.
2. Pattern: Balcony/ Roof drain.
3. Body Material: PVC.
4. Dimensions of Body: Refer Drawings
5. Outlet: Bottom.
6. Dome Material: PVC <<Refer Architect finishes schedule>.

11.06 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

A. Vent Caps:

1. Description: PVC of same brand as of piping.
2. Size: Same as connected stack vent or vent stack.

B. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

C. Manholes/gully traps covers

1. All covers shall be Cast Iron with black bitumen coating. Manhole covers shall have clear opening of 600 x 600 mm.
2. All manholes and gully traps shall be vented as per drainage department requirements.
3. Gully trap covers shall have clear opening of 300 x 300 mm.
4. All manhole covers and frames shall comply with BS 497:1976 (BS EN 124:1994)
5. Covers in paved areas shall be medium duty type having weight as per Table 1
6. Covers in plinth protection shall be light duty having weight as per Table-1
7. Covers in Driveways shall be Heavy duty having weight as per Table-1

CAST IRON MULTI DUTY MANHOLE COVER & FRAME

Features :

Single Seal
Closed Key Holes
Coating Cold Applied

Option :

Ductile Iron
Epoxy Coated
Lockable

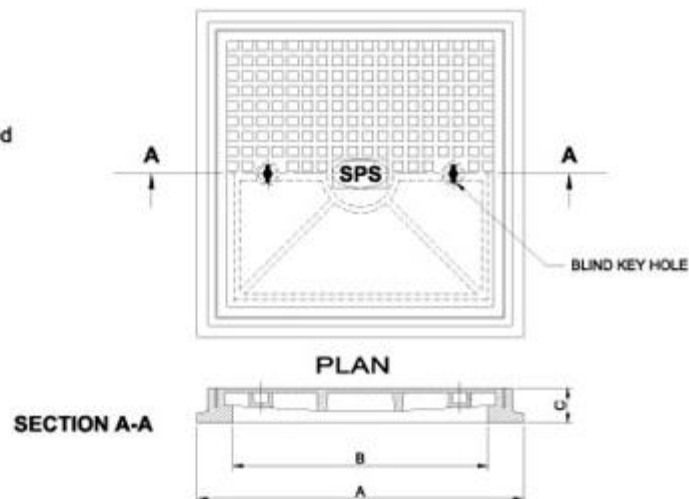


Table 1-1 (Manhole Covers Weights)

S.no	Cover material	Clean Opening	Type	Weight	Standard	Remarks
1	Cast Iron	600 x 600	Light duty	45 Kg	BS EN 124:1994	
2	Cast Iron	600 x 600	Medium duty	67 Kg	BS EN 124:1994	
3	Cast Iron	600 x 600	Heavy duty	90 Kg	BS EN 124:1994	

PART 12 - EXECUTION

12.01 INSTALLATION

- A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.

2. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.
- G. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.
- H. Install fixture air-admittance valves on fixture drain piping.
- I. Install stack air-admittance valves at top of stack vent and vent stack piping.
- J. Install air-admittance-valve wall boxes recessed in wall.
- K. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- L. Install through-penetration firestop assemblies in plastic stacks at floor penetrations.
- M. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 2. Size: Same as floor drain inlet.
- N. Install vent caps on each vent pipe passing through roof.
- O. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.
- P. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- Q. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
 2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
 3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
 4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

- R. Install grease removal devices on floor. Install trap, vent, and flow-control fitting according to authorities having jurisdiction. Install control panel adjacent to unit, unless otherwise indicated.
- S. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
- T. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.
- U. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

12.02 CONNECTIONS

- A. Install piping adjacent to equipment to allow service and maintenance.
- B. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.
- C. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.

12.03 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Grease interceptors.
 - 2. Oil interceptors.
 - 3. Solids interceptors.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

12.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled FOG disposal systems and grease removal devices and their installation, including piping and electrical connections, and to assist in testing.
- B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

12.05 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

12.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain FOG disposal systems and grease removal devices.

END OF SECTION 15155

Sect.15410 - PLUMBING FIXTURES

12.07 QUALITY ASSURANCE

- A. Quality Standard: NSF 61 for fixture materials in contact with potable water.
- B. Quality Standard for Electrical Components, Devices, and Accessories: NFPA 70, Article 100.

12.08 WARRANTY

- A. Materials and Workmanship:
 - 1. Commercial Applications: One year.

12.09 FAUCETS

- A. Lavatory Faucets, <Refer Architecture fixture selection and Specifications>:
 - 1. Two-handle mixing non-pressure type valve.
 - a. Body Material: Commercial, solid brass (with non-metallic coatings or Chrome finish as required by the architect).
 - b. Finish: Polished chrome plate.
 - c. Maximum Flow Rate: Maximum [2.5 gpm (9.46 L/min.)],
 - d. Mounting: [Deck, exposed] [Deck, concealed] [Back/wall, exposed] [Back/wall, concealed].
 - e. Spout: [Rigid, gooseneck] type.
 - f. Spout Outlet: Aerator/ Spray
- B. Sink Faucets, <Refer Architecture fixture selection and Specifications>:
 - 1. [Kitchen faucet with spray, three-hole fixture].
 - a. Body Material: [Commercial, solid brass] (with non-metallic coatings or Chrome finish as required by the architect).
 - b. Finish: Polished chrome plate]
 - c. Maximum Flow Rate: 2.5 gpm (9.46 L/min.), unless otherwise indicated.
 - d. Mixing Valve: Two-lever handle.
 - e. Backflow Protection Device for Hose Outlet: Not required.
 - f. Mounting: Deck, Back/wall as recommended by the architect.
 - g. Spout Outlet: Aerator/ Spray
 - h. Drain: Stopper with chain.

12.010 TOILET SEATS

A. Toilet Seats :

1. Toilet seat for water-closet-type fixture.
 - a. Material: Molded, solid plastic.
 - b. Configuration: front with cover.
 - c. Size: Regular.
 - d. Class: Standard commercial.

12.011 FIXTURE SUPPORTS

A. Water-Closet Supports :

1. Combination carrier designed for standard mounting height of wall-mounting, water-closet-type fixture.

B. Lavatory Supports:

1. Type [lavatory carrier with exposed arms and tie rods] or [lavatory carrier with concealed arms and tie rod] for wall-mounting, lavatory-type fixture.

C. Sink Supports:

1. Type [sink carrier with exposed arms and tie rods] or [II, sink carrier with hanger plate, bearing studs, and tie rod] for sink-type fixture.

12.012 WATER CLOSETS (WASTREN)

A. Water Closets, <Refer Architecture fixture selection and Specifications> :

1. Floor-mounting, floor-outlet, vitreous-china fixture designed for [gravity-type tank] operation.
 - a. Style: [Close coupled] [One piece].
 - 1) Bowl Type: Round front design. Include bolt caps matching fixture.
 - 2) Height: Standard.
 - 3) Design Consumption: Dual Flush Design with Major (6.0 L/flush) Minor (4 L/flush)].
 - 4) Tank: Gravity type. Include cover.
 - b. Supply: [NPS 3/8 (DN 10)] [NPS 1/2 (DN 15)] chrome-plated brass or copper with wheel-handle stop.
 - c. Toilet Seat: Included

12.013 WATER CLOSETS (EASTREN)

A. Squatting WC, <Refer Architecture fixture selection and Specifications> :

1. Flat Bowl, vitreous-china fixture designed for [gravity-type tank] operation.

- 1) Type: Flat and Shallow design
- 2) Flush Tank : Yes (check drawings for installation height)
- 3) Design Consumption: Single Flush Design with Major (6.0 L/flush).
- 4) Tank: Gravity type.
- 5) Color (.Refer Architecture fixture selection and Specifications)

b. Supply: [NPS 1/2 (DN 15)] chrome-plated brass or copper with wheel-handle stop.

c. DN50 supply pipe from Flush tank to WC. Pipe shall be concealed.

END OF SECTION

Sect.15441 - DOMESTIC WATER PUMPS

PART 13 - GENERAL

13.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

13.02 SUMMARY

- A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic cold water:
 - 1. Close-coupled centrifugal pumps.
 - 2. Separately coupled centrifugal pumps.

13.03 SUBMITTALS

- A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For domestic water pumps to include in emergency, operation, and maintenance manuals.

13.04 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

13.05 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.

- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

13.06 COORDINATION

- A. Coordinate size and location of concrete bases.

PART 14 - PRODUCTS

14.01 CENTRIFUGAL TRANSFER PUMPS

A. Manufacturers:

1. Armstrong Pumps Inc.
2. Grundfos Pumps Corp.
3. Wilo Pumps
4. Refer Approved list of manufacturers

B. Description: Factory-assembled and -tested, single or Multistage stage

1. The unit shall be a packaged factory assembled and tested unit complete with duty/stand by pump, interconnecting pipework in copper, bronze, valves, safety devices and prewired control panel.
2. Pumps shall be constant speed:
3. Pump shall be bronze fitted centrifugal, single stage, end suction type
4. Pump shall be rated for a minimum of 175 PSIG working pressure.
5. Casings shall be cast iron with gauge ports, vent and drain ports at top and bottom of casing.
6. Shaft impeller shall be stainless steel 316.
7. Mechanical seals shall be with carbon rotating ring, stainless steel spring, ceramic seat and flexible bellows and gaskets. Grease lubricated ball type bearings shall be provided.
8. A suction diffuser with strainer shall be installed on the suction of each pump. Shut of, check and Gate valves shall be installed on the discharge of each pump.
9. Pump and Motor Assembly: Hermetically sealed, replaceable type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.

C. Capacities and Characteristics:

1. Capacity: Refer Equipment Schedule

2. Total Dynamic Head: Refer Equipment Schedule
3. Maximum Continuous Operating Temperature: 220 deg F (104 deg C).
4. Impeller Size: As per Manufacturer Recommendation
5. Inlet and Outlet Size: As per Manufacturer Recommendation
6. Speed: As per Manufacturer Recommendation
7. Motor Horsepower: Refer Schedule
8. Brand used for design selection : Grundfos

14.02 CONTROLS

1. Control of pumps shall be as follows:
2. A low level float switch in the underground water storage tank shall prevent dry running of the pumps.
3. Pump switching shall be controlled by high and low level float switches installed in Overhead water tank
4. The duty and standby pumps shall be controlled from an automatic control panel
5. A two position mode selection switch shall be provided on this Control Panel. In 'Auto' position of the mode selection switch, the operation of pumps shall be controlled by float. In 'Manual' position of the duty selection switch, the pump shall be switched ON/OFF using push buttons.

PART 15 - EXECUTION

15.01 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

15.02 CONCRETE BASES

- A. Install concrete bases of dimensions indicated for pumps and controllers.
 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.

15.03 PUMP INSTALLATION

- A. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

15.04 CONNECTIONS

- A. Install piping adjacent to pumps to allow service and maintenance.
- B. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
 - 1. Install flexible connectors adjacent to pumps in suction and discharge piping of pumps:
 - 2. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps
 - 3. Install pressure gages at suction and discharge of pumps.

15.05 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness and Clean strainers on suction piping.
 - 3. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 4. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 5. Start motor.
 - 6. Open discharge valve slowly.

15.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 15441

Sect. 15450 - POTABLE-WATER STORAGE TANKS

PART 16 - GENERAL

16.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary apply to this Section.

16.02 SUMMARY

- A. This Section includes potable-water storage tanks and related accessories for indoor installation.

16.03 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.
- B. HDPE: High-density polyethylene plastic.
- C. PE: Polyethylene plastic.

16.04 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories. Indicate dimensions, wall thickness, insulation, finishes and coatings, required clearances, methods of assembly of components, and piping connections.
- B. Manufacturer Seismic Qualification Certification: Submit certification that indicated steel, potable-water storage tanks, accessories, and components will withstand seismic forces.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- C. Manufacturer Certificates: Signed by manufacturers certifying that potable-water storage tanks comply with requirements.
- D. Source quality-control test reports.
- E. Purging and disinfecting reports.

16.05 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of potable-water storage tanks and are based on the specific system indicated.
- B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water storage tanks and components. Include appropriate NSF marking.
- C. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 to 9," for potable-water storage tanks. Include appropriate NSF marking.

16.06 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified Civil Works.

PART 17 - PRODUCTS

17.01 PLASTIC, NONPRESSURE, POTABLE-WATER STORAGE TANKS

- A. FRP, Potable-Water Storage Tanks:
 - 1. Description: FRP, Horizontal, Cylindrical Shape nonpressure-rated water tank; complying with NSF 61 barrier materials for potable-water tanks.
 - 2. Construction: ASTM D 3299, filament-wound or ASTM D 4097, FRP.
 - 3. Tappings: Factory-fabricated, FRP flanged-end nozzle.
 - a. NPS 2 (DN 50) and Smaller: Include plastic-to-steel transition fitting from tank nozzle flange to ASME B1.20.1, female thread.
 - b. NPS 2-1/2 (DN 65) and Larger: Flanged.
 - 4. Tank Support: Separate factory-fabricated steel stand, capable of supporting tank.
- B. Manhole: Watertight, 24 inches (600 mm)] in diameter.
- C. Cover for Open Tank: Plastic, same as or similar to tank material and with shape that encloses top of tank.
- D. Specialties and Accessories: Include tappings in the tank and the following:
 - 1. Vacuum relief valve.
 - 2. Free air vent with insect screen.

- E. PE, Potable-Water Storage Tanks:
 - 1. Description: PE, Horizontal, Cylindrical, nonpressure-rated water tank; complying with NSF 61 barrier materials for potable-water tanks.
 - 2. Construction: ASTM D 1998, molded PE.
 - 3. Tappings: Factory-fabricated bulkhead fittings, attached to tank.
 - a. NPS 2 (DN 50) and Smaller: With female thread.
 - b. NPS 2-1/2 (DN 65) and Larger: Flanged.
 - 4. Tank Support: Separate factory-fabricated steel stand, capable of supporting entire bottom of tank.
- F. Manhole: Watertight, 24 inches (600 mm)] in diameter.
- G. Cover for Open Tank: Plastic, same as or similar to tank material and with shape that encloses top of tank.
- H. Specialties and Accessories: Include tappings in the tank and the following:
 - 1. Vacuum relief valve.
 - 2. Free air vent with insect screen.

17.02 SOURCE QUALITY CONTROL

- A. Test and inspect potable-water storage tanks according to the following tests and inspections and prepare test reports:
 - 1. Nonpressure Testing for Potable-Water Storage Tanks: Fill tanks to water operating level to ensure structural integrity and freedom from leaks. Hold water level for two hours with no drop in water level. Repair or replace tanks that fail test with new tanks, and repeat until test is satisfactory.

PART 18 - EXECUTION

18.01 CONCRETE BASES

- A. Install concrete bases of dimensions indicated for tanks.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
 - 2. For supported tanks, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported tanks.

- B. Cast-in-place concrete materials and placement requirements are specified in Civil Works.

18.02 INSTALLATION

- A. Install water storage tanks on concrete bases, level and plumb, firmly anchored. Arrange so devices needing servicing are accessible.
 - 1. Install horizontal tanks on concrete piers and factory-fabricated saddles.
- B. Anchor tank supports and tanks to substrate.
 - 1. Use steel or FRP straps over or around plastic tanks.
- C. Install tank seismic restraints.
- D. Install the following devices on tanks where indicated:
 - 1. Tank vents on nonpressure tanks.
 - 2. Connections to accessories.
- E. After installing tanks with factory finish, inspect finishes and repair damages to finishes.

18.03 FIELD QUALITY CONTROL

- A. Perform the following final checks before filling:
 - 1. Verify that vacuum relief valves are correct size.
 - a. Manually operate vacuum relief valves.
 - b. Adjust vacuum settings.
- B. Filling Procedures: Follow manufacturer's written procedures. Fill tanks with water to operating level.

18.04 CLEANING

- A. Clean and disinfect potable-water storage tanks.
 - 1. Flush tanks, after required standing time, with clean, potable water until chlorine is not present in water coming from tank.
- B. Prepare written reports for purging and disinfecting activities.

END OF SECTION 15450

Chapter Sixteen (Sect.15485.33) - SOLAR WATER HEATERS

PART 19 - GENERAL

19.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

19.02 SUMMARY

- A. Light Commercial Solar water heaters with Electrical Backup.

19.03 QUALITY ASSURANCE

- A. Quality Standard for Performance Efficiency: ASHRAE/IESNA 90.1 and ASHRAE 90.2.
- B. Comply with Australian standards or equivalent American standards.
- C. Technical design, construction quality and measurement of performance (accelerate ageing, continuous control) all shall be done as per Australian standards AS 2712.
- D. Manufacturer's Qualification: Firms regularly engaged in manufacture of solar heaters or types and capacities required whose products have been satisfactory used in similar services for not less than twenty years.

19.04 SUBMITTALS

- A. Submit the following according to Conditions of Contract and Specifications.
 - 1. Product Data: Size, dimensions, capacity, pressure rating, accessories and special features and operating characteristics of all equipments.
 - 2. Shop Drawing: Detailed equipment assemblies indicating dimensions, required clearances, method of field assembly, components and location and size of each field connection.
 - 3. Wiring Diagrams: Detailed wiring diagram for each item of equipment with electric power supply.
 - 4. Maintenance Data: Submit maintenance data and parts list for solar heater, control and accessories, including "trouble shooting" maintenance guide

19.05 WARRANTY

- A. Materials and Workmanship:
 - 1. Light Commercial Solar Water heaters with Electric backup: Three years.
 - 2. Tanks: One year.

19.06 DELIVERY AND STORAGE

- A. Product shall be delivered to site stored and protected under provisions of General Conditions of Contract.
- B. Factory packaged items shall be stored in shipping containers or in safe covered storage until time of installation.

19.07 PRODUCTS

- A. SOLAR WATER HEATERS
 - 1. GENERAL Supply, deliver and install where indicated on drawings Thermo siphon or Forced draft Solar hot water systems complying with Australian Standard AS2712 or equivalent American standard, and manufactured under a Quality Assurance System complying to ISO 9001.
 - 2. Technical design, construction quality and measurement of performance (accelerate ageing, continuous control) all shall be done as per AS 2712.
- B. TOTAL SYSTEM CAPABILITY:
 - 1. The solar system capacity shall be as shown on drawings and shall supply the required hot water (Liters/day) at 60 deg C at an annual solar contribution of minimum 75%.
- C. SYSTEM DESCRIPTION
 - 1. The system shall be designed as a fully integrated, packaged heating system incorporating the solar collectors, storage tank, backup heating and all other necessary controls for safe and efficient operation.
 - 2. The solar circuit shall be an 'active' pumped system that utilizes drain back technology.
- D. SOLAR PANELS:
 - 1. Each collector shall have a nominal effective absorption surface area of as recommended by the manufacturer for required capacity.
 - 2. Collectors shall be accredited to EN 12975, constructed of copper waterways, 38mm glasswool insulation in base and 28mm polyster insulation on the sides, marine grade aluminium outer casing and 0.2mm copper absorber plate.
 - 3. The absorber plate shall be Tinox sputtered copper Titanium Oxide having a minimum absorbance factor of 0.95+/-2 and maximum emissivity factor of 0.04+/-2.

4. The collector shall be glazed with low iron toughened safety matt glass of a minimum thickness of 3.2mm with a maximum iron oxide content of 0.04

E. THERMAL STORAGE TANK

1. It shall operate with neutral treated water at a pH level of 8.5 to 9.0.
2. It shall contain the appropriately sized internal thermal expansion volume to suit the maximum number of solar collectors with a storage temperature rise of 75°C and be equipped with all necessary pressure relief valves.
3. The storage tank shall be fully insulated with a minimum of 50 mm high density glass fibre bats and cased within a totally weatherproof outer enclosure made from Color bond steel. It shall come completely attached to a support frame for locating on a floor or concrete plinth.

F. POTABLE WATER HEAT TRANSFER COIL

1. It shall be constructed from copper coils connected in parallel which and have a pressure drop across the coil of no more than 35kPa.
2. It shall be constructed with a ring main circulation return connection at the centre to facilitate re heating.
3. It shall be fully brazed and hydrostatically pressure tested in manufacture to 2200 kPa for operation on a potable water circuit of upto 1200 kPa

G. CAPACITY.

1. Storage-Tank Construction: Steel.
2. Heating Elements: Two; wired for simultaneous operation, unless otherwise indicated.
3. Capacity: Refer Drawings

H. Water Heater Accessories:

1. Combination temperature and pressure relief valves.
2. Pressure relief valves.
3. Water heater stand and drain pan units.
4. Water heater stands.
5. Water heater mounting brackets.
6. Drain pans.
7. Piping Manifold Kits: Manufacturer's factory-fabricated piping arrangement.
8. Piping-Type Heat Traps: Field-fabricated piping.

19.08 SOURCE QUALITY CONTROL

- A. Water Heater Storage Tanks, Specified to Be ASME-Code Construction: Tested and inspected according to ASME Boiler and Pressure Vessel Code.

19.09 INSTALLATION

- A. Installation of Solar hot water collectors must be installed with tilt and exposed to direct sun (without shadowing).
- B. They should be tilted towards equator (south direction) with angle of 25. Single unit or multiple units can be connected together in parallel and connected to common Headers (CWS, HWS , HWR) to cover the desired daily hot water load and shall be as per the design of specialist solar manufacturer.
- C. The system shall also be equipped with all necessary safety devices that guarantee the system shall function in a satisfactory way. Such safety devices shall involve cold inlet relief valve and Pressure & Temperature relief valves.
- D. A pressure reduction valve should also be fitted to maintain the incoming pressure less than 850 kPa. The Pressure & Temperature relief valve shall be set to relieve water at 1000kPa and/or 99C
- E. The storage tank shall be equipped with all necessary fittings on cold and hot water side, in order to connect with piping network (by the specialist contractor). It shall be the contractors responsibility to ensure that all civil, electrical, mechanical (piping etc) and all work related to solar water heater system are done according to the specifications.

END OF SECTION 15485.33

PREAMBLE TO PRICING AND METHOD OF MEASUREMENTS

BILL OF QUANTITIES

PREAMBLE TO PRICING AND METHOD OF MEASUREMENTS

Table of Contents

<u>Description.</u>	<u>Page No.</u>
Generally	1
Method of Measurement	2
Pricing	2
Adjustment Item	3
General Requirements	3
Materials at Site	11
Shop Drawings, Working Drawings, Operations and Maintenance Instructions	12
Provisional Sums	12
Bill Item for Conditions of Contract	12
Abbreviations	13
Variations	14
Fix only	14
Supply Only	14
Sub-Contractors	15
Prime Cost Rates (PC Rates)	15
Site Work	16
Disposal of excess excavated material	17
Underground Drainage	17
Formwork	19
Precast Concrete	19
Reinforcement to Masonry	20
Masonry	20
Metal Work	21

**Preamble to Pricing and
Method of Measurements**

Woodwork	21
Thermal and Moisture Protection	23
Doors and Windows	23
Ironmongery	24
Finishes	24
Painting and Decoration	25
Mechanical Installations	26
Rates for Plumbing and HVAC	27
Electrical Installations	27
External Services	28
External Works	28
Proprietary Materials	28
Measurable Contract	28
Builder's Work	28
Profit	30

PREAMBLE TO PRICING AND METHOD OF MEASUREMENTS

Generally

The Bill of Quantities herein, including all notes and instructions, forms an integral part of the Bid/Contract Documents. However, the descriptions contained in the Bill of Quantities for each item are not necessarily complete. The Contractor is referred to the Conditions of the Contract and other Documents, Specifications and Drawings as well as relevant Standards and Codes of Practice for further information as no claim or variation will be considered on account of the Contractor's failure to do so.

The Contractor is cautioned to familiarize himself with the full content of other Contract Documents including the Instructions to Bidders, Bid Form, General Conditions, Particular Conditions, Bid / Contract Drawings and Specifications or any other information that can be easily inferred from any of them and all obligations contained in the documents shall be included in the item rates and / or contract price.

Drawings, Specifications and Bill of Quantities and all other documents are complementary and if description of any item is included in any of them, it shall be deemed included in all.

The Contractor's bid for the entire work shall provide for supervision of any or all trades that are intended to be performed with his own forces, his domestic sub-contractors and nominated sub-contractors. No extra compensation for services as a General Contractor will be paid.

The Contractor shall not use these Bills of Quantities as the basis for a construction program or for the purposes of ordering materials or arranging sub-contracts. The references for these activities shall be the drawings, specifications and instructions issued by the Engineer.

This is a Measurable type of Contract. The quantities contained within these Bills of Quantities may not accurately reflect the quantities of works as indicated in the drawings, Specification and Package Scope. The contractor is to satisfy himself for the accuracy of all quantities. No claim will be entertained for differences in quantities between the Tender Drawings, Specification and Bills of Quantities.

Items in the Preamble Section of these Bills of Quantities are deemed to qualify and to form part of description of measured work to which they refer including composite description.

All measurements are net and the rates shall include for all laps, waste, working space, etc. and trade or traditional allowances.

Amendments shall not be made to these Bills of Quantities without the authority, in writing of the Engineer.

A price or rate is to be entered against each item in the Bills of Quantities. The cost of any item left un-priced will be deemed to be included for elsewhere in the Bills of Quantities, and the rate for the un-priced item will be taken as nil. Any item of the Day Works if not entered by the Bidder shall have to be carried out at the Rate as decided by the Engineer.

For the general guidance of the bidders the relevant CSI Section numbers have been mentioned in the beginning of each Bill/Division/Section. This does not absolve the Bidder's responsibility to confirm and price according to the appropriate BSI/ASTM/CSI code applicable to any item mentioned in the Bill of Quantities and drawings etc.

Method of Measurement

The quantities in the Bill of Quantities have been prepared generally in accordance with the **Principles of Measurement (International) for works of construction dated June 1979 / Standard Method of Measurement of Building Works (SMM 7) seventh edition year 1988, published by the Royal Institution of Chartered Surveyors, 12 Great George Street, Parliament Square, London SW1P 3AD, U.K. amended to suit the local practice and conditions.** The description of each item (which description shall imply references to any heading, sub-heading, preamble or other clause of item which shall apply) shall be held to include all claims, materials, workmanship, including all taxes, duties, charges, all Government levies, landing charges, transport, profit and overheads and all other incidental costs to complete the Works.

These preambles are to be read in conjunction with the item description in the Bill of Quantities.

"As described" means as directed in the Specifications and / or Drawings.

Unless otherwise described or measured separately, prices for all items shall include for all necessary straight, raking or circular cutting.

The Conditions of Contract applicable to this Contract is as specified in Volume 1 – Tender & Contract Conditions of the Tender and Contract Document.

Pricing

The prices shall be comprehensive and must include for complying in all respects with the instructions to Bidder, Conditions of Contract, Specifications, and Drawings and for all matters and things necessary for the proper construction and completion of the whole of the Works. No claim for additional payment will be allowed for any error or misunderstanding by the Contractor of the work involved.

The rates and sums inserted in the Bills of Quantities are deemed to include for the following:

- (i) Labor and all costs in connection therewith.
- (ii) Materials, goods and all costs in connection therewith (e.g. carriage, freight, delivery, unloading, storing, returning packing handling, Letters of Credit, Bank Guarantees, Bank charges and the like, Customs duties, port dues, import duties, taxes, charges, Insurances and other dues levied by any authority or imposed by the Government, hoisting or lowering, replacing work, goods or materials damaged, broken, lost or stolen until the issue of a Certificate of Completion.
- (iii) Fittings and fixing materials or goods in position.
- (iv) Plant.
- (v) Waste, bulking, shrinkage and overlaps.
- (vi) Land required for tips and stockpiles including all costs for obtaining any necessary licenses and approvals.
- (vii) Allowance for phasing requirements of works, effect on programming of the works of all traffic diversions and construction activity associated with diversion or installation of services.
- (viii) For taking measures for the support and full protection of pipes, cables and other apparatus required during the progress of the Works as required by Service Authority or the Engineer.
- (ix) For working alongside and liaising with other Contractors working on the same site.
- (x) Preparation and submission of shop drawings.
- (xi) Overhead charges and profit.
- (xii) Guarantees and warranties where necessary.
- (xiii) Temporary works, if any.

Lump sums shall not be given where unit rates are applicable.

Where the word "allow" is used, the cost of the item shall be the responsibility of the Contractor.

The amounts set against any items of overhead shall include for all costs in connection with letters of credit, bank charges, interest charges and insurance after the materials come under the control of the Contractor.

The rates inserted will be used to determine the amount of the Contractor's Interim Payments.

The Bidder shall submit the full and detailed rate breakdown of all the BOQ items including spare parts items in the format as per enclosed Annexure-1, together with their Bid submission. The breakdown is to show the actual calculations of the General Items, Labor, Plant and Materials costs for the Works, the build-up of measured rates with on-costs and site and Head Office overheads and any other allowances used to arrive at the Bid Price. In addition the Bidder will be required to provide the Engineer within 48 hours with a full and detailed breakdown/any other information if requested. The purpose of this Breakdown/Rate Analysis is to make sure that (i) the rates used in the analysis of the items of permanent works and those quoted in the Day Works are reciprocal to each other, (ii) the bid is not front loaded, and (iii) the markup of Overheads & profit is uniform throughout the bid.

Where "fix only" items are specified, the rate shall be deemed to include for taking delivery, storing and installation of goods or materials in works where appropriate.

The rates inserted in the Schedule of Day work shall be deemed to be the rates used by the Contractor in making up rates for works items in all Parts of the Bills of Quantities.

Adjustment Item

The adjustment item, if any, addition or deduction, shall apply to all Bill items, excluding provisional sum unless clearly indicated otherwise. The adjustment item shall not be a lump sum, but a percentage of the total Bid amount excluding provisional sum or a percentage of the total for the items indicated. The adjustment items shall be applied to all applicable item rates and sums entered in the Bills of Quantities (including any addenda). The adjusted rates and sums shall be applied for the valuation of Variations.

General Requirements

Standards

Where no reference is made to a code, standard or Specifications in Section "B" Specifications of the SUB-CONTRACT Documents, the Standard Specifications of the American Society of Testing Materials, (ASTM), British Standard Codes of Practice (BSCP) or any other relevant standard as approved by the EMPLOYER shall govern.

Drawings

The WORK shall agree in all particulars with the Drawings or any approved modifications of them or such other drawings as may be issued during the SUB-CONTRACT.

The EMPLOYER will supply two copies of each of the drawings to the CONTRACTOR free of charge.

The CONTRACTOR will make any further copies required by him at his own expense.

The CONTRACTOR will keep one set of all drawings duly mounted with muslin cloth and hanged on the wooden drawings stand when not in use.

CONTRACTOR'S (Drawings & Documents)

The CONTRACTOR shall submit three prints/copies of all drawings, documents and schedules to be prepared by him. These will be of a standard size and format acceptable to the EMPLOYER. All such submission by the CONTRACTOR shall be accompanied by a letter of submittal.

Record Drawings

The CONTRACTOR shall prepare during the progress of the SUB-CONTRACT, drawings showing the WORK "as built" including the positions of all services, plant and equipment. The drawings shall be prepared to a form & detail to the satisfaction of the EMPLOYER and prints shall be submitted to the EMPLOYER'S REPRESENTATIVE for his approval as the WORK proceeds. At the completion of the SUB-CONTRACT the CONTRACTOR shall supply to the EMPLOYER reproducible of each drawing.

Supply of Water and Electricity

The CONTRACTOR shall make his own arrangements for the provision of water & electricity whether for use in the execution and construction of the WORK or otherwise. In the event of the source of water being from any existing piped supply the CONTRACTOR shall comply with any regulations laid down by the Water Authority and shall pay for such supply, stand-pipe connections, meter rents and all other charges as required all at his own expense. Similarly he will be responsible for all costs in providing electricity. Where electricity is not available for 24 hours, diesel/petrol driven electricity generators in good and reliable condition and of sufficient capacity to meet the requirements of construction equipment and lighting and other facilities at Site will be used by the CONTRACTOR.

Disposal of Wastes

The CONTRACTOR shall make adequate arrangements to the satisfaction of the EMPLOYER'S REPRESENTATIVE for disposal of all sewage, rubbish and all other waste material arising from or connected with the execution of the WORK.

Other Services

The CONTRACTOR shall make his own arrangements for and shall provide any service (including telephone) which may require in addition to the foregoing.

Bench Marks and Control Points

All levels, lines, grades and measurements shown on the Drawings shall be measured from a Bench Mark and points to be established by the EMPLOYER within the Points Site of the WORK. The CONTRACTOR shall be responsible for ensuring the levels of all parts of the work are accurately related to this Bench Mark which shall be notified to the CONTRACTOR by the EMPLOYER immediately after commencement of the WORK.

Survey

The CONTRACTOR shall furnish and maintain at his own expense survey instruments stakes and other such materials and give such assistance, including qualified staff as may be required by the EMPLOYER who will establish Bench Marks base lines, grades and other principal control points. The CONTRACTOR shall, however, call the EMPLOYER'S attention to any inaccuracies and discrepancies of such controlling points etc., before proceeding with the work. The CONTRACTOR shall at his own expense, establish working or construction lines and grades as required, which shall be frequently checked by the EMPLOYER'S REPRESENTATIVE but the CONTRACTOR shall be solely responsible for the accuracy thereof.

Safeguarding Bench Marks & Control Points

The CONTRACTOR shall safeguard all points, stakes, grade marks and bench marks made or established on the work. If disturbed he shall bear the cost of re-establishing them and also the entire Points expense of rectifying the work rendered defective due to such disturbance.

Progress Photograph

The CONTRACTOR shall, throughout the construction of the WORK use digital camera for photography and provide the progress photographs in color to the EMPLOYER. He will also submit three prints each of size 5"x7" along with the recorded data at two week intervals. All such photographs will be taken under the direction of the EMPLOYER.

Materials and Workmanship

As soon as possible after the SUB-CONTRACT has been awarded, the CONTRACTOR shall submit to EMPLOYER list of suppliers from whom he proposes to purchase the materials necessary for the execution of the WORK. The information regarding the names of suppliers may be submitted at different times, as may be convenient, but no approved source of supply shall be changed without the prior permission of the EMPLOYER'S REPRESENTATIVE.

Preference shall be given to the use of materials and fittings manufactured in Pakistan which comply with the SUB-CONTRACT and are competitive in price. Foreign materials shall only be used with the consent of the EMPLOYER.

All materials incorporated in the WORK shall be new and of the best quality and description of their respective kinds and shall comply with all relevant specifications. Similarly the workmanship in every case shall be of the best character, and the whole shall be subject to the approval of the EMPLOYER.

Materials whose quality and construction are not covered by the Technical Specifications shall be of equal or better quality than the relevant sample accepted by the EMPLOYER'S REPRESENTATIVE.

Samples

In addition to any special provisions herein for the sampling and testing of materials, the CONTRACTOR shall submit to the EMPLOYER as he may require samples of all materials and goods which he proposes to use or employ in or for the WORK. Such samples, if approved, will be retained by the EMPLOYER'S REPRESENTATIVE, and no materials or goods of which samples have been submitted shall be used on the WORK unless and until such samples have been approved in writing by the EMPLOYER.

The EMPLOYER'S REPRESENTATIVE may reject any materials and goods which in his opinion are inferior to the samples thereof previously approved and the CONTRACTOR shall promptly remove such materials and goods from the Site.

The cost of supplying all such samples and of conveying same to such place of inspection or testing as the EMPLOYER may designate within the country of origin shall be deemed to be included in the tendered rates and prices.

Samples will be retained by the EMPLOYER and when directed by the EMPLOYER'S REPRESENTATIVE the CONTRACTOR shall dispose of the samples. Except for those which may be incorporated into the WORK after approval, such as plumbing and electric fixtures.

Tests Generally, Access to Premises

The EMPLOYER may examine and may require to be tested any materials or goods required in or for the WORK such as he may decide from time to time and shall have unrestricted access to the CONTRACTOR'S, CONTRACTOR'S and supplier's premises for such purpose at all times and the CONTRACTOR shall specify this requirement when placing all orders.

The EMPLOYER will notify the CONTRACTOR whether materials and goods will be inspected at the manufacturer's or supplier's premises or at the Site. No materials or goods shall be dispatched from such premises until such notification is given and, if appropriate, inspection is complete and a release certificate is given to this effect. In both cases the CONTRACTOR is to notify the EMPLOYER when materials and good will be ready for inspection and shall do so adequately in advance for him to make the necessary arrangement for inspection.

The CONTRACTOR shall afford the EMPLOYER all facilities, assistance, labor and appliances necessary for the convenient examination, testing weighing or analysis of all such materials or goods. The CONTRACTOR shall provide and prepare such test pieces of any such materials or goods as the EMPLOYER may require.

Notwithstanding any tests which may have been carried out off the Site the EMPLOYER shall be empowered to order further tests of any materials or goods to be made on the Site and to reject such materials or goods should they fail to pass such test on the Site.

The full cost of providing all facilities, labor, consumable stores and appliances required in connection with all testing on the Site shall be deemed to be included in the tendered rates and prices.

Test Certificates

Should the EMPLOYER not inspect any materials or goods at the place of manufacture, the CONTRACTOR shall, if required, obtain certificates of test from the suppliers of such materials or goods and shall send such certificates to the EMPLOYER. Such certificates shall certify that the materials or goods concerned have been tested in accordance with the requirements of the Technical Specifications and shall show the results of all the tests carried out. The CONTRACTOR shall provide adequate means of identifying the materials & goods delivered to the Site with the corresponding certificates.

Testing at an independent Laboratory

Where tests are specified or directed by the EMPLOYER to be carried out in an independent testing laboratory, the CONTRACTOR shall supply and deliver the samples and shall arrange for the relevant tests to be carried out. The independent testing laboratory shall be nominated by the CONTRACTOR and acceptable to the EMPLOYER. Unless otherwise specified the CONTRACTOR shall arrange for one copy each of the independent testing laboratory's test certificates to be delivered to the EMPLOYER and to the EMPLOYER not less than 3 working days before the materials covered by the relevant test certificates are to be incorporated in the WORK. Each test certificate shall be relatable to the materials from which the sample was taken.

Site Testing

The CONTRACTOR shall carry out such laboratory and field test (including tests to check the accuracy of testing equipment and methods but excluding tests specified to be carried out in an independent testing laboratory) as specified or as can reasonably be inferred from herein, as may be necessary to ensure and satisfy the EMPLOYER that the requirements of the Technical Specifications are met. The type and frequency of testing shall be in accordance with the relevant standards except as otherwise specified herein or directed by the EMPLOYER.

The CONTRACTOR'S attention is drawn to the fact that the frequencies of testing specified in the relevant clauses are intended to represent only a general guide. The EMPLOYER shall be empowered to vary the frequencies at which tests are conducted should he deem this necessary for the proper control of the quality of the WORK. Should the EMPLOYER'S REPRESENTATIVE vary the frequencies stated in the relevant clauses of the Technical Specifications, the CONTRACTOR shall not be entitled to extra payments thereof.

Unless otherwise agreed or directed by the EMPLOYER methods of sampling and test procedures shall be in accordance with the relevant Standard Methods of ASTM, British Standard Codes of Practice or any other relevant standard approved by the EMPLOYERS. Sample will be selected by the EMPLOYER'S REPRESENTATIVE.

The CONTRACTOR shall keep clear, accurate and up-to-date records of tests and immediately any test is completed shall supply two copies and summaries of the results thereof to the EMPLOYER'S REPRESENTATIVE in such form as he may require. Testing equipment operations and records shall be available for inspection by the EMPLOYER'S REPRESENTATIVE at all times.

Removal of Condemned Materials

The EMPLOYER'S REPRESENTATIVE may require the CONTRACTOR to remove and dispose of any materials employed of the EMPLOYER'S REPRESENTATIVE, are unsuitable or have been incorrectly deposited or have suffered damage by exposure to the weather or otherwise are not in accordance with the specified requirements for such materials. The CONTRACTOR shall be entitled to no payment whatsoever in respect of such materials.

Contractor and Engineer's Site Offices

- i- Contractor shall provide and maintain a temporary, weather tight site office for his own use and that for Engineer's use complete with facilities for filing, drawings, specifications correspondence, and other appurtenances necessary for the proper execution of the Work. The Contractor shall make provision for transportation and off-site living accommodation for his personnel and provide necessary power, water, sanitary facilities, necessary for his personnel, equipment cartage and materials operations. Facilities shall be as approved by the Engineer.
- ii- contractor at his own cost shall provide, erect and maintain an office facility at Site for the sole use of the Engineer's/Consultant's Staff. Facility shall be serviced with power, potable filtered water, lighting, air conditioning, telephone connection, sewerage and waste disposal facilities, during the entire construction phase and up to six months from the date of Substantial Completion, of the type as follows:

Office facility shall be temporary type weather-tight construction having a total floor area of not less than 500 sq. ft. And shall be air-conditioned and have attached meeting room as well as a washroom containing W.C., urinal and washbasin. A mobile shipping container designed for the above purpose in accordance to the requirements of the Engineer, shall be acceptable.

Furniture, Equipment etc. for Site Office: All necessary office furniture, including filing facilities for two junior and one senior staff of Engineer/ Consultant should also be provided.

Computer & Printer: The contractor shall provide a latest PENTIUM IV computer with laser color printer with all peripherals as required by the Engineer, printer to be capable of printing A-3 size sheets, fax machine, photo copier capable of copying up to A-3 size sheet: (powder copies)

Furniture

One Table Approx. 5' x 3' , two tables of approx. size 4' x 2' 6"

One good quality revolving Chair, and six Nos. Good quality non-revolving chairs.

Drawings Stand for holding 30 drawings.

An Internet/E-mail account

As per the requirement of the Engineer for exclusive use of Engineer/consultant and their staff

Telephone & Fax

A separate telephone line for fax machine shall be provided by the Contractor. The maintenance and the stationary of the entire aforesaid facilities shall solely be the responsibility of the contractor

Transportation facility

The contractor shall provide a minimum 1000 cc brand new vehicle, along with driver and POL, (to be transferred to the employer after successful completion of the project) in connection with performance of official duties, exclusively for the Resident Engineer.

The contractor shall also provide adequate transportation facility in connection to performance of official duties, exclusively for the site staff of the Engineer/Consultant during the construction as well as the extended period (if any) as and when required by the Engineer/ Consultant.

For both the above items the Contractor shall furnish, supply and provide, as may be necessary without specific direction of the Engineer, all fuels, lubricants, tires and other supplies, all maintenance, repairs and running costs and suitably qualified drivers at all times.

Security

Contractor shall be responsible for the security of the site offices and its contents at all times

First Aid Box

First Aid Box suitably equipped for a site force of about 20 people.

The foregoing furniture, equipment and miscellaneous items shall be provided and installed by the CONTRACTOR within 15 days of the Letter of Intent from the EMPLOYER.

Sanitary Accommodation for Site

The CONTRACTOR shall also maintain and service a suitable sanitary accommodation facility and provide consumable stores including soap, etc.

Surveying Equipment

The CONTRACTOR shall provide & maintain in an accurate and serviceable condition the following new surveying equipment at Site at all times during the execution of the WORK:

- 1No. Theodolite to read to 20 seconds complete with tripod and accessories.
- 1No. Reversible level complete with tripod and accessories.
- 1No. 14 ft. telescopic leveling staff graduated in feet.
- 1No. 100 ft. steel tapes.
- 1No. 50 ft. steel tapes.
- 1No. 12 Ft. flexible steel tapes.
- 1No. Steel tape repair kit.
- 1No. Plumb bobs.

The foregoing equipment shall be inspected at the Site of WORK by the EMPLOYER'S REPRESENTATIVE within 15 days of the receipt by the CONTRACTOR of the Letter of Intent from the EMPLOYER.

In addition to the specified list of equipment, the CONTRACTOR shall also provide and renew from time to time such miscellaneous materials and equipment as might reasonably be required at the Site.

Traffic Routes to be Maintained

The CONTRACTOR shall not cause unnecessary obstruction of roads, footpaths or waterway at any time during the course of the WORK and in no circumstances shall closure, in whole or in part, of these or any other "right of way" be permitted except with the prior permission of the EMPLOYER'S REPRESENTATIVE in writing. All disturbances to be negotiated with the affected community in advance.

The CONTRACTOR shall maintain adequate, through safe traffic routes for vehicles and pedestrians on public highways within and adjacent to the Site of the WORK, including such diversions of highways as may be required, and make arrangement for watching, signaling, and control of traffic by day and night and for adequate lighting all to the satisfaction of the EMPLOYER'S REPRESENTATIVE.

All temporary diversions shall be constructed to adequate widths and maintained in good condition at all time by the CONTRACTOR to the satisfaction of the EMPLOYER'S REPRESENTATIVE and on completion of the CONTRACT all such road shall be left in a condition approved by the EMPLOYER. The temporary diversions shall be removed and reinstated to the satisfaction of the EMPLOYER/EMPLOYER when no longer required.

The CONTRACTOR shall make arrangements and co-operate with all other CONTRACTORS working in the area for directing, routing, marshalling, controlling and circulating the traffic connected with the WORK in accordance with the EMPLOYER'S REPRESENTATIVE requirement in order that the flow of all traffic may be facilitated, that all obstruction, inconvenience & delay may be minimized and that the interest of all concerned including the general public may be promoted.

The CONTRACTOR shall, before commencing work affect any public highway or right of way, submit to the EMPLOYER'S REPRESENTATIVE his proposals for the control of traffic, access for residents & diversions in respect of the area in which he proposes to work. The EMPLOYER'S REPRESENTATIVE will instruct the CONTRACTOR to make such amendments as are considered necessary.

The CONTRACTOR shall pay all cost and expenses attendant upon the employment of any Police, which the Local Magistrate/Government may appoint for the preservation of peace, or the prevention of trespass and theft, or for any other purpose on or near the site of the WORK.

Protection of Livestock

The CONTRACTOR shall be responsible for protection of livestock against damage or accidents because of the WORK, during day and night. All gaps made in fences and hedges etc. to be closed when WORK are not in progress and all trenches and excavations to be suitably protected.

Haulage Routes

The CONTRACTOR shall submit to the EMPLOYER'S REPRESENTATIVE as soon as possible after the acceptance of the Tender and from time to time thereafter as required, proposals for the routing of traffic in connection with the execution of WORK being the traffic of the CONTRACTOR, his suppliers in the movement or haulage of heavy loads, construction plant, materials and spoil (hereinafter referred to as "the construction traffic") including particulars of the public roads of the public roads which he, the CONTRACTOR, proposes to select as routes to be used by the construction traffic.

The EMPLOYER'S comment on all such proposal as may be submitted by the CONTRACTOR.

Support

The CONTRACTOR shall provide ample shoring to all poles, buildings, walls, roads, railings and structures etc., adjacent to the trenches and shall carry out the trench work in close-timbered lengths near such property at his own expense.

Protection Mains, Services & Apparatus

The information given on the Drawings relating to existing services is given for general guidance only and is not guaranteed and no responsibility & Apparatus whatsoever is accepted by the EMPLOYER for the accuracy thereof. The CONTRACTOR shall refer directly to the concerned authorities for more detailed information on any of the services within the working spaces of the site.

The CONTRACTOR shall not cause or permit interference with mains, services or apparatus whether indicated on the Drawings or not & shall be responsible for their protection. He shall give notice and provide reasonable facilities to the relevant authority and/or their servants to enable them to do alterations, repairs or maintenance WORK if so required.

If during the course of the WORK underground services are uncovered they shall be carefully protected and shall be immediately referred to the EMPLOYER'S REPRESENTATIVE.

Diversion of Mains, Services & Apparatus

The CONTRACTOR shall make arrangements with the appropriate owners/ authorities and pay all costs for any temporary diversions of mains, services and apparatus which may be required in carrying out the WORK.

Dealing with Water

The CONTRACTOR shall take all necessary measures to prevent water from the Site causing a nuisance on or in any neighboring land or property either by causing flooding or by depositing sediment on the surface of the ground or in drains or water-courses. Wherever necessary to prevent this, the CONTRACTOR shall construct temporary drainage channels, layers, sumps and traps in addition to those shown on the Drawings discharging into existing drains, ditches or water-courses. The CONTRACTOR shall remove all sediment which may accumulate on any land or in any drains, ditches or watercourses or in any other property as a result of his operations.

All WORK including those below subsoil standing water level shall be carried out in the dry unless specified otherwise. The CONTRACTOR'S arrangements for controlling the inflow of water into the parts of the excavation being worked and during the placing of concrete and other WORK therein and for the collection and disposal of water shall be to the EMPLOYER'S approval. All costs and charges in dealing with water in anyway whatsoever and effects thereof will be deemed to be included in the several rates in the Bills of Quantities.

Water flowing into excavations shall be carried by trenches, drainage layers or open jointed drains to sumps from which it shall be pumped. Such trenches, drains or sumps shall generally be clear of the WORK unless approved otherwise by the EMPLOYER'S REPRESENTATIVE.

The CONTRACTOR shall keep all surfaces upon or against which concrete is to be deposited free from running water and no concrete shall be placed until such surfaces are properly drained. Suitable precautions shall be taken to prevent running water from washing out cement or concrete while it is setting or from injuring the WORK in any other way. Notwithstanding the approval by the EMPLOYER'S REPRESENTATIVE of the CONTRACTOR'S methods of dealing with water, the CONTRACTOR shall be responsible for and accept all the risks and liabilities of dealing with water from whatever source and of all effects thereof.

WORK to be Water-tight

All WORK, intended to retain or exclude water or through which water is to be passed shall be absolute water-tight, so as not only entirely to prevent loss of water from the WORK, but also so as entirely to prevent the percolation of water into any part or parts of the WORK.

Name Boards / Temporary Signage

The CONTRACTOR shall erect only such name boards as the EMPLOYER may approve. These must be of simple and becoming appearance. They shall display the name of the project, the CONTRACTOR, and such other information as the EMPLOYER may direct or approve.

Materials at Site

Payment for unfixed materials delivered on site shall be included in the Monthly valuations shall and shall be certified as provided for by the Conditions of Contract.

The valuation so certified by the Engineer shall be the invoiced cost of the materials, if the Engineer considers this cost to be realistic, plus any customs duty or other taxes paid together with an allowance for port dues and delivery to and unloading at the Site. The valuation for unfixed materials on site shall be the net reimbursement to the Contractor of the cost of the materials delivered and unloaded at the Site and as such shall be exclusive of any profit or Contractor's overheads mark-up.

Notwithstanding the foregoing, such net reimbursement to the Contractor for unfixed materials on Site shall be less than the total price included by the Contractor in the Bill of Quantities for both supplying fixing and sufficient value shall be retained for payment to the Contractor in subsequent monthly payment for permanently fixing the materials in the Works.

The Contractor shall make due allowance in pricing the Bill of Quantities to take account of these clauses.

Formwork materials including all struts, timber or sheet boarding, all other timber work, waffle moulds, proprietary shuttering and the like shall not be considered as "unfixed materials on site" for the purposes of monthly valuations.

Shop Drawings, Working Drawings, Operations and Maintenance Instructions.

The Contractor is to allow in his rates for the production of all shop drawings, working drawings, operations and maintenance instructions called for in the Specifications.

These shall include but not to be limited to the following:

- (i) The surveyed location of all existing services.
- (ii) A Combined Services Drawing including all surveyed existing and proposed services showing manholes, draw pits, joint boxes, inspection chambers, lighting column bases traffic signal bars, concrete surrounds, pipe diameters, etc. to scale, plus any other possible obstructions.
- (iii) Combined Services Working drawings original and new.
- (iv) Separate sets of working drawings for each individual service showing proposed locations for submission to the service authorities.
- (v) Existing ground levels.
- (vi) Earthworks cross sections.
- (vii) Temporary traffic sign design and fixing details.
- (viii) Proposed traffic sign design and fixing details.
- (ix) Mechanical, electrical and other services drawings, diagrams and instructions as required in the contract and directed by the Engineer.
- (x) Temporary work drawing where requested by the Engineer.

The rates in the appropriate section shall include for design of the civil works as specified in the Contract and for providing working drawings, shop drawings, schedules, specifications, calculations, etc. and for obtaining the Engineer's approval.

Provisional Sums

The Provisional Sums given in the Bill of Quantities may be used in whole or in part, or not at all, on the instruction of the Engineer.

Percentage of adjustment for Provisional Sums as provided in the Conditions of Contract shall not be applicable to any work carried out by other Contractors or Service Authorities employed directly by the Employer. Payments to such Contractors or Service Authorities shall be made directly by the Employer.

The Contractor shall co-ordinate with the Service Authorities and provides all necessary facilities as may be required and as foreseeable by an experienced Contractor. The cost of such co-ordination and facilities is deemed to have been included in the respective item given in Bill No. 1 of the Bill of Quantities.

Bill Item for Conditions of Contract

Payment for this item will be pro-rata to the value of work completed and approved by the Engineer and shall cover all costs and expenses including overhead and profits incurred by the Contractor in carrying out the requirements of the Conditions of Contract, not otherwise, included in the Bills of Quantities. Breakdown of the same shall be submitted together with the Tender Documents.

Abbreviations

In the Specification and Bill of Quantities the following abbreviations have the meanings hereby assigned to them:

B.S.	Means the specification issued by the British Standards Institution (B.S.I.)
C.P.	Means the code of practice issued by the B.S.I.
AASHTO	means the specification issued by the American of State Highways & Transportation Officials.
ASTM	means the specification issued by the American Society for Testing & Materials.
AC	Asbestos Cement
B.S.	British Standards
Cont'd	Continued
DEPT, Dept.	Department
Dia	diameter
Drg.	Drawing
E.O.	Extra Over
F.C.	Fiber Cement
GRP	Glass Fiber Reinforced Plastics
HDPE	High Density Polyethylene
HP	Horse Power
ISO	International Standards Organization
Kg.	Kilograms
Kw/hr	Kilowatt per hour
L.R.B.	Local Regulatory Body
L.S.	Lump Sum
M	meter
mm	millimeter
m ³ , cu.m.	Cubic meter
m ² , sq.m.	Square meter
MDPE	Medium Density Polyethylene
Mic	Micron
Min., min	Minimum
MDD	Maximum Dry Density
MH	MANHOLE
No.	Number
Nos.	Numbers
O.P.C.	Ordinary Portland cement
PE	Polyethylene
P.Q.	Provisional Quantity
PVC	Polyvinyl Chloride
Qty.	Quantity
RHS	Rectangular Hollow Section
Spec	Specifications
S.R.C.	Sulphate Resisting Cement
t, tons	tonne
uPVC	Unplasticised Polyvinyl Chloride
W	Width
P.C. Rate	prime cost rate
>	Greater than
≥	Equal to or Greater than
<	Less than
≤	Equal to or Less than
=	Equal to

Rates for various items throughout the Bills of Quantities shall include, unless otherwise stated or measured, for cutting of every description and the consequent waste, for work in girths, widths or heights of less than 300mm and for all short lengths.

Rates for all work shall include for protection, provision of samples and testing.

The pricing of materials shall take account of the following:

- (i) Pricing Preambles and Specifications shall apply reciprocally between sections of the works unless otherwise described.
- (ii) Materials shall be of the quantity specified unless otherwise directed by the Engineer.
- (iii) All materials shall be transported, handled, stored and fixed in accordance with the printed instructions or recommendations of their manufacturer's or suppliers.
- (iv) Protection of completed work, all casings and temporary coverings and making good, cleaning and polishing and clearing away upon completion.

Variations

The rates inserted in the Bills of Quantities with application of adjustment item will be used to value any variations to the work, whether omission or addition. The Contractor shall not be entitled to payment for profit and overheads on the value of work omitted.

Any claim or additional General Requirement costs, General and Special attendance's, Builders work and the like on variation Works, shall be considered only upon receipt of full supporting contemporary substantiation being presented by the Contractor to the Engineer.

Fix only

The expressions "fix only" used in these Bills of Quantities means that the contractor shall provide the following facilities:

- (i) Fixing as defined in Clause GP 7.2 of POM(I).
- (ii) Supplying full size templates.
- (iii) Giving and marking dimensions and taking responsibility for their accuracy.
- (iv) Getting in, protecting, handling, distribution and placing in position.
- (v) Assembling as required.
- (vi) Casing up and protection, including clearing away protection on completion of the works.
- (vii) Full cost of replacement of any items which are damaged, broken, lost or stolen after the acceptance of the items from the supplier or client and until handing over the complete works.
- (viii) Other necessary and usual facilities and documentation.

Supply Only

The expression "supply only" used in these Bills of Quantities means that the Contractor is to provide for everything as defined in Clause GP4.1 of POM(I) in connection with such items except fixing in position. All such items are to be delivered to Site and stored in accordance with the Engineer's instructions.

Sub-Contractors

Any sub-contractors which the Contractor proposes to use for the works are subject to the approval of the Engineer and the Employer.

The Contractor should ascertain from sub-contractors and suppliers before the works put in hand particulars of positions in which chases, holes, mortices and the like will be required to be formed or left. No claim for the extra costs of cutting away work already built due to the Contractor's failure to ascertain these particulars will be admitted.

Any sub-contractor who has not been approved by the Engineer and the Employer shall not be used in connection with the carrying out of the Works.

The Contractor shall allow for any additional costs incurred due to sub-contractors working different hours from and extended hours to those worked by the Contractor.

Prime Cost Rates (PC Rates)

Where Prime Cost (PC) Rates are included, the Contractor is to include in his rate the full amount shown. Such rate is for the material cost only of the particular item so described, delivered to the site. The Contractor is, in addition to those relevant items listed at Clause A, Page 9, to allow in his rates for all auxiliary materials required for fixing such as mortar for bedding and jointing, adhesive and all similar items of a like nature. The Prime Cost will be expended at the discretion of the Engineer and the adjustment to the Contractor's rate will be the net difference between the Prime Cost (PC) Rate stated in the description and the actual price paid (benefit of any discount passing to Employer).

The word "attendance" means the following:

Attendance to be provided by the Main Contractor

The Main Contractor shall be responsible for providing, including but not limited to, the following attendances:

- i) Use of Main Contractors administrative arrangements.
- ii) Use of Constructional Plant.
- iii) Use of Contractor's Mess Room, Sanitary and Welfare Facilities.
- iv) Co-ordination and scheduling of all works related to each sub-contract.
- v) Use of Standing Scaffolding.
- vi) Use of Temporary Works including water and Electricity.
- vii) Supplying full size setting out templates.
- viii) Giving and marking dimensions and taking responsibility for their accuracy.
- ix) Space for Sub-Contractors Office and Stores.
- x) Providing working space.
- xi) Offloading Sub-Contractors materials and placing in Stores.
- xii) Clearing away rubbish.
- xiii) Other necessary and usual facilities, documentation, general intergrades attendances, labor and assistance.

Attendance to be provided by the Sub-Contractor shall include but not be limited to the following

- i) All special scaffolding required by him in the execution of his works.

- ii) Taking from stores, distributing, hoisting and placing in position, all items of plant, equipment and materials required by him in the execution of his works.
- iii) All labor, plant, etc. (other than included in Attendances to be provided by Main Contractor).
- iv) Site offices and stores required by him for the execution of his works.
- v) Obtaining security passes for access of work people to the Site.

Site Work

All quantities for excavations have been measured net with no allowance for increase in bulk or working space.

The method of measurement and any measurement will be entirely at the discretion of the Engineer but generally will be as follows:

- (i) Where there is no reduced level excavation, other excavations will be measured from natural ground level.
- (ii) In instance where there is excavation to reduce levels, other excavations will be measured from the reduced level.

Should the Contractor be able to use any excavated material arising from the works as general filling then it shall be measured as material backfilling in making up levels with a deduction of items for filling and for material removed from Site.

In addition to the provisions of POM (I) Sections B8 rates for excavation shall include for the following -

- (i) Excavation by whatever means are necessary including hand excavation in any kind of ground material including running silt and running sand.
- (ii) Excavation to the Commencing Level to be measured separately.
- (iii) Commencing excavation at any depth.
- (iv) Excavation below the normal water table level.
- (v) Over break and soft spots including filling with mass concrete to the levels required by the Engineer.
- (vi) Forming temporary spoil heaps where required and multiple handling including any charges in connection therewith.
- (vii) Working space.
- (viii) Excavation around existing services and mains.
- (ix) Trimming or grading ground to produce level surfaces or surfaces to falls or slopes.
- (x) Ramming and compacting sides and bottom of excavations.
- (xi) Supporting the sides of excavations.
- (xii) Keeping excavations free from water by whatever means necessary

The rates for items of imported fillings, graded level filling etc, shall include, but not limited, for the following:

- (i) Grading to slopes and falls.

- (ii) Special compacting to form vertical or battering faces.
- (iii) Forming sinking's.
- (iv) Forming earth bunds and grading to gabions as required.
- (v) Leveling, and compacting to formation levels below roads, buildings, paved areas, etc.
- (vi) Compacting in layers.
- (vii) Any loss in volume due to compaction and for any additional materials required due to penetration of the filling materials into the ground or any settlement or compacting of the original ground levels under the weight of materials or due to methods of compaction or construction traffic.
- (viii) Temporary spoil heaps and multiple handling as required.
- (ix) All labors including handpacking and temporary retaining boards where required.
- (x) Blinding with sand or similar approved fine material where required to receive concrete or the like.
- (xi) Costs of testing.

Disposal of excess excavated material

Rates for disposal of excess excavated material shall include for any necessary double handling and the provision of a tip, if necessary, including any charges in connection therewith.

Underground Drainage

The rates for trenches for services pipes, drainage pipes, ducts, cables, etc. shall include for disposal and for bedding and backfilling as specified for each service.

The rate for trenches shall include for backfilling to trenches with approved excavated material. If the excavated material is not suitable imported fill shall be used.

The rates for drains, inspection chambers, etc. are to allow for testing.

Rates for drain pipes generally are to include for all short lengths, back stops, wooden plugs and retaining and alignment pegs required in laying and for the extra involved over normal trench excavating in hand packing and tamping selected fine material around the lower half of the pipes to buttress them against the side of the trench. Rates are to be include for leaving all pipes clean and clear.

Pipes are measured nett as laid and are to include for all cuttings, etc. for laying in trenches of any depth, and building in to sides of inspection chambers.

Rates for drain fittings on all types of drain pipes are to include for extra joints of all types and cutting and waste on all pipes.

Rates for drain accessories shall include for concrete surrounds and any additional excavation and disposal.

The rates for all concrete work shall include for the following:

- (i) Concrete testing and testing cost.
- (ii) All considerations arising from the specification.
- (iii) Mixing, hoisting to any height or lowering to any depth and placing and compacting on the surfaces of any material or on formwork by whatever means necessary.
- (iv) Pouring in hot weather conditions in accordance with the Specification.

- (v) Compacting by vibrators if required.
- (vi) Forming any control and construction joints, locations as agreed by the Engineer.
- (vii) Shuttering to upper surfaces not exceeding 15 degrees from horizontal.
- (viii) Curing, hacking surfaces for key and protecting concrete surfaces from harmful weather conditions.
- (ix) All surface treatment to unset concrete.
- (x) Finishing to floor slabs as Specification.
- (xi) Expanded metal lathing and angle beads.
- (xii) Joint sealing between concrete and plaster.
- (xiii) All costs in connection with the construction of "kickers".
- (xiv) Forming and grouting grooves and mortises and making good to holes and mortises.
- (xv) Water bars and the like.

The rates for plain concrete foundations and concrete blinding shall include for the following:

- (i) Any extra volume of concrete used in lieu of formwork.
- (ii) Forming sloping surfaces where required.

The rates for concrete work laid in trenches as bed or surround to all pipes and ducts shall include for all necessary formwork.

The rates for reinforced concrete shall include for working concrete around reinforcement.

The rates for bar reinforcement shall include for the following:

- (i) Extra material in hooks, laps and the like not required by the Specification.
- (ii) Positioning and protecting starter bars.
- (iii) Straightening (if required) cutting to length and bending reinforcement to required shapes and complying with the Specification.
- (iv) Fixing rods of any diameter in any position including any necessary hoisting.
- (v) All considerations arising from the Specification.
- (vi) Epoxy coating as required and all necessary preparation.
- (vii) Supporting in position during concreting, provision of supports, chairs, block spacers and steel binding wire and approved / proprietary distance pieces.
- (viii) Welding bars to form mesh reinforcement.
- (ix) Additional cutting and bonding in connection with holes, mortises, pockets, grooves, chases and the like.
- (x) Providing bar bending schedules to be checked and approved by the Engineer.

The rates for fabric reinforcement shall include for the following:

- (i) Straight, raking, curved and circular cutting and waste.
- (ii) Bending to profiles.
- (iii) Laps of once full square / rectangular module or as noted.
- (iv) All considerations arising from the Specification.
- (v) Supporting in position during concreting: provision of supports, chairs, block spacers, steel binding wire and approved / proprietary distance pieces.

- (vi) Cutting, bending and notching around all obstructions.

Formwork

The rates for formwork or moulds shall include for the following:

- (i) Small quantities.
- (ii) All cutting and waste including raking curved or circular cutting and notching around pipes, ducting and fittings.
- (iii) Grooves of any sectional areas, all stops, chamfers and splayed angles.
- (iv) Setting up, strutting and supporting at any height above the structure subject to any limitations imposed by the Engineer.
- (v) All considerations arising from the specification.
- (vi) Carefully coating with mould oil ensuring that no shutter oil is applied to surfaces of reinforcement.
- (vii) Easing, striking, removing and cleaning and preparing for re-use and removal when no longer required.
- (viii) The provision of all props, stays, struts, wedges and bolts.
- (ix) Overlaps and passing's at angles and labors at intersections.
- (x) Shortening struts or shapes and re-strutting or reshoring where required.
- (xi) Rubbing down, filling and making good the surface of concrete after removal of shuttering.
- (xii) Cutting or notching shutters or moulds to in-situ or precast concrete around projecting reinforcement.

The rates for wrought formwork to produce a special finish shall include for the following:

- (i) Any necessary rubbing down or filling allowed by the Specification to produce the finish demanded by the specification.
- (ii) Cutting out and re-casting unsatisfactory work or work not fulfilling the requirements of the specification.
- (iii) Carrying out remedial or any other work required by the Engineer as an alternative to cutting out substandard work.
- (iv) All consideration arising from the specification.

Precast Concrete

The rates for precast concrete shall include for the following:

- (i) Reinforcement.
- (ii) The provision of moulds.
- (iii) Forming a fair face in accordance with the specification to all exposed surfaces.
- (iv) Square, rounded and mitred angles.
- (v) Hacking or forming keys to all other surfaces.
- (vi) Holes or notching for pipes.
- (vii) All considerations arising from the specification.
- (viii) Hoisting to any height including the provision of lifting hooks or other devices approved by the Engineer.

- (ix) Setting and bedding in position and jointing in mortar as specified.
- (x) All necessary temporary struts or supports.
- (xi) Sills and copings etc. shall include for plain ends and mitred angles where necessary.

Reinforcement to Masonry

- A. The contents of this section equally apply to reinforcement included within the Masonry section of the Bills of Quantities, unless otherwise stated.

Masonry

The rates for blockwork shall include for the following:

- (i) Block testing at a recognized laboratory, provision of certificates.
- (ii) All considerations arising from the specification.
- (iii) Building at any level or height of slabs or beams.
- (iv) Small quantities and any extra labor in forming kerbs.
- (v) Straight, raking, curved and circular rough or fair cutting.
- (vi) Forming bull nose edges to quoins and the like.
- (vii) All labor and materials necessary for closing wall cavities.
- (viii) Plumbing at angles.
- (ix) Cutting and bonding at angles, openings and intersections.
- (x) Building into and / or against adjacent work.
- (xi) Providing solid course blockwork at still level at all openings and bearings of all in-situ concrete and at the top of all free standing walls.
- (xii) Wedging and pinning up to soffits and all insulation required between tops of concrete block partitions and underside of structure.
- (xiii) Special or concrete filled blocks at angles, openings and intersections, and soffit junction and heads of walls.
- (xiv) Providing any means necessary to prevent concrete cast on hollow blockwork or over cavities from falling into voids or cavities (subject to the approval of the Engineer).
- (xv) All necessary keys for in-situ finishing.
- (xvi) Grouting up at back of walls built against other construction.
- (xvii) All necessary starter bars and cast in wall ties at junctions between blockwork and in-situ concrete and all strap supports and lateral supports in accordance with the Specification and shown on the drawings.
- (xviii) All reinforcement to blockwork in accordance with the Specification and shown on the drawings.
- (xix) All necessary expansion joints, control joints, sealant and termination bars as required by the Specification and shown on the drawings.
- (xx) Fire stopping and smoke seals.
- (xxi) Insulation.

The rates for block walls shall include, for the following additional labors:

- (i) Cutting or forming chases or grooves for slabs, partitions, staircases, etc.
- (ii) Cutting grooves for water bars, flashings and the like and making good and pointing in similar mortar.

- (iii) Bedding and pointing frames, etc., building in door and window frames and the like.
- (iv) Building in or cutting and pinning in and making good ends of lintels, brackets, timbers, steelwork, holder bats and the like.
- (v) Building in or cutting for and making good around pipes, ducting, fittings and the like.

Metal Work

The rates for all steelwork and metalwork shall include for the following:

- (i) Ends, angles, intersection, ramps on frames, bearers, stays and the like.
- (ii) Assembling and jointing together components.
- (iii) Stanchions and rafter restraints, gussets and end places.
- (iv) Allowance for rolling margin.
- (v) The weight of weld metal in welded constructions.
- (vi) Members of any length.
- (vii) Cutting to size and shape and joints in the running length.
- (viii) Notches, holes, slots, miter / angle ends, and for all drilling and splay cut ends.
- (ix) Grinding welds to a smooth finish, unless otherwise required.
- (x) Fixing with appropriate non-corroding countersunk screws including holes unless otherwise described.
- (xi) Riveted and bolted work shall include rivets, bolts and holes and countersunk holes.
- (xii) Approved protection to cut ends or holes in galvanized work or other applied finish.
- (xiii) All considerations arising from the specification.
- (xiv) Metal door frames shall include for assembling, fixing with clamps, filling with mortar, temporary supports and removal of base ties.
- (xv) Floor plates, duct covers and the like shall include narrow widths, laying in position, frames, and for all holes, slots and the like and making good.
- (xvi) All preparation, protection coatings and final decoration with the items to which they relate.
- (xvii) All fittings and fixing required, including grouting in position.
- (xviii) Forming cambers in structural steel beams as indicated on the drawings.
- (xix) Shop drawings.

"Welding" is deemed to be in accordance with the specification and for the material to which it is to be used. Base plates, ends, caps, cleats, brackets, stiffeners, bolts, etc., shall be included in the weights of the associated steelwork in which they occur.

Woodwork

Sizes of sawn timber are basic.

Sizes of milled (wrote) timbers are finished.

Woodwork shall be deemed to be fixed with non-corroding nails unless otherwise described.

Screwed woodwork shall be described and shall be deemed to be fixed with non-corroding screws.

These preambles apply equally to all items measured as composite units.

The rates for woodwork shall include for the following:

- (i) Working to size and shape.
- (ii) Raking, curved or splay cutting.
- (iii) Short lengths, mitres, stops, ends and angles.
- (iv) Rebates, chamfers, grooves, scribed edges, rounded edges and the like.
- (vi) Cross grain and stopped work.
- (vii) All joints in the running length including structural joints.
- (viii) Cutting and fitting to steelwork.
- (ix) All considerations arising from the specification.
- (x) Trimming around openings.
- (xi) Extra timber in joints, horns, etc.
- (xii) Notching, boring and sinking have, rounded curves and splayed edges.
- (xiii) Holes for pipes, tubes, bars, cables, conduits, ducting, trunking and the like.
- (xiv) Treating backs of woodwork in contact with structure.

The rates for framed woodwork shall include for the following:

- (i) Proper framed joints.
- (ii) Glueing joints.
- (iii) Doweling cramps and / or screwing joints.

The rates for milled woodwork shall include for the following:

- (i) Punching, fixings below exposed surfaces and filling flush.
- (ii) Any necessary sanding to remove "rippling" caused by milling machines.
- (iii) Wreaths, ramps and the like.

The rates for wood work described as "selected" shall include for the following:

- (i) Keeping clean and clear finishes.
- (ii) Punching nails and pins below exposed surfaces and filling with an approved colored filler to match the woodwork.
- (iii) Where described also as "screwed" the woodwork shall be fixed with screws recessed and pelleted to match the woodwork.

The rates for doors shall include for fitting and hanging any type.

The rates for frames and linings shall include for bedding in specified mortar where required.

The rates for plywood, blackboard and the like shall include for straight raking curved and circular cutting and all consequent wastage.

The rates for plastic laminate faced manufactured boards shall include for providing plastic laminate edgings and balancing laminates and removal of protective coatings.

The rates for ironmongery shall include for the following:

- (i) Mortises, sinking's and the like.
- (ii) All considerations arising from the specifications.

- (iii) Removing before and replacing after decoration.
- (iv) Fixing to wood or metal doors.
- (v) Testing and easing and adjusting.
- (vi) Oiling and leaving in perfect working order.
- (vii) Adhering strictly to mastering and sub-mastering schemes.
- (viii) Supplying and labeling at least two keys for each and every lock and handing over to the Engineer.
- (ix) Master key if required by the specification or drawings.

The rates for ironmongery described as "fixed to hardwood" shall include for fixing to plywood, blackboard and the like.

Thermal and Moisture Protection

The rates for work in this section shall include for the following:

- (i) Preparation and priming of surfaces to receive membranes.
- (ii) Laps, seams and narrow widths.
- (iii) Straight, raking, curved and circular cutting, notching, bending and all consequent wastage.
- (iv) All considerations arising from this specification.
- (v) Cement sand triangular fillet to returns behind the waterproofing membrane.
- (vi) Holes for pipes, standards and the like.
- (vii) Angles, returned ends and dressed ends on flashings.
- (viii) Dressing up and cover up stands and around and into gargoyles, vent pipes and the like.
- (ix) Tropical grade mastic pointing to all flashings.
- (x) Forming outlets, skirting, aprons, gutters and channels and forming small openings.
- (xi) Flashings and the like to penetrations through waterproofing systems.
- (xii) Clearing rubbish and cleaning areas on completion.
- (xiii) Testing in accordance with the specification and to the approval of the Engineer.
- (xiv) Providing an appropriate warranty / guarantee as required by the specification.
- (xv) Cement sand cant and reinforcing strip at corners.

Applied finishes described in this section are deemed to be measured as the relevant preamble in which they occur.

The cost of the mastic sealant and backer rod to be included in the item for Aluminum flashing.

Doors and Windows

The rates for work in this section shall include for the following:

- (i) Frames.
- (ii) Sub-frames.
- (iii) Architraves.
- (iv) Transoms.

- (v) Stops.
- (vi) Sealant.
- (vii) Weather bars.
- (viii) Thresholds or sills.
- (ix) Glazing.
- (x) Insulation.
- (xi) Ironmongery (except in timber doors where it is measured separately).
- (xii) Decoration.

Sizes referred to are structural opening sizes.

Ironmongery

Matching screens, keys and framing mortises in glass and the like shall be understood to be included.

Finishes

All finishing, screeds and backings have been measured net.

Rates for finishes shall include for the following:

- (i) Well wetting solid surfaces to be plastered or screeded.
- (ii) Preparing surfaces for finishing on backings including raking out joints of blockwork partitions, hacking surfaces of concrete or applying bonding agent to form a key and any necessary dubbing out.
- (iii) All cutting and waste, arises, short lengths, angles, ends, etc., making good or cutting and fitting around pipes conduits trunking pipe brackets and the like and making good up to door and window frames, skirting etc., all temporary rules and working around buried pipes, cables, conduits, etc.
- (iv) Angle beads, plaster stops, control joints, expanded metal strips, furring and lath, glass fibre scrims, aluminum channels and the like to all plasterwork around doors, windows at vertical abutments etc., and securely fixing to backgrounds.
- (v) All narrow widths, small areas and all cuttings.
- (vi) Fair edges, rebated edged, splayed edges, rounded edges, arises, quirks, grooves, flutes and the like.
- (vii) All setting out, temporary rules, screeds, templates and supports.
- (viii) Curing and cleaning off / down upon completion.
- (ix) Dubbing out as necessary to take up tolerances in the structure and cambers in floors and the like.
- (x) Expansion joints and control joints.
- (xi) Expanded metal lathing wherever required.

Rates for screeds and backgrounds shall include for the following:

- (i) Finishing with a tampered floated or trowelled surface as required.
- (ii) Laying level or to falls or slopes as required.
- (iii) Laying in bays where required including formwork to all edges, reinforcement, joint filler and sealant as detailed and specified.

Rates for wall and floor tiles and the like shall include for the following:

- (i) Fixing with an approved adhesive.
- (ii) Pointing up joints with mortar and cleaning off as required.
- (iii) Rounded, beveled and fair edges as required.
- (iv) Metal edge strips, dividers etc.
- (v) Straight, raking and curved cutting.
- (vi) Provision of expansion joints and sealant as indicated on the drawings.
- (vii) Provision of slurry protections or the like including removing same in floor areas subjected to movement of labor and materials.
- (viii) General protection of finished work to the Engineer's approval.

Rates for ceiling finishes shall include for the following:

- (i) Finishing with trowelled surface or other as required.
- (ii) False ceiling to include for all hangers, ceiling grid, tiles and insulation layers, and drop of any height.
- (iii) Bulkheads as shown on drawings.
- (iv) Work to sloping, curved, level soffits as required.
- (v) Straight, raking and curved cutting.
- (vi) Cutting and fitting around light fittings, A/C. equipment, etc.
- (vii) Shop drawings.
- (viii) Supporting framework, angle trims and other accessories.
- (ix) Lining to ceilings, beams and up stands.
- (x) Metal plaster stops, angle beads, etc.

Painting and Decoration

Painting to Structural Steelwork and Metalwork may either be included in this section or within either section to which it occurs and has been measured either as M2 or kg of Steel/Metalwork.

The rates for painting and decorating shall include for the following:

- (i) Painting either internally or externally.
- (ii) All cleaning and preparatory work to the surface to be painted including rubbing down between coats.
- (iii) Priming shall include for using a primer appropriate to the surface to which it is being applied.
- (iv) Preparation of manufactured boards and wood products shall include for surface filling.
- (v) Work on "Woodwork" shall include both softwood and hardwood and for knotting.
- (vi) Extra preparation on metal trims and the like over that of general surfaces in which they are decorated.
- (vii) Unless of a differing specification, work shall be deemed to cover internal or external painting.
- (viii) Work in multi-colors.
- (ix) Work to curved surfaces.

- (x) All cutting into edges.
- (xi) Scaffolding as required and working to or at any height.
- (xii) All narrow widths, cutting to line, opening edges of doors.
- (xiii) Rates for sprayed paint shall include for all masking work.

Mechanical Installations

The rates and prices for plant, equipment and installations are to be all inclusive of supply, installation, testing, commissioning and all associated builders work required for the full operation of such plant, equipment and installations, to comply in all respects with the Specification, Bills of Quantities, Drawings and to the complete satisfaction of the Local Regulatory Body and the Engineer.

The rates for pipework and ductwork shall include for the following:

- (i) All cuttings, short lengths and small quantities.
- (ii) Made bends.
- (iii) Couplers and / or joins in the running length.
- (iv) Splay cut ends.
- (v) All considerations arising from the specification.
- (vi) Fixing with approved holder bats or pipe clips cut and pinned, built in or plugged and screwed.
- (vii) Sleeves through walls.
- (viii) Bends and fittings on pipes whatever the diameter.
- (ix) Fittings to ductwork of all shapes and sizes.
- (x) Rates for cable and duct trench excavation shall include for all excavation, bedding, backfill and disposal as required by the Statutory Authority standard specification.
- (xi) Backfilling to trenches with approved excavated material. If the excavated material is not suitable imported fill shall be used.

The rates for sanitary fittings and the like shall, unless otherwise described or implied, include for the following:

- (i) Assembling component parts including suitable bedding compounds.
- (ii) Flexible connections from the supply point.
- (iii) All necessary plugging and screwing.
- (iv) Joints to water services with straight or bent proprietary connectors.
- (v) Cleaning off all protective wrappers and leaving ready for use.
- (vi) Leaving taps and valves greased, clean and in full working order.

The Contractor shall include for the supply of manufacturers recommended spares as required by the Specification for all mechanical engineering installations and shall submit details of spares to be provided by him on the Schedule of Recommended Spares, including other relevant details.

Rates for Plumbing and HVAC Work

Rates for all pipe work shall include for assembling and joining, pipe supports, pipe sleeves and cover plates and the like. Rates for pipework shall include for all fittings to small pipes (i.e. pipes into an internal dia. of 60mm or less) fittings (except joint in running lengths) to large pipes (i.e.

pipes with internal dia exceeding 60mm) and to gutters shall be enumerated, grouped together for each size of pipe and gutter and described as fittings.

Rates for duct work are to be included all fittings, brackets, hangers and other support.

Rates for insulation are to be included for cutting, waste, joining lap and working around and our ancillaries, fittings, flanges and other obstructions.

Electrical Installations

The rates and prices for plant, equipment and installations are to be all inclusive of supply, installation, testing, commissioning and all associated builders work required for the full operation of such plant, equipment and installations, to comply in all respects with the Specification, Bills of Quantities, Drawings and to the complete satisfaction of the Local Regulatory Body and the Engineer.

The rates in general shall include for the following:

- (i) All cutting, short lengths and small quantities.
- (ii) All joints in the running length and all connections.
- (iii) All considerations arising from the specification.
- (iv) Fixing conduits / cable trays, etc., by approved methods.
- (v) Pipe sleeves through walls.
- (vi) Assembling component parts.
- (vii) Cleaning off all protective wrappers and leaving ready for use.
- (viii) Leaving all equipment etc., clean and in full working order.
- (ix) Draw wires in empty conduits.
- (x) Rates for cable and duct trench excavation shall include for all excavation, bedding, backfill and disposal as required by the Statutory Authority standard specification.
- (xi) Backfilling to trenches with approved excavated material. If the excavated material is not suitable imported fill shall be used.

The Contractor shall include for the supply of manufacturers recommended spares as required by the Specification for all electrical engineering installations and shall submit details of spares to be provided by him on the Schedule of Recommended Spares, including other relevant details.

The cable lengths / routes are measured from point to point on the drawing (horizontal plan distance on the drawing, any cable required for connections, loops, etc., at equipments, appliances, control gear or the like will be deemed to be included.

Multiple Ducts and Cables

The quantity stated in the Bills of Quantities for multiple ducts and cables is the length of a single duct or cable in the particular group of ducts or cables. The contractor will allow the cost of number of ducts or cables in the rate as appropriate. eg., a qty of 50m against a 3 way 200mm dia duct means that a total quantity of $50 \times 3 = 150\text{m}$ of 200mm duct is to be priced for, ditto for cables.

External Services

The rates for all manholes and the like are to be all inclusive of all costs for the complete construction, in accordance with the specifications, drawings and local authority requirements.

External Works

Where external works are analogous to other sections of the work e.g. excavation concrete etc., the clauses elsewhere shall apply equally to this section of the work.

Kerbing – Rates shall include for construction of concrete bed and lacking, supply and laying of precast concrete kerbs either straight or curved, finishing, curing and protecting building in gratings and frame.

Paved areas (footpaths and roadways) – Rates shall include bedding material, supply and laying of paving slabs including all cutting to fit around manhole covers and the like. Allow for forming patterns and designs in the paving stones all as detailed.

The rates for gates and fences in this section shall include for the following:

- (i) Frames including lugs.
- (ii) Sealant.
- (iii) Ironmongery.
- (iv) Decoration.
- (v) Civil works including earthworks, concrete, formwork, reinforcement, protections, etc.

Proprietary Materials

Where manufacturers names or proprietary material names are given against certain items in the Bills of Quantities, the rates and prices inserted shall be for those specified material or other similar and equally approved materials. All proprietary materials shall be installed strictly in accordance with the manufacturer's printed instructions and the Contractor shall be deemed to have allowed for such in his pricing.

Measurable Contract

This Contract is a Measurable type of Contract.

Builder's Work

Drilling, cutting or leaving of holes for pipes, ducts and the like through walls floors, partitions, roofs, etc., and subsequently making good.

Cutting and pinning ends of supports for pipes, equipment, appliances, fittings and the like to walls, floors, partitions, soffits, etc., and making good.

Cutting or leaving mortises, sinking's, etc. for holding down bolts, brackets, supports and the like and grouting in.

Cutting chases for pipes and the like in walls, floors, partitions, etc. and subsequent making good.

Cutting and fitting around, boring holes through and making good of finishing's up to pipes, supports, brackets and the like.

The formation of concrete bases, plinths, etc. for plant, tanks, and equipment, including anti-vibration pads incorporated within the plinth as necessary. The subcontractor shall supply all other vibration isolation.

The painting of exposed pipe work, fittings, equipment etc.

The supply and installation of sub-frames where required for grilles, diffusers, luminaries, sprinkler heads, loudspeakers and the like.

Cutting and making good openings in false ceilings, bulkheads, walls for grilles, diffusers, luminaries, sprinkler heads, loudspeakers and the like.

The Contractor shall be completely responsible for obtaining the requirements for holes, fixings, and any other builders work between trades and ensure that such information as is shown on the drawings is in accordance with his own and the Employer's requirements. Details of builders work which is not shown in the drawings but which are required by the Contractor / Subcontractors shall be forwarded to the Engineer for his written approval before the work is put in hand. Cost of such works shall be borne entirely by the Contractor.

the drilling, cutting or leaving of holes or aperture through structural floors, walls, beams etc., shall be avoided, but where this become a necessity the Contractor must obtain the written approval of the Engineer before such work is put in hand. Cost of such works shall be borne entirely by the Contractor.

Installation of all embeds to be cast to the concrete such as brackets, channels, bolts or plates required for fixing of cladding and curtain walling. Embeds to be provided by the sub-contractor.

Coordination and provision of all necessary holes in the steel structure for fixing of cladding.

"Builders work" will include all the above, but it should be noted that this list is not intended to be exhaustive and everything necessary will be deemed to be included.

The Contractor is referred to the Architectural/Structural Drawings for further information. The Contractor shall allow for any plinths or bases required for MEP equipment installations.

"Builders work" shall include for all penetrations through concrete surfaces for MEP Equipment, including (but not limited to) stair pressurization fans, ventilation openings through skylight up stands, fire barrier seals as required and the like.

Items in respect of general attendance (assistance) to be provided by the Main Contractor to the Nominated Sub-Contractors shall include the following items, free of all charges:

Provision of all site hoardings, fencing, controlled access openings and the like.

Provision of temporary hard standings for vehicular traffic and the like.

Provision of un-hindered access to working areas.

Preparation of the site, including (but not limited to); removal of asphalt road surfacing, kerbs, pavers, lighting poles, bollard, shrubs, signage, telephone kiosks and the termination / relocation of all existing underground and exposed services.

Provision of grid lines / markers and levels, including checking and verification.

Use of Contractor's administrative arrangements including the necessary supervision, coordination and shop drawings as applicable / as required.

Opening and maintaining letters of credit, repayments, etc. as applicable/required.

Unloading, distributing, hoisting and lowering of materials.

Unloading the delivered items to site, checking for damage and processing of insurance claims, as applicable / required.

Use of personnel hoist, stairs, platforms and walkways.

Use of constructional plant.

Use of Contractor's facilities.

Use of Temporary Works.

Space for Sub-Contractor's offices and stores.

Scaffolding, including access scaffolding and mobile platform.

Unloading, distributing, hoisting, lowering and placing in position items of plant, machinery or the like.

Provision of water for the Works and that required for testing and commissioning.

Provision of power and lighting for the Works and power required for testing and commissioning, including fuel and consumption charges.

Lifting, hoisting, craning etc.

Insurance of the Works.

Provision of safe and secure space for offices goods and materials.

Programming of the Work including progress reporting and co-ordination of the Works to comply with the Contractor's programme.

Co-ordination of the whole of the works including the work of Sub-Contractors and any relevant authorities etc.

Provision of protection to finished work.

Clearance of all rubbish and debris.

Cleaning the finished work as part of the final cleaning obligations as detailed in the Specification.

Provision of any specialist scaffolding, access scaffolding and mobile platforms.

Provision of all specialist lifting, hoisting, craning etc. For off-loading, positioning and installation of materials and services equipment.

Co-ordination of the whole of the Works including the work of other Nominated sub-contractors as Domestic Sub-Contractors and providing all special attendance as required for the works which are required by sub-contractors and not covered under General Attendance's.

Profit

Where the Contractor is required to add for 'Profit' a percentage figure shall be inserted as indicated. This percentage value shall include all profits for site office, head office and other overheads.

CONSTRUCTION OF
BOUNDARY WALL AROUND
GIRLS HOSTEL, PHASE II

BILL OF QUANTITIES

GRAND SUMMARY

S.NO:	DESCRIPTION	AMOUNT
A	PRELIMINARIES AND GENERAL REQUIREMENTS	Included in Permanent Works.
B	PERMANENT WORKS	
1	Civil Works	
	• Boundary Wall	
	• Guard Room	
2	Electrical Works Guard Room	
3	Plumbing Works Guard Room	
GRAND TOTAL AMOUNT CARRIED TO FORM OF BID		

Amount in Words _____

S.No	Description	Qty	Unit	Rate	Amount
A	STRUCTURE WORKS All items under this head to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respect and to the entire satisfaction of the Engineer.				
1	Excavation for foundation in all kind of soil/rock from existing ground level upto the required level including site clearing/cleaning, backfilling with approved excavated materials, dressing, leveling, compacting. surplus materials carting away from the site including all leads & lifts and dispose off at approved locations by the Engineer etc. complete in all respect as per specifications, drawings and direction of the Engineer.				
	i) From NGL (+ -) 0.0 upto -1.50 meter depth	810	M ³		
	ii) From - 1.50 meter depth upto - 3.00 meter depth	246	M ³		
2	Supplying and filling earth from approved outside sources including breaking clods, leveling, dressing, watering, consolidating and compacting in 15 cm layers to obtain required density including all lead & lifts etc. complete in all respect as per specifications, drawings and direction of the Engineer.	1516	M ³		
	<u>CONCRETE</u>				
3	Providing and laying plain cement concrete class "E" (1:4:8) in foundation having a minimum Cylindrical strength of 10 Mpa at 28 days, for blinding or under floor where required using approved quality of 25mm maximum size graded crush stone with approved quality sand including rodding, leveling, compacting and curing, including fixing and removing of formwork etc., complete as per specifications, drawings and to the entire satisfaction of Engineer.				
	i) Below foundation, plinth, situ, under Floor /SOG /Ramps and where required	85	M ³		
4	Providing and laying plain cement concrete class "D" (1:3:6) having a minimum Cylindrical strength of 10 Mpa at 28 days, where required using approved quality of 25mm maximum size graded crush stone with approved quality sand including rodding, leveling, compacting and curing, including fixing and removing of formwork etc., complete as per specifications, drawings and to the entire satisfaction of Engineer.	75	M ³		

S.No	Description	Qty	Unit	Rate	Amount
5	<p>Providing and laying Reinforced cement concrete having a minimum Cylindrical strength of 21 Mpa at 28 days, using approved quality of 20 mm maximum size graded crush aggregate with approved quality fine aggregate including mechanically vibrating, leveling, compacting and curing, including fixing and removing of formwork etc., complete as per specifications, drawings and to the entire satisfaction of Engineer.</p> <p>a) Sub-Structure</p> <p>i) Footing of any type</p> <p>ii) Plinth Beams</p> <p>iii) Columns upto Plinth level</p> <p>iv) Retaining / RCC Wall upto Plinth level</p> <p>b) Super-Structure</p> <p>i) Columns</p> <p>ii) Coping Beams etc.</p> <p>REINFORCEMENT</p>	230 60 25 135 35 20	M ³ M ³ M ³ M ³ M ³ M ³		
6	<p>Providing, supplying, cutting, fabricating, placing and installing in position etc., straight or curved and tie hot rolled or cold-worked deformed steel bar reinforcement having minimum yield strength 414 Mpa (60,000 psi), including cost of binding wire, chairs, wastages, precast c.c. spacers and welding where required by the Engineer, as per BS or ASTM standard. Only the overlaps which are shown on drawings or instructed by the Engineer shall be payable as per BSI 4466. Complete as per drawing and specifications for all kind of R.C.C. work. (Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer.)</p> <p>i) Sub-Structure</p> <p>ii) Super-Structure</p>	45 8	M.Ton M.Ton		
7	<p>Providing and applying industrial bitumen coats /paint with waterproofing component 2 coats mixed according to suppliers instruction & specs on all blinding surfaces under foundation etc., complete in all respect, as per specifications & relevant drawings and all works to be carried out the satisfaction of the Engineer.</p>	1960	M ²		
8	<p>Providing and fixing PVC Centre bubble Type ribbed water stops in Tanks & Wall of 300mm wide x 6mm thick including cutting or jointing etc, complete in all respect, as per specifications & relevant drawings and all works to be carried out the satisfaction of the Engineer.</p>	130	Rm		

S.No	Description	Qty	Unit	Rate	Amount
9	Providing and fixing 150mm dia PVC pipe of approved quality & standard for weep holes including cutting or jointing etc., complete in all respect, as per specifications & relevant drawings and all works to be carried out the satisfaction of the Engineer.	110	Nos		
B	ARCHITECTURE WORKS				
10	Providing and laying 50mm thick DPC damp proof course with cement concrete 1:2:4 cast in situ using graded screened crushed stone of 19 mm and down gauge mixed with pudlo (2.5kg per 50kg of cement bag) or any approved equivalent water proofing agent including form work and its removal, true line & level, finishing, compacting, curing etc. complete in all respects as per standard, specification, drawing and entire satisfaction of the Engineer.	85	M ²		
11	Providing and laying 1:3:6 cement concrete Solid Block Masonry straight or curved walls of approved quality blocks strength of block not less than 1000 Psi, setting the blocks in 1:4 cement sand mortar, raked joints including, scaffolding, wedges, strips, M.S 1/4" dia bar/anchors from RCC columns / walls at every third layer horizontally and 1 meter vertically, hacking of existing surface for bonding where necessary, true line & level, finishing, curing etc. at any height & any floor. complete in all respect as per standard, specification, drawing and entire satisfaction of the Engineer.etc. complete in all respect as per specifications and drawings and as directed by the Engineer.	150	M ³		
12	Providing and applying 20mm thick Plaster with Grooves & drip course of C.S mortar 1:4 on external walls, columns or where required etc., using expanded metal mesh on cc & Rcc joints including hacking the concrete surfaces scaffolding corner beads, chamfered edges, rounding off corner etc. All plaster to finish smooth flat in true line, level & plumb and properly cured Complete in all respects as per drawings, specifications and to the entire satisfaction of the Engineer.	2060	M ²		
13	Providing and applying three coats of weather shield paint on external surface of approved colour shade including preparing the surface rubbing with sand paper, filling the voids with filling putti etc., at any height in any floor complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (at any height in any floor)	2060	M ²		

S.No	Description	Qty	Unit	Rate	Amount
14	Providing, fabricating, welding & fixing in position MS tube gate, comprising of 150mm x 150mm x 3.91mm thick MS tube for vertical main frame, 50mm x 75mm x 3.18mm thick tube vertically and horizontally, Ms sheet 18Swg (1.219mm), SS Handle 38mm dia with 900mm long, L-drop both side, drop bolt both side, heavy duty hold fast not less than 12 inches long, wheel track with 75mm angle iron/flat iron etc. including allied works, approved colour enamel paint including & over a coat of red oxide paint as per specification etc. complete in all respect as per drawing, standard, specifications and direction of the Engineer. The contractor shall submit shop drawings (without any additional cost) for approval prior to start of work.	30	Sqm		
15	Providing and fixing 25mm (1 inch) thick thermopore sheets having density 35kg/Cum to fill the Expansion Joint of building, boundary wall etc. complete in all respect as per drawing, standard, specifications and direction of the Engineer.	30	Sqm		
TOTAL CARRIED TO GRAND SUMMARY					

S.No	Description	Qty	Unit	Rate	Amount
A	STRUCTURE WORKS All items under this head to be carried out as per specifications, Drawings, relevant BSI/ASTM Standards, and complete in all respect and to the entire satisfaction of the Engineer.				
1	Excavation for foundation in all kind of soil/rock from existing ground level upto the required level including site clearing/cleaning, backfilling with approved excavated materials, dressing, leveling, compacting. surplus materials carting away from the site including all leads & lifts and dispose off at approved locations by the Engineer etc. complete in all respect as per specifications, drawings and direction of the Engineer.				
	i) From NGL (+ -) 0.0 upto -1.50 meter depth	25	M ³		
	ii) From - 1.50 meter depth upto - 3.00 meter depth	12	M ³		
2	Supplying and filling earth from approved outside sources including breaking clods, leveling, dressing, watering, consolidating and compacting in 15 cm layers to obtain required density including all lead & lifts etc. complete in all respect as per specifications, drawings and direction of the Engineer.	25	M ³		
3	Providing and laying stone soling from approved quarry including hand packing & filling voids with stone material, consolidating & compacting with power or hand roller etc. complete in all respect as per specifications, drawings and direction of the Engineer.	6	M ³		
	CONCRETE				
4	Providing and laying plain cement concrete class "E" (1:4:8) in foundation having a minimum Cylindrical strength of 10 Mpa at 28 days, for blinding or under floor where required using approved quality of 25mm maximum size graded crush stone with approved quality sand including rodding, leveling, compacting and curing, including fixing and removing of formwork etc., complete as per specifications, drawings and to the entire satisfaction of Engineer.				
	i) Below foundation, plinth, situ, under Floor /SOG /Ramps and where required	6	M ³		
5	Providing and laying plain cement concrete class "D" (1:3:6) having a minimum Cylindrical strength of 10 Mpa at 28 days, where required using approved quality of 25mm maximum size graded crush stone with approved quality sand including rodding, leveling, compacting and curing, including fixing and removing of formwork etc., complete as per specifications, drawings and to the entire satisfaction of Engineer.	3	M ³		

S.No	Description	Qty	Unit	Rate	Amount
6	<p>Providing and laying Reinforced cement concrete having a minimum Cylindrical strength of 21 Mpa at 28 days, using approved quality of 20 mm maximum size graded crush aggregate with approved quality fine aggregate including mechanically vibrating, leveling, compacting and curing, including fixing and removing of formwork etc, complete as per specifications, drawings and to the entire satisfaction of Engineer.</p> <p>a) Sub-Structure</p> <p>i) Footing of any type</p> <p>ii) Plinth Beams</p> <p>iii) Columns upto Plinth level</p> <p>b) Super-Structure</p> <p>i) Columns</p> <p>ii) Beams, Lintels & projections etc.</p> <p>iii) Slab & projections etc.</p> <p>REINFORCEMENT</p>	5	M ³		
		5	M ³		
		2	M ³		
		3	M ³		
		6	M ³		
		5	M ³		
7	<p>Providing, supplying, cutting, fabricating, placing and installing in position etc., straight or curved and tie hot rolled or cold-worked deformed steel bar reinforcement having minimum yield strength 414 Mpa (60,000 psi), including cost of binding wire, chairs, wastages, precast c.c. spacers and welding where required by the Engineer, as per BS or ASTM standard. Only the overlaps which are shown on drawings or instructed by the Engineer shall be payable as per BSI 4466. Complete as per drawing and specifications for all kind of R.C.C. work.</p> <p>(Bars to be cut and placed in position at any level according to the Bar bending schedule prepared by the contractor and approved by the Engineer.)</p> <p>i) Sub-Structure</p> <p>ii) Super-Structure</p>	1	M.Ton		
		1	M.Ton		
8	<p>Providing and applying industrial bitumen coats /paint with waterproofing component 2 coats mixed according to suppliers instruction & specs on all blinding surfaces under foundation etc, complete in all respect, as per specifications & relevant drawings and all works to be carried out the satisfaction of the Engineer.</p>	86	M ²		
B	ARCHITECTURE WORKS				
9	<p>Providing and laying 50mm thick DPC damp proof course with cement concrete 1:2:4 cast in situ using graded screened crushed stone of 19 mm and down gauge mixed with pudlo (2.5kg per 50kg of cement bag) or any approved equivalent water proofing agent including form work and its removal, true line & level, finishing, compacting, curing etc. complete in all respects as per standard, specification, drawing and entire satisfaction of the Engineer.</p>	18	M ²		

S.No	Description	Qty	Unit	Rate	Amount
10	Providing and laying machine made Solid Block Cavity wall comprising of 125mm thick inner wall 50mm cavity and 125mm outer wall, using 125mm x 200mm x 300mm approved quality CC 1000 psi solid block for inside & out side wall set in cement sand mortar (1:4), 50mm cavity filled with 38mm thick Master Thermo Shield or approved equivalent sheet having density 35 kg/cum, blocks are required in regular shape, size with sharp square corners and parallel faces, uniform in color, free from flaws and cracks, including scaffolding, racking out the joints, curing, courses shall be kept in plumb, complete in all respect as per drawing, standard, specifications and direction of the Engineer.	35	M ³		
11	Providing and laying 1:3:6 cement concrete Solid Block Masonry straight or curved walls of approved quality blocks strength of block not less than 1000 Psi, setting the blocks in 1:4 cement sand mortar, raked joints including, scaffolding, wedges, strips, M.S 1/4" dia bar/anchors from RCC columns / walls at every third layer horizontally and 1 meter vertically, hacking of existing surface for bonding where necessary, true line & level, finishing, curing etc. at any height & any floor. complete in all respect as per standard, specification, drawing and entire satisfaction of the Engineer.etc. complete in all respect as per specifications and drawings and as directed by the Engineer.	2	M ³		
12	Providing and laying 25mm thick average levelling CC screed over Rcc slab for achieving leveled surface with (1:4) cement sand mortar, complete in all respect and as per drawing & specification and to the entire satisfaction of the Engineer.	30	M ²		
13	Providing and laying in position Water proofing membrane PG-3000 or RL-G300 3mm thick from Pak Hy-Oils, Roofline or approved equivalent over above leveled surface including primer coating, overlapping (horizontal & vertical) complete as per manufacturer's specifications, instruction & as shown in the drawing etc., complete in all respects as per drawings, specification and as directed by the Engineer.	30	M ²		
14	Providing & laying in position 40mm thick Diamond jumbo Lon-Board from Diamond Foam or approved equivalent having density 35kg/cum, over above Water Proofing membrane with rebated edge as per manufacturer's specifications, instruction & as shown in the drawing etc., complete in all respects as per drawings, specification and as directed by the Engineer.	30	M ²		
15	Providing and laying 50mm thick (Avg.) minimum with 3000 psi strength concrete screed including BRC mesh 4" x 4" x 10 swg from AI - Burhan (Pvt) Ltd or approved equivalent in required slope curing, making ridges, valleys, chamfered edges etc. complete in all respects as per drawings, specifications and as directed by the Engineer.	30	M ²		

S.No	Description	Qty	Unit	Rate	Amount
16	Providing and fixing G.I. molded steel door frame 150mm wide, manufactured from galvanized iron steel sheet of 16 gauge having single/double rebate size 38mm x 12mm, with holes and threads. including 4 Nos - 100mm long steel hinges (for each shutter), fitted with one locking box treated, 2 coats of matt enamel paint and over a coat of special red oxide primer coat, filling polecat/Polyester putty on joints and making surface special including cutting holes and filling the cavity with cement concrete 1:2:4 etc. in any floor at any height complete in all respects as per drawings, relevant specifications and as directed by the Engineer.	12	Rm		
17	Providing and fixing fully glazed Bronze anodized or powder coated aluminum Sliding / fixed & open able /Top hung windows & ventilators as per British standard manufactured by Pakistan cable, Lucky, Krudson or approved equivalent (fixing through their approved fabricators) deluxe model box section 95mm x 30mm and 2mm thick including the cost of aluminum netting ,fittings, gaskets with all required accessories & hardware (Hinges/roller, handle, stay, lock, weather strip etc..) 5mm thick distortion free clear local glass, silicon sealant to all junction of CC/RCC member & windows to give water/wind proof, cutting /drilling holes and making good damages to walls etc. complete in all respects as per drawings, relevant specifications and as directed by the Engineer.	3	M ²		
18	Providing, Making & fixing in position 38mm (1-1/2") thick solid core approved colour Formica finish flush door shutters with & without vision panel. Comprising of 6mm thick lamination sheet (manufacturer pressed lamination sheet over lasani board) on either side, over all around best quality Partal or approved wood frame 50mm wide horizontal, vertical & cross /diagonal & 150mm wide lock rail in full length, hollow area except framing to be filled with the approved rough wood, 38mm x 13mm (1-1/2" x 1/2") thick Golden teak wood edge lipping all around. The door shutter mechanically pressed by standard manufacturers under power driven hydraulic press as approved by the Engineer, including polish, nails, glue or any required hardware's and applying solignum for termite treatment, at any height & any floor etc., complete in all respects as per drawing, standard, specifications and direction of the Engineer. (Note: Cost inclusive of Ironmongery such as Hinges, Tower bolts, Locks, Handles, kick & push plate etc.)	5	M ²		

S.No	Description	Qty	Unit	Rate	Amount
19	Providing making and fixing in position floor mounted lower cabinets made of 3/4" thick laminated MDF i/c all around Oak wood lipping, rough wood frame, complete with all accessories i.e. imported magnetic hinges, locks, catchers, best quality handles etc. including termite treatment using termite liquid and (Lacquer polish treatment as separately paid item) complete in all respects (at any height / floor) as per drawing, specifications, and or as directed by the Engineer. (Front face will be measured for payments)	2	M ²		
20	Providing making and fixing in position wall mounted upper cabinets made of 3/4" thick laminated MDF i/c all around Oak wood lipping, rough wood frame, complete with all accessories i.e. imported magnetic hinges, locks, catchers, best quality handles etc. including termite treatment using termite liquid and (Lacquer polish treatment as separately paid item) complete in all respects as per drawing, specifications, and or as directed by the Engineer. (Front face will be measured for payments)	1	M ²		
21	Providing and laying 1:5:10 cement concrete bed under floors using graded Crushed Aggregate 3/4 & down gauge with levelling, ramming, watering and curing etc. complete in all respects and as per drawing, standard, specifications and direction of the Engineer. (under flooring of Marble, Mosaic & Porcelain tiles etc..).	1	M ³		
22	Providing and laying approved Pakistani made Glazed/ unglazed/ Matt ceramic tiles in floor with different sizes, colour and pattern in any floor & any height including & over 1" (25mm) thick cement sand mortar 1:3, setting the tiles in slurry of grey cement over mortar, filling the joints/grouting with approved grouting material, complete in all respects and as per drawing, standard, specifications and direction of the Engineer. Base Price of tile Rs.1600 per Sq.M. (It may be noted that increasing /decreasing in the rate shall be made accordingly).	6	M ²		
23	Providing and fixing Marble tiles flooring 300mm x 300mm/300mm x 600mm x 12mm thick Boticena Fancy marble tiles, fine dressed on the surface without windings in any floor & any height including & over 13 mm (1/2 inch) thick base of cement mortar 1:3 setting of tiles in slurry of grey cement over mortar including filling the joints (grouting) and washing the tiles with white cement slurry & matching colour pigment, curing, finishing, grinding, rubbing, chemical polishing etc. complete in all respects and as per drawing, standard, specifications and direction of the Engineer.	20	M ²		

S.No	Description	Qty	Unit	Rate	Amount
24	Providing and laying 20mm thick pre-polished approved shade Boticena Fancy marble counter top/slab with bull nosing / chamfering, rounded edges, size not less than 1500mm x 600mm for vanity, kitchen counter or where required including & over 40mm thick RCC 1:2:4 slab set in 1:4 C.S mortar, fill the joints by approved grouting material, making hole for wash basin/sink, fixing in wall by cutting/chiseling in RCC/CC member, maintaining the line & level, curing etc., complete in all respects and as per drawing, standard, specifications and direction of the Engineer.	1	M ²		
25	Providing and applying 13mm thick C.S Plaster with 1:4 on internal wall & columns etc., including fixing of 200mm wide strip G.I. Wire Mesh 24 Swg thick at all junctions of concrete and masonry, hacking the concrete surfaces, scaffolding, corner beads etc. making edges, corners, grooves etc. All plaster to finish smooth flat in true line, level & plumb and properly cured Complete in all respects as per drawings, specifications and to the entire satisfaction of the Engineer.	55	M ²		
26	Providing and fixing approved Pakistani make, colour & size ceramic glazed tiles in dado and skirting in any floor & any height, including & over 13 mm (1/2 inch) thick base of cement mortar 1:4 setting of tiles in slurry of grey cement over mortar base including grouting with approve material the joints and washing the tile with white cement slurry curing and cleaning etc., Complete in all respects as per drawings, specifications and to the entire satisfaction of the Engineer.	6	M ²		
27	Providing and fixing 300mm x 150 x 12mm (1/2") thick Pre-Polished Boticena Fancy marble tile skirting set in grey cement slurry including and over 13mm (1/2") thick cement sand mortar base 1:4 & curing etc., Complete in all respects as per drawings, specifications and to the entire satisfaction of the Engineer.	5	Rm		
28	Providing & applying three coats on all internal wall surface with (ICI) Deluxe Matt emulsion paint of approved shade including and over one priming coat, preparation of surface, filling depression with putty, rubbing, sand papering and cleaning etc. at any height in any floor, complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	35	M ²		
29	Providing and applying 13mm thick 1:6 C.S Plaster on ceiling staircase (waist slab, landings & steps) etc., hacking the concrete surfaces, scaffolding etc. All plaster to finish smooth flat in true line, level & plumb and properly cured Complete in all respects as per drawings, specifications and to the entire satisfaction of the Engineer.	25	M ²		

S.No	Description	Qty	Unit	Rate	Amount
30	Providing and applying three coats of Oil Bound Distemper paint on ceiling, including and over one priming coat, preparation of surface, filling depression with putty, rubbing, sand papering and cleaning etc. at any height in any floor, complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer.	25	M ²		
31	Providing and applying 20mm thick Plaster with Grooves & drip course of C.S mortar 1:4 on external walls, columns or where required etc., using expanded metal mesh on cc & Rcc joints including hacking the concrete surfaces scaffolding corner beads, chamfered edges, rounding off corner etc. All plaster to finish smooth flat in true line, level & plumb and properly cured Complete in all respects as per drawings, specifications and to the entire satisfaction of the Engineer.	65	M ²		
32	Providing and applying three coats of weather shield paint on external surface of approved colour shade including preparing the surface rubbing with sand paper, filling the voids with filling putti etc., at any height in any floor complete in all respects as per standard specification, drawing and entire satisfaction of the Engineer. (at any height in any floor)	60	M ²		
33	Providing & Laying free foam natural stone wall cladding random stone 1" & 1-1/2" thick rough finished approved local stone on wall (straight, curved, arches etc.) with cement sand mortar 1:2 making the stone surface smooth, curing, etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	5	M ²		
34	Providing, making & fixing of Rain water spout etc. complete in all respects as per specifications & relevant drawings and all works to the satisfaction of the Engineer. (at any height any floor)	1	Nos		
TOTAL CARRIED TO GRAND SUMMARY					

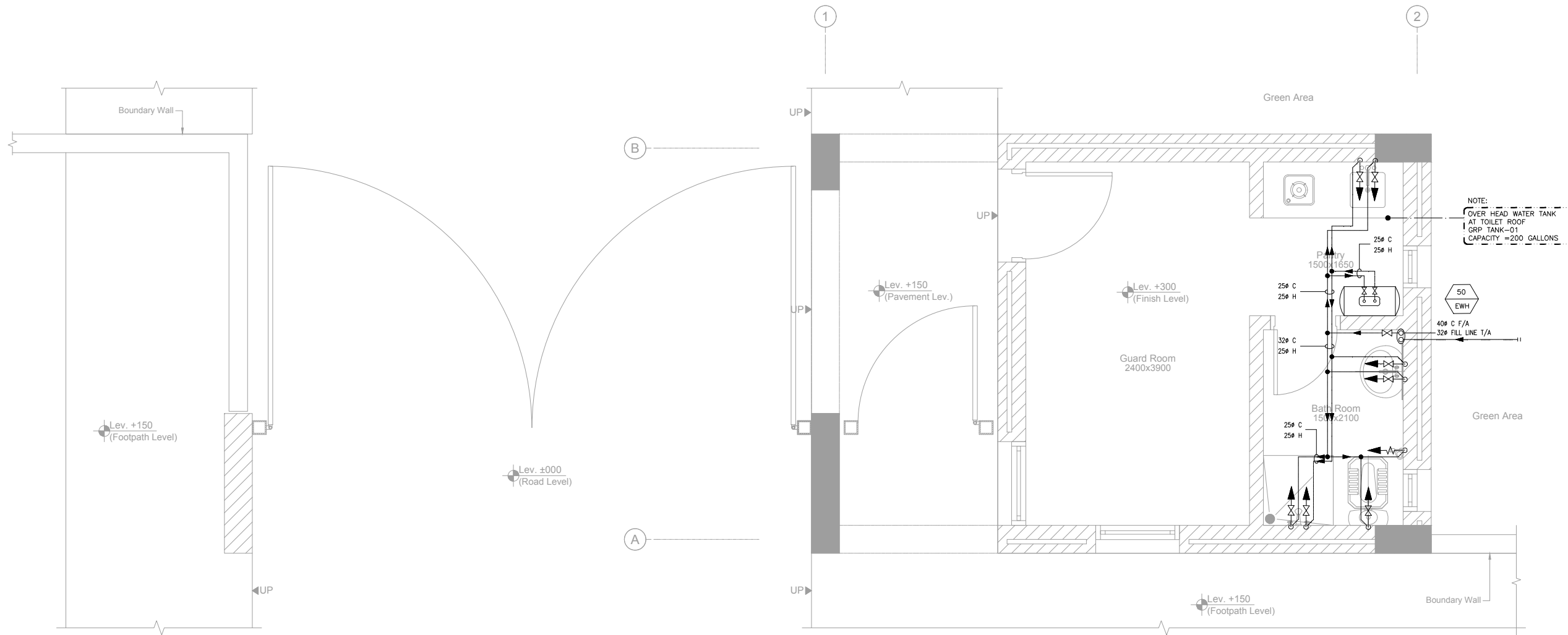
S.No	Description	Qty	Unit	Rate	Amount
1	Supply and installation of following size internal diameter PVC / uPVC Class-D pipe / Flexible PVC Conduit.				
i	25 mm dia PVC Conduit	5	Rm.		
ii	32 mm dia PVC Conduit	10	Rm.		
2	Supply and installation of following size UPVC Pipe Class-D / Road Crossing Sleeves Class-D for Power				
i	50mm dia uPVC Pipe (Class-D)	10	Rm.		
3	Supply and installation of Pull Boxes (Floor / Wall) 16 SWG, Size 300mm x 150mm with all installation	2	No.		
4	Providing and Construction of Manhole Size 3'-0" x 3'-0" x 3'-0" deep, 6"thick, concrete 1:2:4 ratio with 2'	1	No.		
5	Supply, installation, testing and commissioning of following wall mounted surface type Distribution Board (DB) made with 16 SWG sheet metal, dust				
i	LP-DB	1	No.		
6	Supply, installation, testing and commissioning of following 10/13/15/20A, gang type switches, Dimmer				
i	One Gang Switch 10A	2	No.		
ii	Four Gang Switch 10A	1	No.		
iii	One Gang Fan Dimmer Switch 10A	1	No.		
iv	13A, International Switch Socket Outlet	3	No.		
7	Supply, installation, testing and commissioning of following Light fixtures complete with starters, Electronic				
i	Surface Ceiling mounted LED Down light Fixture (IP-20), PF>0.9, 4000K with Aluminum Profile housing and 1x25W LED lamp	4	No.		
ii	Surface Ceiling mounted LED Down light Fixture (IP-44), PF>0.9, 4000K with Aluminum housing and 1x10W LED lamp	1	No.		
8	Supply, installation, testing and commissioning of following types of fan / Bell, including all connecting				
i	56" dia Sweep Ceiling Fan complete with hook	1	No.		
ii	8" dia Exhaust Fan	2	No.		
9	Supply, laying, tagging, testing and commissioning of Circuit wiring from DB to Switchboard including	1	No.		
10	Supply, laying, tagging, testing and commissioning of Point wiring from Switch Board to Light/fan Point	7	No.		
11	Supply, laying, tagging, testing and commissioning of Point wiring from Light point to Light point with 3x1.5	1	No.		
12	Supply, laying, tagging, testing and commissioning of wiring for 13A Switch Socket outlet with 2x2.5 sq.mm				
i	DB to Socket outlet	2	No.		
ii	Socket outlet to Socket outlet	1	No.		
13	Supply, laying, termination, tagging, testing and commissioning of following size copper conductor multi core / single core, unarmoured, 0.6 kV/1 kV, 450/750V or 300/500V voltage				
i	4C, 10 Sqmm Cu/PVC/PVC	50	Rm.		
ii	1C, 10 Sqmm Cu/PVC as ECC	50	Rm.		
TOTAL CARRIED TO GRAND SUMMARY					

S.No	Description	Qty	Unit	Rate	Amount
A	<u>WATER SUPPLY:</u>				
1	Cold and Hot Water Supply Piping Supply, installation Testing and Commissioning of of PPR PN - 20 Cold/Hot water pipes as per DIN 8077-8078 with molded fittings PN - 25 as per DIN 16962, including pipe supports a as indicated on the drawing, as per specifications and Engineers approval.				
	(i) 20 mm dia	20	Rm		
	(ii) 25 mm dia	32	Rm		
	(iii) 32 mm dia	10	Rm		
	(iv) 40 mm dia	10	Rm		
2	Valves Providing and fixing of Isolation/Gate valves of same material as piping as indicated on the drawing, as per specifications and Engineers approval.				
	(i) 25 mm dia	2	Nos.		
	(ii) 32 mm dia	1	Nos.		
	(iii) 40 mm dia	1	Nos.		
3	Water Tank and Connection Connection to external Water supply network including Excavation, Backfill, Piping, Valves etc., complete all in accordance with the drawing and specifications.	1	Job		
4	Plumbing Specialties: Supply and installation of the following including all fittings, fixings, accessories, etc., as indicated on the drawing, as per Specifications and Engineers approval.				
	(i) 20mm dia. Hose Bib	1	Nos.		
	(ii) Air Relief Valve	1	Nos.		
5	Electric Water Heaters Providing and fixing of ceiling hung Electric Hot water heater with all accessories like Clamps, isolation valves, Air relief valves as indicated in the drawings, as per specifications and engineers approval				
	(i) HWC - 01 (Capacity 50 Liter)	1	Nos.		

S.No	Description	Qty	Unit	Rate	Amount
B	<u>SANITARY SEWAGE:</u>				
1	Soil, & Waste Pipes Providing and fixing, uPVC pipes (Class-D) and fittings as per BS EN 1401 for below ground installations for Soil, Waste, Vent & R/w pipes including cleanout plug, clamps, hanger collars, supports, specials (bend, tees, Y-tee etc.) as indicated on the drawing, as per specifications and Engineers approval.				
	(i) 50 mm dia	5	Rm		
	(ii) 75 mm dia	6	Rm		
	(iii) 100 mm dia	4	Rm		
	(iv) 150 mm dia	8	Rm		
2	Drainage Specialties Providing and fixing, PVC floor trap with multiple dia inlet and cleanout plug of the approved self cleaning design with S.Steel grating, as indicated on the drawing, as per specifications and Engineers approval.				
	(i) Floor Trap	2	Nos.		
	(ii) Floor Drain	1	Nos.		
	(iii) Floor Cleanout	1	Nos.		
3	Manholes and Gully traps Construction of 750 x 750 Sanitary sewage manhole with 600x 600 heavy duty cover as specified and shown on the drawing, as per specifications and Engineers approval.	1	Nos.		
	Construction of 450 x 450 gully trap with Sanitary sewage manhole with 300x 300 cover as specified and shown on the drawing, as per specifications and Engineers approval.	1	Nos.		
4	External Connection Connection to external Sewage network, after obtaining approval from local authorities including the cost of excavation, Piping as specified and shown on the drawing, as per specifications and Engineers approval.	1	Job.		

S.No	Description	Qty	Unit	Rate	Amount
C	<u>PLUMBING FIXTURES:</u>				
2	Providing and fixing first quality Eastern type water closet by NMC or Equivalent with flush tank, build in S-Trap, Stop cock, necessary clamps, supports as per drawings, specifications and Engineers Approval.	1	Nos.		
3	Providing and fixing of wash basin by NMC with mixer by Qabil/Sonex, two (2) nos. Stop cocks with Flexible Connection , flexible drain pipe to floor drain as per drawings , specifications and engineers approval.	1	Nos.		
4	Providing and fixing of Shower head by Qabil/Sonex with shower mixer and angle valves as per architectural fixture selection ,complete in all respect.	1	Nos.		
5	Providing and fixing of Pantry Sink by NMC or Equivalent with mixer by Sonex/Qabil and angle valves as per architectural fixture selection ,complete in all respect.	1	Nos.		
6	Providing and fixing bath toilet accessories by Qabil/Faysal as under or Equivalent:				
	(i) Toilet Paper Holder	0	Nos.		
	(ii) Hand Spray / Muslim shower with Double bib cock	1	Nos.		
	(iii) Soap dish	1	Nos.		

S.No	Description	Qty	Unit	Rate	Amount
<p>D 1</p>	<p><u>Fire Fighting Works:</u> <u>Fire Extinguishers</u> Supply and installation of below mentioned Fire Extinguishers as per drawings and Specifications.</p> <p>(i) 6 Kg CO2 wall mounted fire Extinguisher with wall mounted bracket</p> <p>(ii) 5 Kg ABC Type Dry powder Extinguishers with wall mounted bracket</p>	<p>1 1</p>	<p>Nos Nos</p>		
TOTAL CARRIED TO GRAND SUMMARY					



Client :



Consultant :



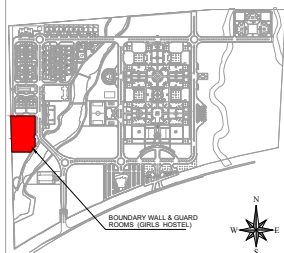
EA Consulting Pvt Ltd

Head Office: AL-9, 15th Lane, Khayaban-e-Hilal Phase 7,
 Defence Housing Authority, Karachi, 75500 - Pakistan
 Phone No. : 111-111-584, Fax No. : 584-1525
 Email : info@eaworld.com | www.eaworld.com

Project :

**UNIVERSITY OF
 TURBAT
 BALOCHISTAN PAKISTAN
 PHASE - II**

Key Plan :



- Note:**
- All dimensions to be checked and verified on Site.
 - Only written dimensions to be followed. Do not scale any drawing.
 - All dimensions are in metre / millimetre unless otherwise specified.
 - All Structural And MEP drawings to be read in conjunction with Architecture drawings.
 - The Architect / Engineer shall be notified of any discrepancy immediately.

North:
 (North Arrow pointing upwards)

Rev. No.	DATE	DESCRIPTION
REVISIONS		

Date of Issue	May 2024
Issued To	Client
Issued For	Tender

PLUMBING

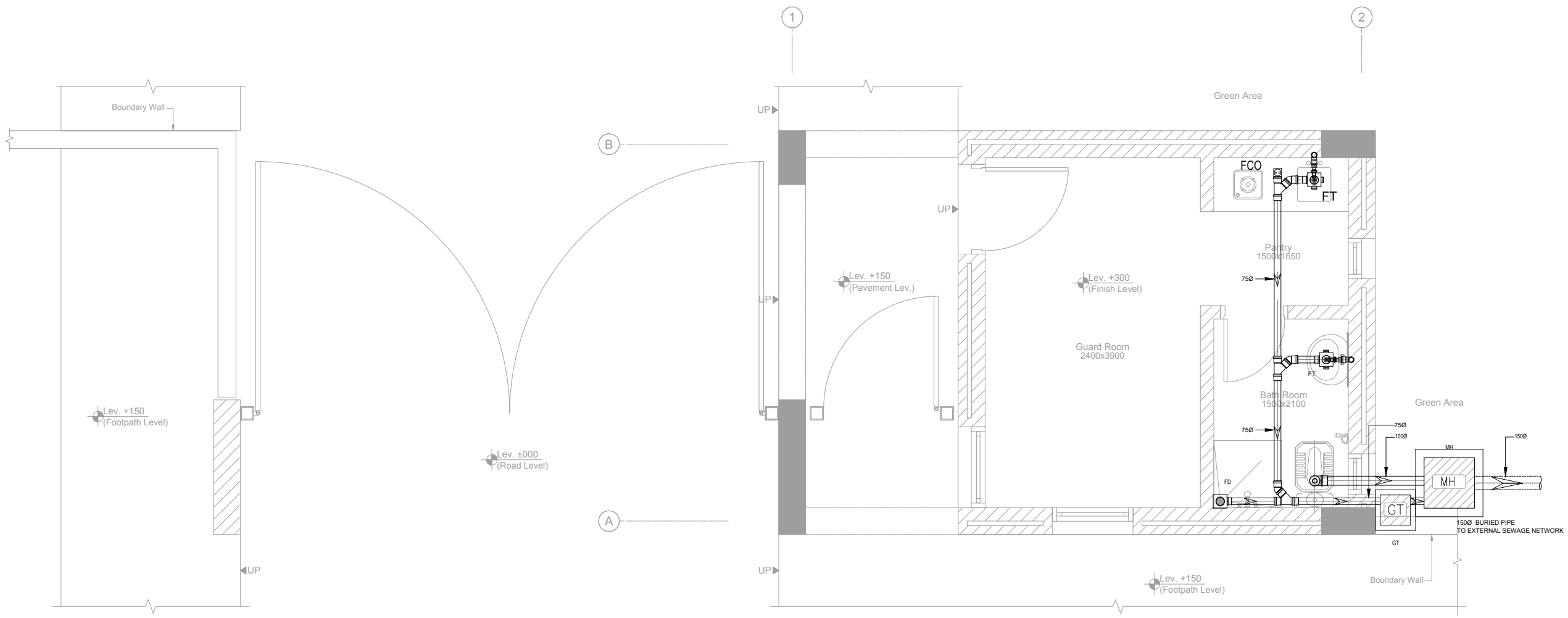
Status:
TENDER

Building Name:
**EXTERNAL DEVELOPMENT
 BOUNDARY WALL & GUARD
 ROOMS (GIRLS HOSTEL)**

Drawing Title:
**GROUND FLOOR PLAN
 (GUARD ROOM - 01)
 WATER SUPPLY LAYOUT**

Designed :	Checked :	Approved :
MS	AT	ZA
Drawn :	Date :	Scale / Sheet :
MS	May 2024	1:50 @ A3 1:25 @ A1
Project Code :	Rev. :	
01067	00	

Drawing No. :
EA-01067-UBGT-W1-0300



Client :



Consultant :

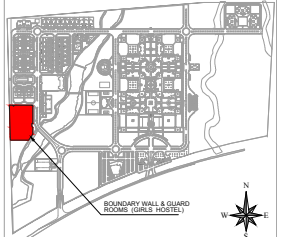


EA Consulting Pvt Ltd
 Head Office: AL-9, 15th Lane, Khayaban-e-Hilal, Phase 7, Defence Housing Authority, Karachi, 75500 - Pakistan
 Phone No: 111-111-5544, Fax No: 594-1925
 Email: info@eaworld.com | www.eaworld.com

Project :

**UNIVERSITY OF TURBAT
 BALOCHISTAN PAKISTAN
 PHASE - II**

Key Plan :



Note:
 • All dimensions to be checked and verified on Site.
 • Only written dimensions to be followed. Do not scale any drawing.
 • All dimensions are in metre / millimetre unless otherwise specified.
 • All Structural And MEP drawings to be read in conjunction with Architecture drawings.
 • The Architect / Engineer shall be notified of any discrepancy immediately.

North:
 (North Arrow pointing up)

Rev. No.	DATE	DESCRIPTION

Rev. No.	DATE	DESCRIPTION

PLUMBING

Status: **TENDER**

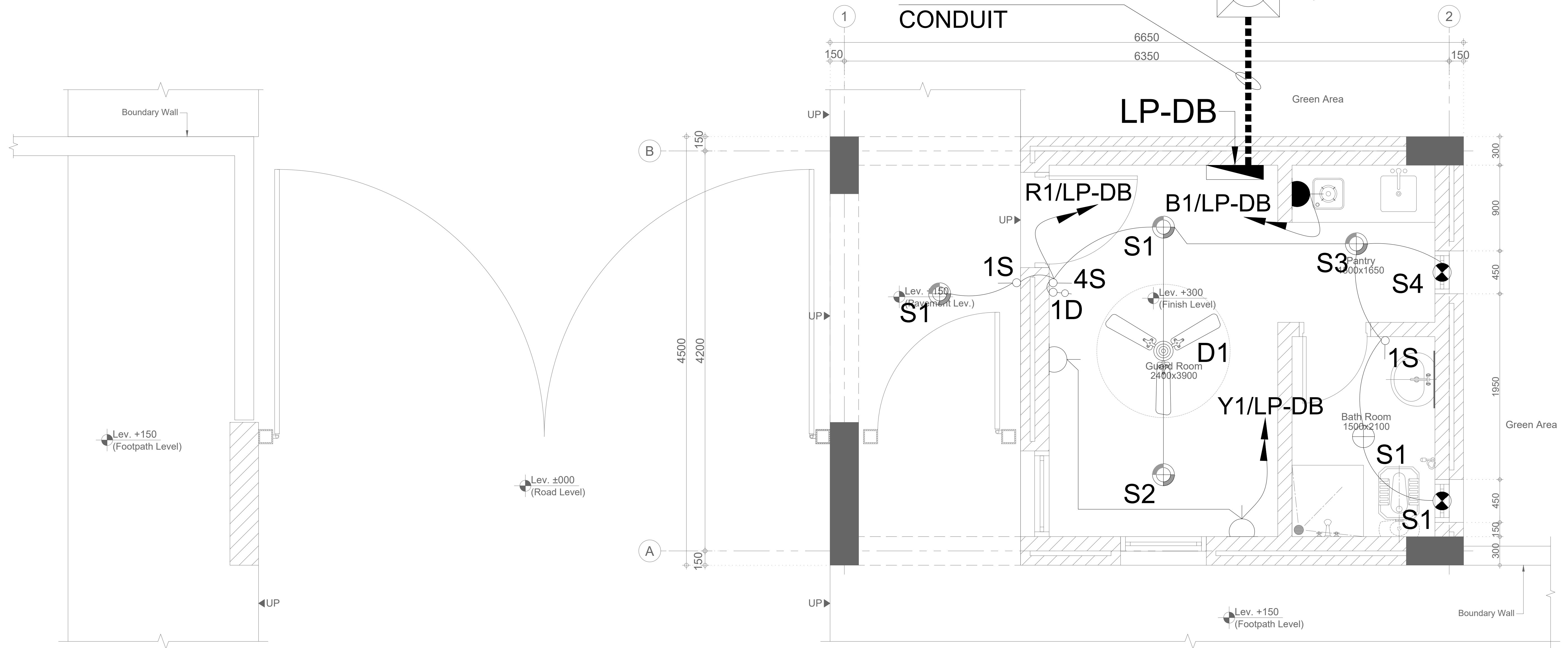
Building Name:
**EXTERNAL DEVELOPMENT
 BOUNDARY WALL & GUARD
 ROOMS (GIRLS HOSTEL)**

Drawing Title:
**GROUND FLOOR PLAN
 (GUARD ROOM - 01)
 DRAINAGE LAYOUT**

Designed :	Checked :	Approved :
MS	AT	ZA
Drawn :	Date :	Scale / Sheet :
MS	May 2024	1:50 @ A3 1:25 @ A1
Project Code :	01067	Rev. : 00
Drawing No. :	EA-01067-UBGT-D1-0300	

REFERENCE INFRASTRUCTURE DRAWING FOR SUPPLY

2Nos 50mmØ uPVC
CONDUIT



LEGEND

S.No.	SYMBOL	DESCRIPTION	LAMP	MOUNTING
01		LIGHTING CONTROL SWITCH (N GANG) / FAN DIMMER (N DIMMER)		WALL
02		DOWN LIGHT FIXTURE , ALUMINUM PROFILE HOUSING (IP-20) , PF>0.9,4000K	1x25 W LED	CEILING SURFACE
03		DOWN LIGHT FIXTURE , ALUMINUM HOUSING (IP-44) , PF>0.9,4000K	1x10 W LED	CEILING SURFACE
04		CEILING FAN 56"		CEILING SURFACE
05		EXHAUST FAN		WALL
06		13A INTERNATIONAL SWITCHED SOCKET OUTLET (LOW LEVEL)		
07		13A INTERNATIONAL SWITCHED SOCKET OUTLET (HIGH LEVEL)		
08		DISTRIBUTION BOARD (DB)		
09		900mm(L)x900mm(W)x900mm(D) MANHOLE (WITH MEDIUM DUTY COVER)		

Client :



Consultant :



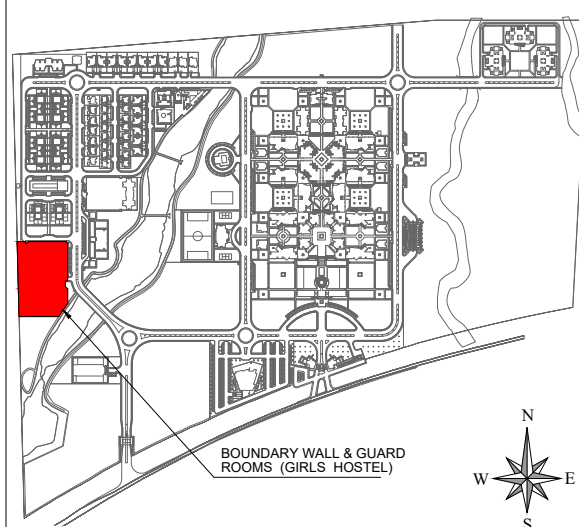
EA Consulting Pvt Ltd

Head Office: AL-9, 15th Lane, Khayaban-e-Hilal, Phase 7, Defence Housing Authority, Karachi, 75500 - Pakistan
Phone No. : 111-111-5544, Fax No. : 594-1825
Email : info@eaworld.com | www.eaworld.com

Project :

**UNIVERSITY OF
TURBAT
BALOCHISTAN PAKISTAN
PHASE - II**

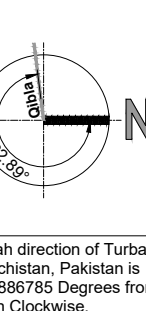
Key Plan :



Note:

- All dimensions to be checked and verified on Site.
- Only written dimensions to be followed. Do not scale any drawing.
- All dimensions are in metre / millimetre unless otherwise specified.
- All Structural And MEP drawings to be read in conjunction with Architecture drawings.
- The Architect / Engineer shall be notified of any discrepancy immediately.

North:



REV. No.	DATE	DESCRIPTION
REVISIONS		

Date of Issue **May, 2024**

Issued To **Client**

Issued For **Tender**

ELECTRICAL

Status:

TENDER

Building Name:

**EXTERNAL DEVELOPMENT
BOUNDARY WALL & GUARD
ROOMS (GIRLS HOSTEL)**

Drawing Title :

**GROUND FLOOR PLAN
(GUARD ROOM - 01)
LIGHTING & POWER LAYOUT**

Designed : _____ Checked : _____ Approved : _____

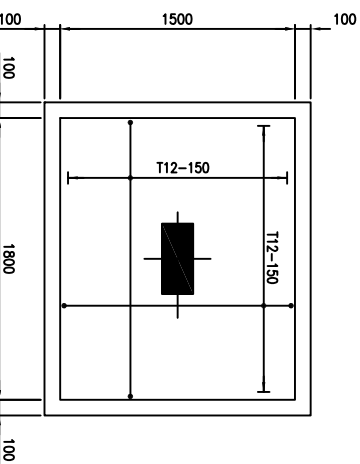
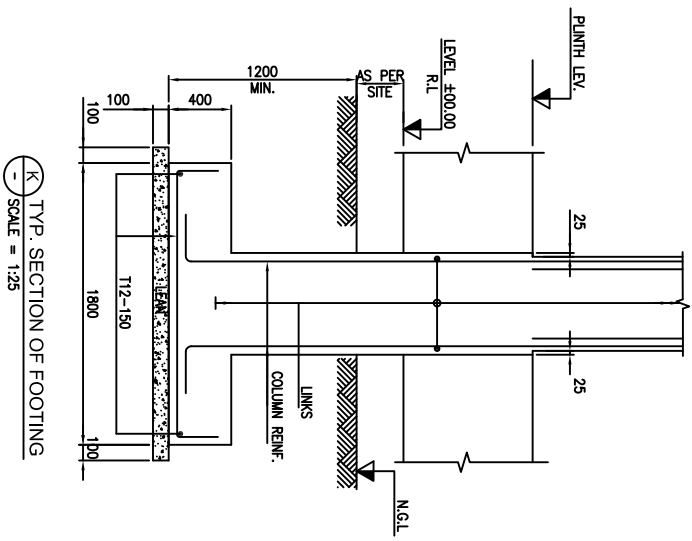
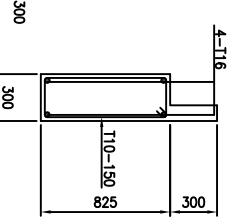
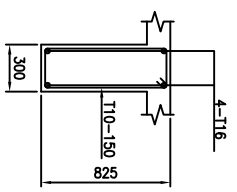
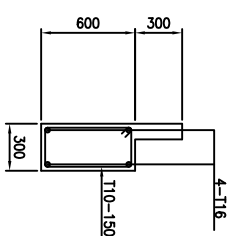
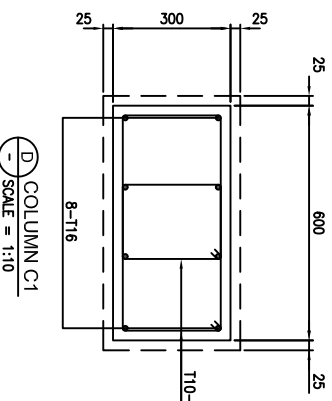
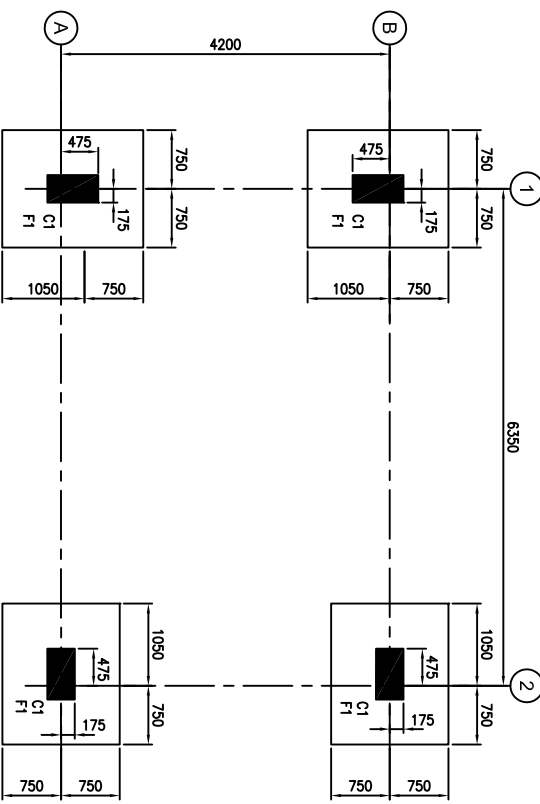
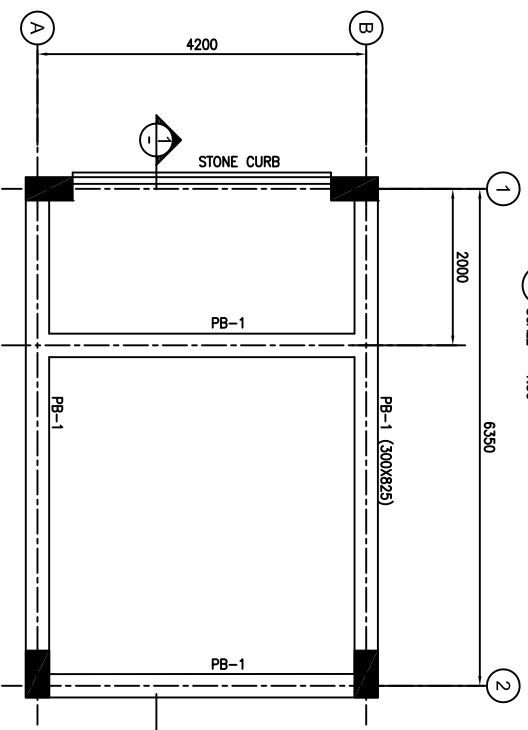
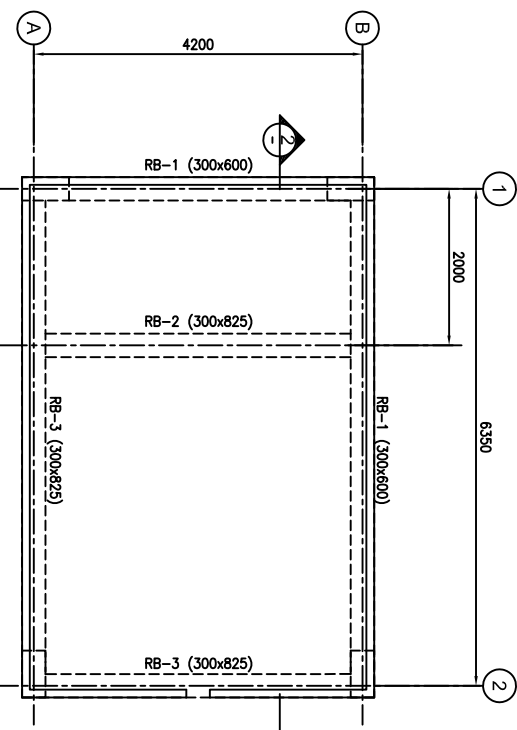
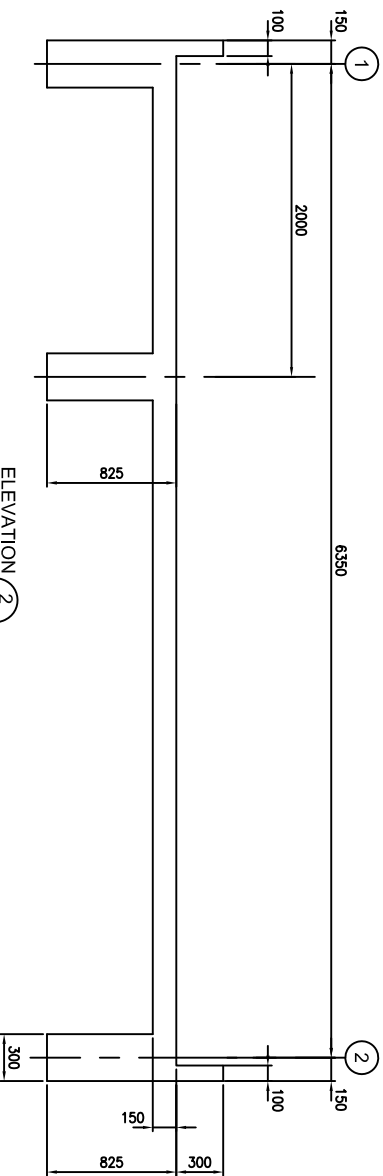
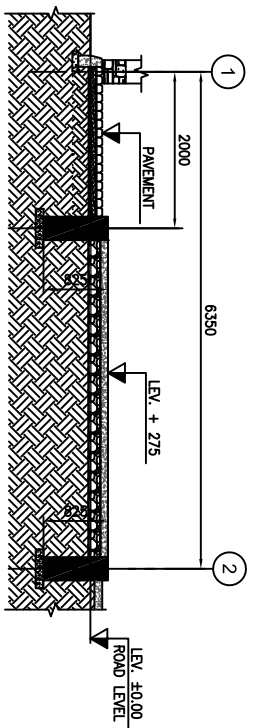
Drawn : _____ Date : _____ Scale / Sheet : _____

Project Code : _____ Rev. : _____

01067 00

Drawing No. : _____

EA-01067-UBGT-EL-0400

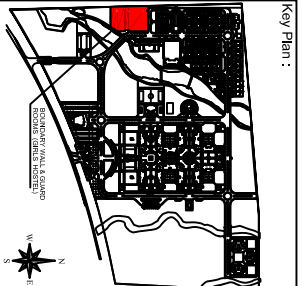


- NOTES:-**
1. ALL DRAWINGS MUST BE READ IN CONJUNCTION WITH ARCHITECTURAL DRAWINGS INCLUDING ALL OTHER RELEVANT DISCIPLINE DRAWINGS.
 2. ALL DIMENSIONS ARE IN MILLIMETERS U.N.O.
 3. MINIMUM 28 DAYS CYLINDRICAL STRENGTH OF STRUCTURAL CONCRETE MEMBERS MUST BE 21 MPa.
 4. ALL FOOTINGS HAVE BEEN DESIGNED USING AN ASSUMED BEARING CAPACITY OF 1.0 TSF. THIS SHOULD BE VERIFIED AT SITE PRIOR TO START OF CONSTRUCTION.
 5. FOOTING MUST BE PLACED ON FIRM WELL COMPACTED AND COMPETENT SOIL AS PER GEOTECHNICAL REPORT.
 6. ALL REINFORCING BARS SHALL BE GRADE 60 DEFERRED BARS WITH YIELD STRENGTH OF 414 MPa CONFORMING TO ASTM-615



EA Consulting Pvt Ltd
 Head Office: 40-15th Lane, Karagah-e-Hind Phase 7, Turbat, Balochistan, Pakistan.
 Phone No.: 9952-1111-4594, Fax No.: 9952-1111-4594
 Email: info@eaconsulting.com | www.eaconsulting.com

UNIVERSITY OF TURBAT
 BALOCHISTAN PAKISTAN
 PHASE - II



NOTES:

- All dimensions to be checked and verified on site.
- Only written dimensions to be used in the drawings.
- All dimensions are in millimeters unless otherwise specified.
- All Structural And MEP drawings to be read in conjunction with the notes.
- The Architect/ Engineer shall be notified of any discrepancy immediately.

Scale: 1:1000
 Date: 15/05/2024
 Issued For: Tender

Rev. No.	DATE	DESCRIPTION
0	15-05-2024	ISSUED FOR TENDER

REVISIONS

DATE OF ISSUE	ISSUED TO	CLIENT
May 2024	Client	Tender

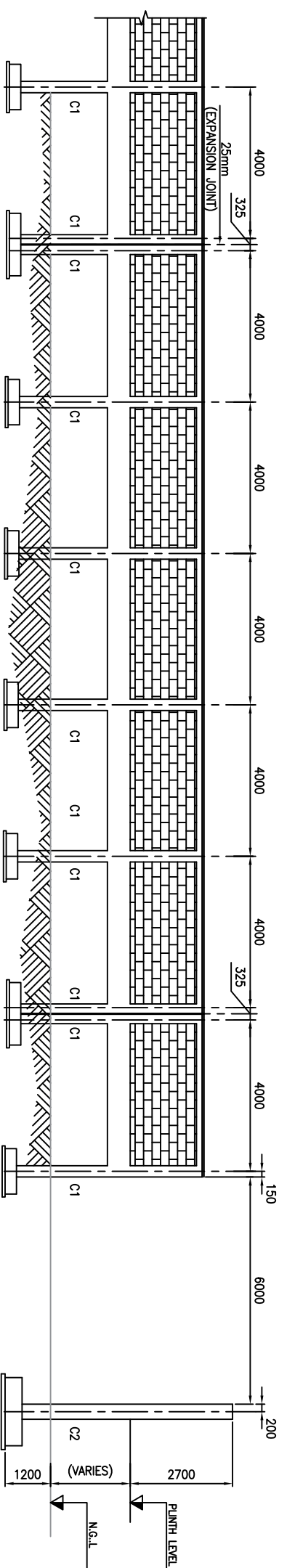
STATUS:

TENDER

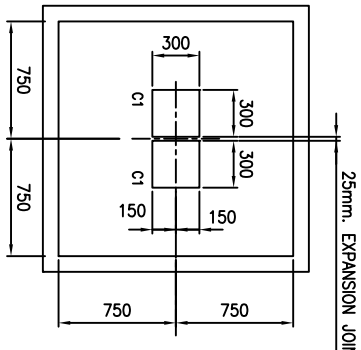
BUILDING NAME:
 EXTERNAL DEVELOPMENT
 BOUNDARY WALL & GUARD
 ROOMS (GIRLS HOSTEL)

DRAWING TITLE:
 GROUND FLOOR &
 ROOF PLAN
 (GUARD ROOM - 02)

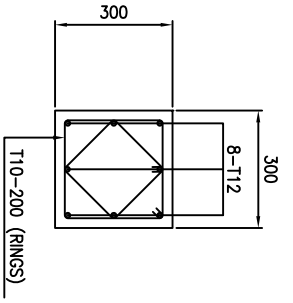
DESIGNED: MR. M.R. (Checked: MR. M.R.)
DATE: July 2022
PROJECT CODE: 01067
SCALE: 1:25 @ A1
REV.: 00
DRAWING NO.: EA-01067-UBGT-ST-01



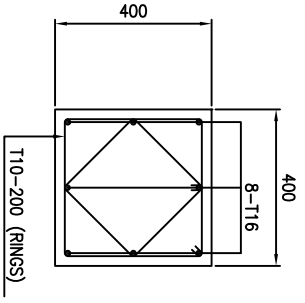
SCALE = 1:75



SCALE = 1:25

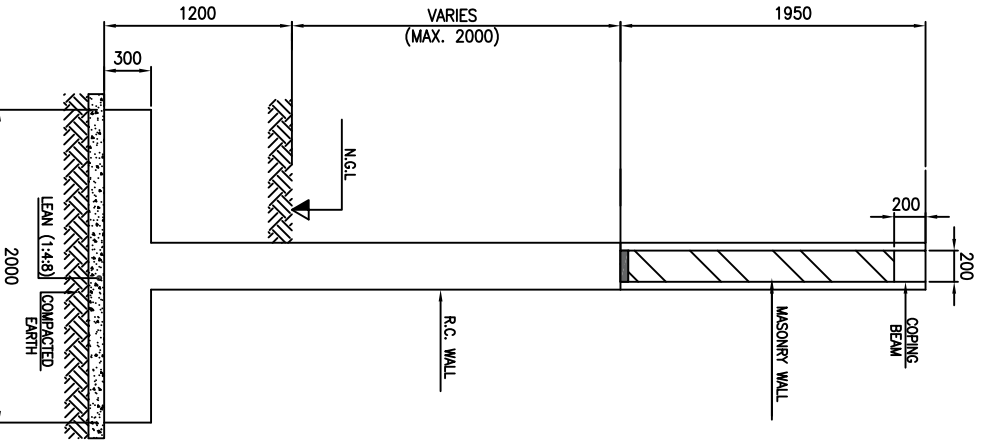


SCALE = 1:10

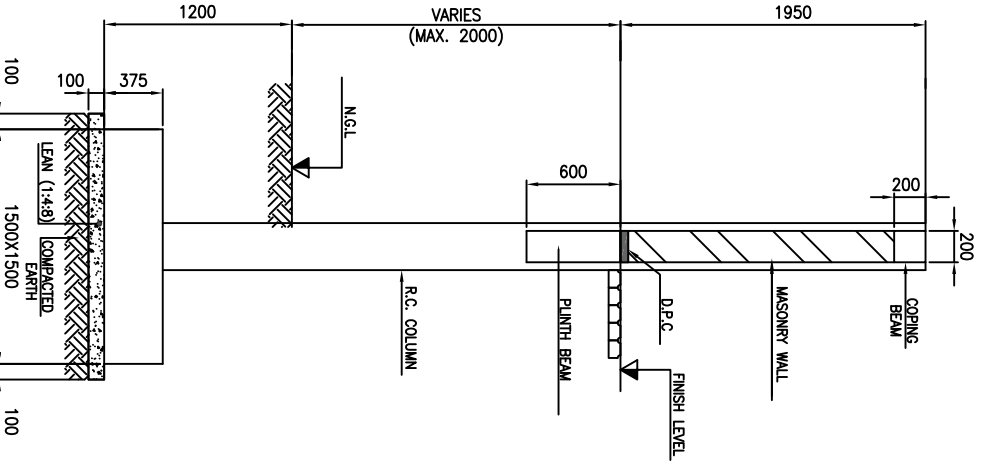


SCALE = 1:10

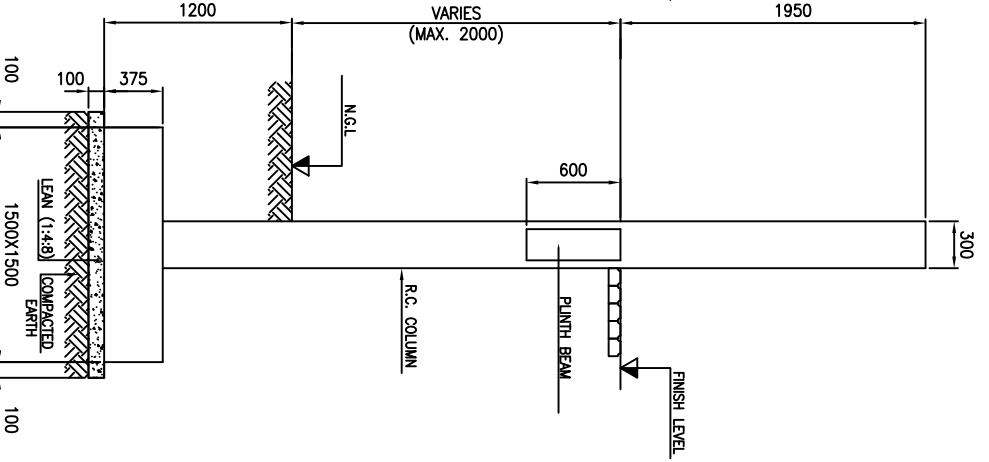
- NOTES:-**
1. ALL DRAWINGS MUST BE READ IN CONJUNCTION WITH ARCHITECTURAL DRAWINGS INCLUDING ALL OTHER RELEVANT DISCIPLINE DRAWINGS.
 2. ALL DIMENSIONS ARE IN MILLIMETERS U.N.O.
 3. MINIMUM 28 DAYS CYLINDRICAL STRENGTH OF STRUCTURAL CONCRETE MEMBERS MUST BE 21 MPa.
 4. ALL FOOTINGS HAVE BEEN DESIGNED USING AN ASSUMED BEARING CAPACITY OF 1.0 TSF. THIS SHOULD BE VERIFIED AT SITE PRIOR TO START OF CONSTRUCTION.
 5. FOOTING MUST BE PLACED ON FIRM WELL COMPACTED AND COMPETENT SOIL AS PER GEOTECHNICAL REPORT.
 6. ALL REINFORCING BARS SHALL BE GRADE 60 DEFORMED BARS WITH YIELD STRENGTH OF 414 MPa CONFORMING TO ASTM-615
 7. RETAINING WALL SHALL BE PROVIDED WHERE DIFFERENCE OF EXISTING GROUND LEVEL AND FINISHED GROUND LEVEL EXCEEDS 1M.



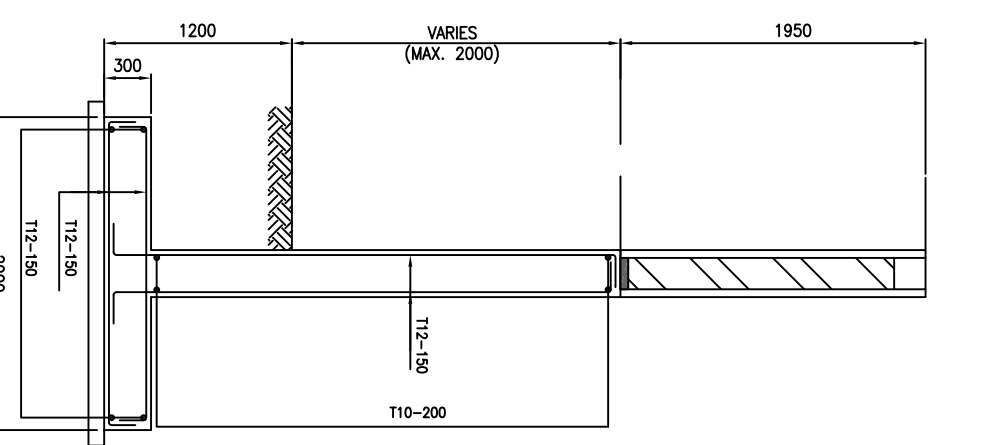
SCALE = 1:25 (DIMENSIONAL)



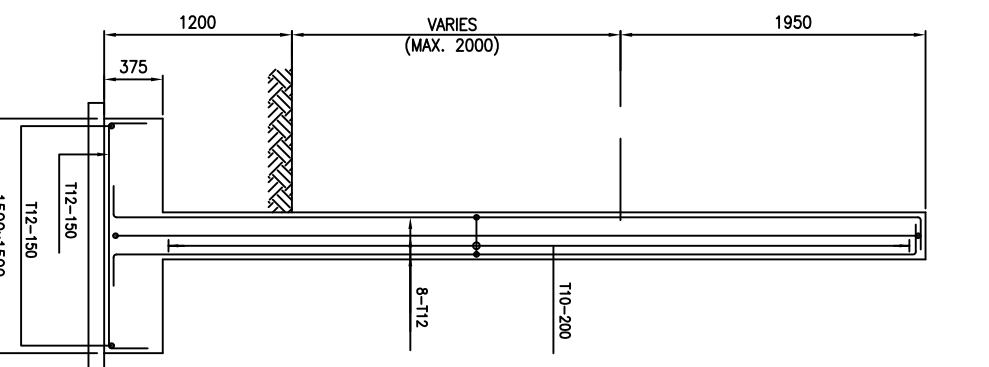
SCALE = 1:25 (DIMENSIONAL)



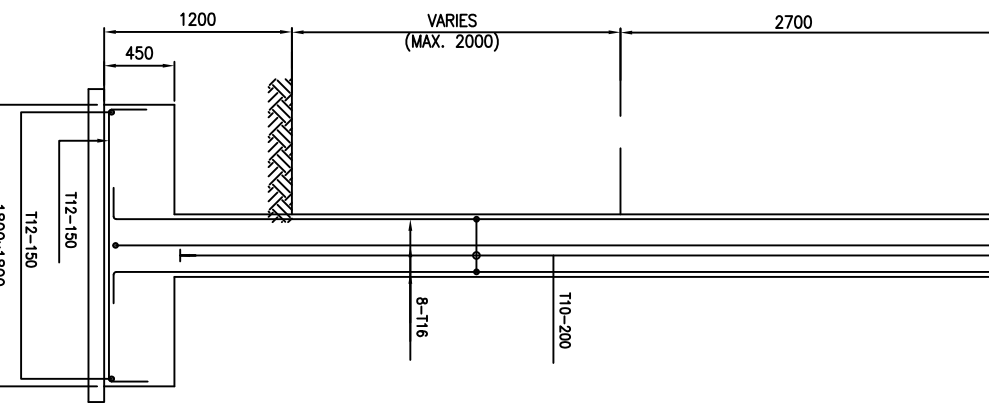
SCALE = 1:25 (DIMENSIONAL)



SCALE = 1:25 (REINFORCEMENT)



SCALE = 1:25 (REINFORCEMENT)



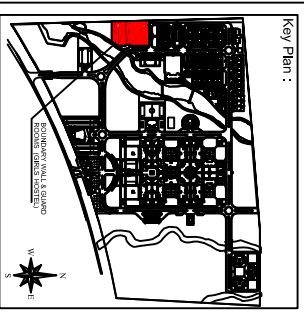
SCALE = 1:25 (REINFORCEMENT)



EA Consulting Pvt Ltd

Head Office: 18th Lane, Kharan Road, Phase 2, Turbat, Balochistan, Pakistan
 Phone No.: 995-111-4594, 995-111-4595, 995-111-4596
 Email: info@eaworld.com | www.eaworld.com

UNIVERSITY OF TURBAT
BALOCHISTAN PAKISTAN
PHASE - II



NOTICE:

- All dimensions to be checked and verified on Site.
- Only written dimensions to be used.
- All dimensions are in meter / millimeter unless otherwise indicated.
- All Structural And MEP drawings to be read in conjunction with the Architect / Engineer shall be notified of any discrepancy immediately.

REV. NO.	DATE	DESCRIPTION
0	06-06-2024	ISSUED FOR TENDER

Date of Issue: May 2024
 Issued To: Client
 Issued For: Tender

STATUS:

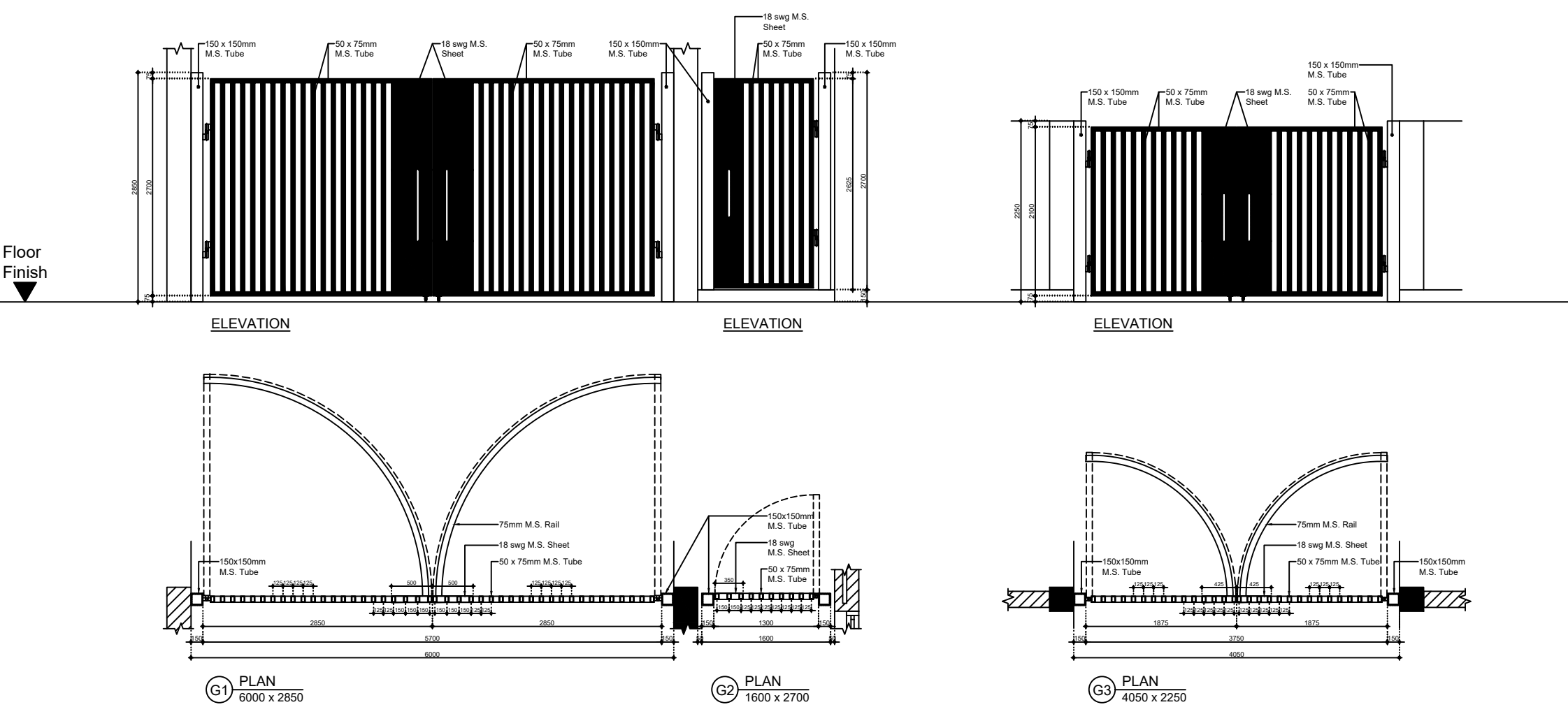
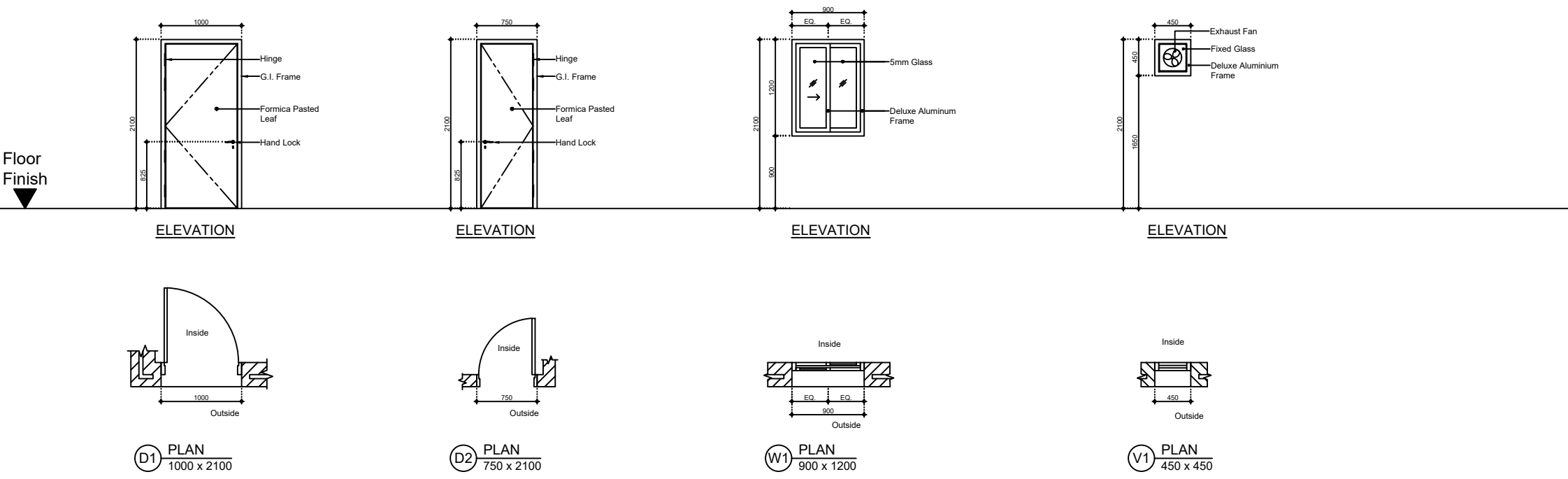
STRUCTURE

TENDER


Building Name:
EXTERNAL DEVELOPMENT
BOUNDARY WALL & GUARD
ROOMS (GIRLS HOSTEL)

Drawing Title:
BOUNDARY WALL
ELEVATION AND SECTIONS


Designed: MR. AK
 Checked: MR. AK
 Date: July 2022
 Project Code: 01067
 Rev.: 00



Client :



Consultant :

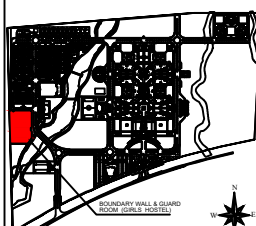


EA Consulting Pvt Ltd
 Head Office: AL-9, 15th Lane, Khayaban-e-Hilal Phase 7, Defence Housing Authority, Karachi - 75500 - Pakistan
 Phone No. : 11-111-554, Fax No. : 594-1925
 Email : info@eaworld.com | www.eaworld.com

Project :

UNIVERSITY OF TURBAT
 BALOCHISTAN PAKISTAN
PHASE - II

Key Plan :



Note:

- All dimensions to be checked and verified on site.
- Only written dimensions to be followed. Do not scale any drawing.
- All dimensions are in metre / millimetre unless otherwise specified.
- All Structural And MEP drawings to be read in conjunction with Architecture drawings.
- The Architect / Engineer shall be notified of any discrepancy immediately.

North:

Chairman Director of Turbat, Balochistan, Pakistan is notified of any discrepancy immediately.

Rev. No.	DATE	DESCRIPTION
REVISIONS		

Date of Issue: May 2024
 Issued To: Client
 Issued For: Tender

ARCHITECTURE

Status: **TENDER**

Building Name: **EXTERNAL DEVELOPMENT BOUNDARY WALL & GUARD ROOM (GIRLS HOSTEL)**

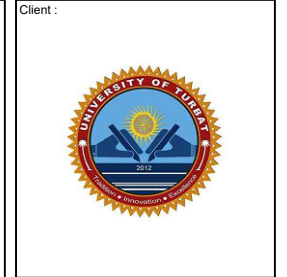
Drawing Title: **DETAIL OF DOOR WINDOWS (PLANS & ELEVATIONS) (GUARD ROOM)**

Designed: MR / Checked: MR / Approved: AK
 Drawn: ME / Date: July 2022 / Scale / Sheet: 1:50 @ A3 / 1:30 @ A1
 Project Code: 01067 / Rev.: 00
 Drawing No.: EA-01067-UBGT-A6-0020

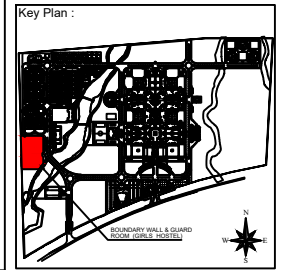
SCHEDULE OF DOORS & WINDOWS

S.#	TYPE / MARK	SIZE		QUANTITY	FRAME	PANEL	HARDWARE
		WIDTH	HEIGHT				
1	D-01	1000	2100	01	18 Gauge G.I Sheet With Matt Enamel Paint	Formica Pasted Over Solid Core Single Leaf Flush Panel	Hand Lock, Tower Bolt, Hinges & Door Stopper, All Items in Stainless Steel - As Per Approved Sample
2	D-02	750	2100	01	18 Gauge G.I Sheet With Matt Enamel Paint	Formica Pasted Over Solid Core Single Leaf Flush Panel	Hand Lock, Tower Bolt & Hinges, All Items in Stainless Steel As Per Approved Sample
3	G-01	6000	2850	01	M.S. Tube (Red Oxide Primer) with Matt Enamel Paint	M.S. Tube (Red Oxide Primer) with Matt Enamel Paint	As Per Design & Detail
4	G-02	1600	2700	01	M.S. Tube (Red Oxide Primer) with Matt Enamel Paint	M.S. Tube (Red Oxide Primer) with Matt Enamel Paint	As Per Design & Detail
5	G-03	4050	2250	01	M.S. Tube (Red Oxide Primer) with Matt Enamel Paint	M.S. Tube (Red Oxide Primer) with Matt Enamel Paint	As Per Design & Detail

S.#	TYPE / MARK	SIZE		QUANTITY	FRAME	PANEL	HARDWARE
		WIDTH	HEIGHT				
1	W-01	900	1200	02	Deluxe Aluminum Frame	5mm Glass, Sliding Panel (As Per Design)	All Items in Aluminum, As Per Approved Sample
2	V-01	450	450	02	Deluxe Aluminum Frame	5mm Glass, Fixed Panel (As Per Design)	All Items in Aluminum, As Per Approved Sample



Project :
**UNIVERSITY OF TURBAT
BALOCHISTAN PAKISTAN
PHASE - II**



Note:
• All dimensions to be checked and verified on site.
• Only written dimensions to be followed. Do not scale any drawing.
• All dimensions are in metre / millimetre unless otherwise specified.
• All Structural And MEP drawings to be read in conjunction with Architecture drawings.
• The Architect / Engineer shall be notified of any discrepancy immediately.

North:
• Detail direction of Turbat, Balochistan, Pakistan is 202.280751 Degree from North Clockwise.

SCHEDULE OF FINISHES

S.#	TITLE	FLOOR	SKIRTING / DADO	WALL	CEILING	REMARKS
1	Guard Room	M.T.F	M.T.S	M.E.P	O.B.D	150mm High Skirting
2	Bath Room	M.C.T	G.C.T	M.E.P	O.B.D	Dado 1500mm High From FFL
3	Pantry	M.C.T	G.C.T	M.E.P	O.B.D	Dado 1500mm High From FFL
Roof Finishes		<ul style="list-style-type: none"> Water Proofing Membrane with Flood Coat + Sand. 50mm Average Screed with BRC Mesh. 40mm Thick Jumbolon Board. 25mm Average Leveling Screed on R.C.C. Slab. 				

DESCRIPTION COMPOUND WORDS		
S.#	ABBREVIATION	DESCRIPTION
1	M.T.F	MARBLE TILES FLOOR
2	M.T.S	MARBLE TILES SKIRTING
3	M.C.T	MATT CERAMIC TILES
4	G.C.T	GLAZED CERAMIC TILES
5	M.E.P	MATT EMULSION PAINT
6	O.B.D	OIL BOND DISTEMPER

LIST OF MATERIAL	
S.#	DESCRIPTION
1	13mm TH. PLAIN CEMENT SAND PLASTER ON ALL INTERNAL WALLS AND CEILING
2	20mm TH. PLAIN CEMENT SAND PLASTER WITH WEATHER SHIELD PAINT ON EXTERNAL WALLS & CHAMRI STONE CLADDING AS PER DRAWING
3	OIL BOND DISTEMPER PAINT ON CEILING
4	MATT EMULSION PAINT ON INTERNAL WALLS
5	MARBLE (BOTICINA) TILES 300x300x12mm TH. CHEMICAL POLISH FLOOR FINISH
6	MARBLE (BOTICINA) SKIRTING 300x150x12mm TH. CHEMICAL POLISH SKIRTING
7	MATT FINISH CERAMIC TILES ON FLOOR IN BATHROOM & PANTRY
8	GLAZED CERAMIC TILES ON WALLS IN BATHROOM & PANTRY

- All Materials To Be Approved By The Architect.
- All Samples Should Be Approved At Least Six Month Before Execution On Site.
- External Finishes are Mentioned on Elevations.

REV. No.	DATE	DESCRIPTION

Date of Issue: **May 2024**
Issued To: **Client**
Issued For: **Tender**

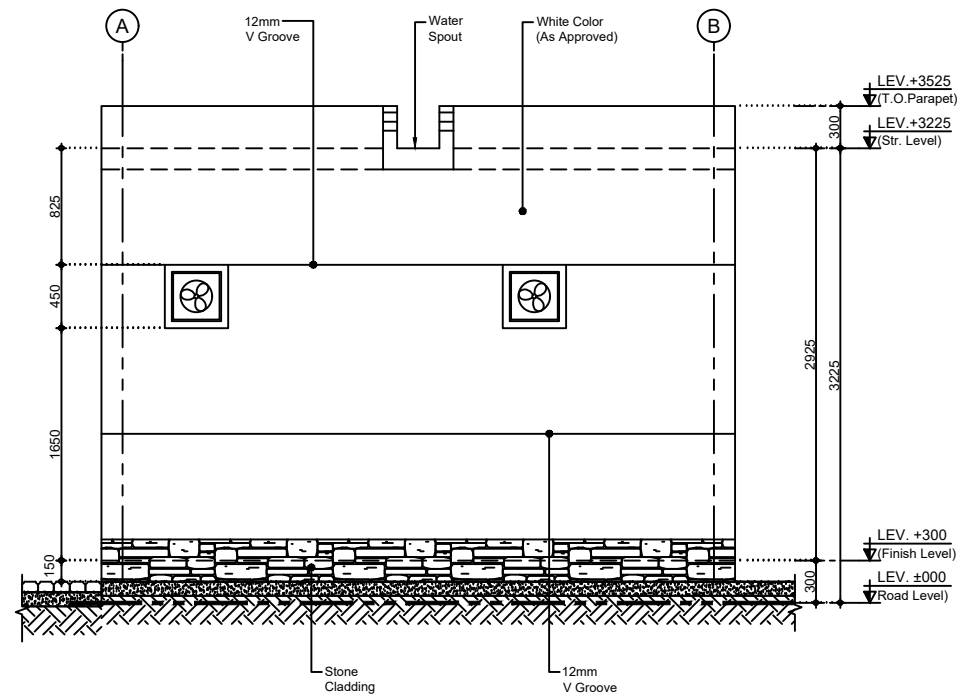
ARCHITECTURE

Status: **TENDER**

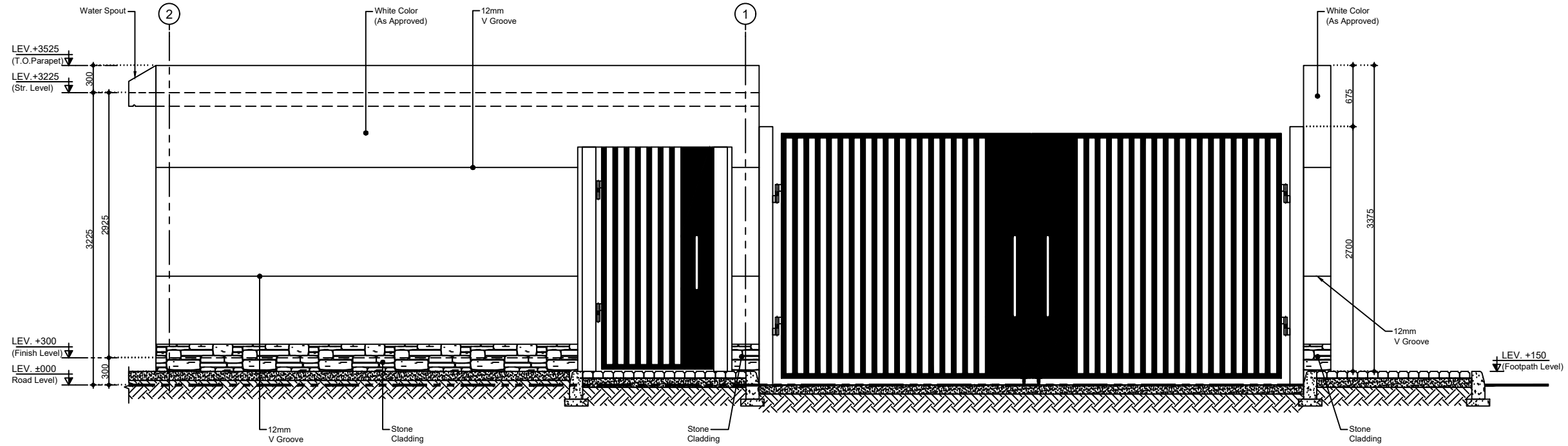
Building Name:
**EXTERNAL DEVELOPMENT
BOUNDARY WALL & GUARD
ROOM (GIRLS HOSTEL)**

Drawing Title:
**SCHEDULE OF FINISHES
& DOOR WINDOWS
(GUARD ROOM)**

Designed : MR	Checked : MR	Approved : AK
Drawn : MR	Date : July 2022	Scale / Sheet : NTS @ A3
Project Code : 01067	Rev. : 00	
Drawing No. : EA-01067-UBGT-A6-0010		



ELEVATION - 04



ELEVATION - 03

Client :



Consultant :



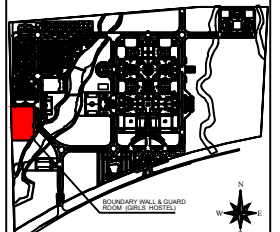
EA Consulting Pvt Ltd

Head Office AL-9 15th Lane, Khayaban-e-Hilal Phase 7,
Defence Housing Authority, Karachi 75500 - Pakistan
Phone No. 111-111-554, Fax No. 584-1825
Email : info@eaworld.com | www.eaworld.com

Project :

**UNIVERSITY OF
TURBAT
BALOCHISTAN PAKISTAN
PHASE - II**

Key Plan :



Note:
• All dimensions to be checked and verified on site.
• Only written dimensions to be followed. Do not scale any drawing.
• All dimensions are in **metre / millimetre** unless otherwise specified.
• All Structural And MEP drawings to be read in conjunction with Architecture drawings.
• The Architect / Engineer shall be notified of any discrepancy immediately.

North:

Rev. No.	DATE	DESCRIPTION

Rev. No.	DATE	DESCRIPTION

Date of Issue	May 2024
Issued To	Client
Issued For	Tender

ARCHITECTURE

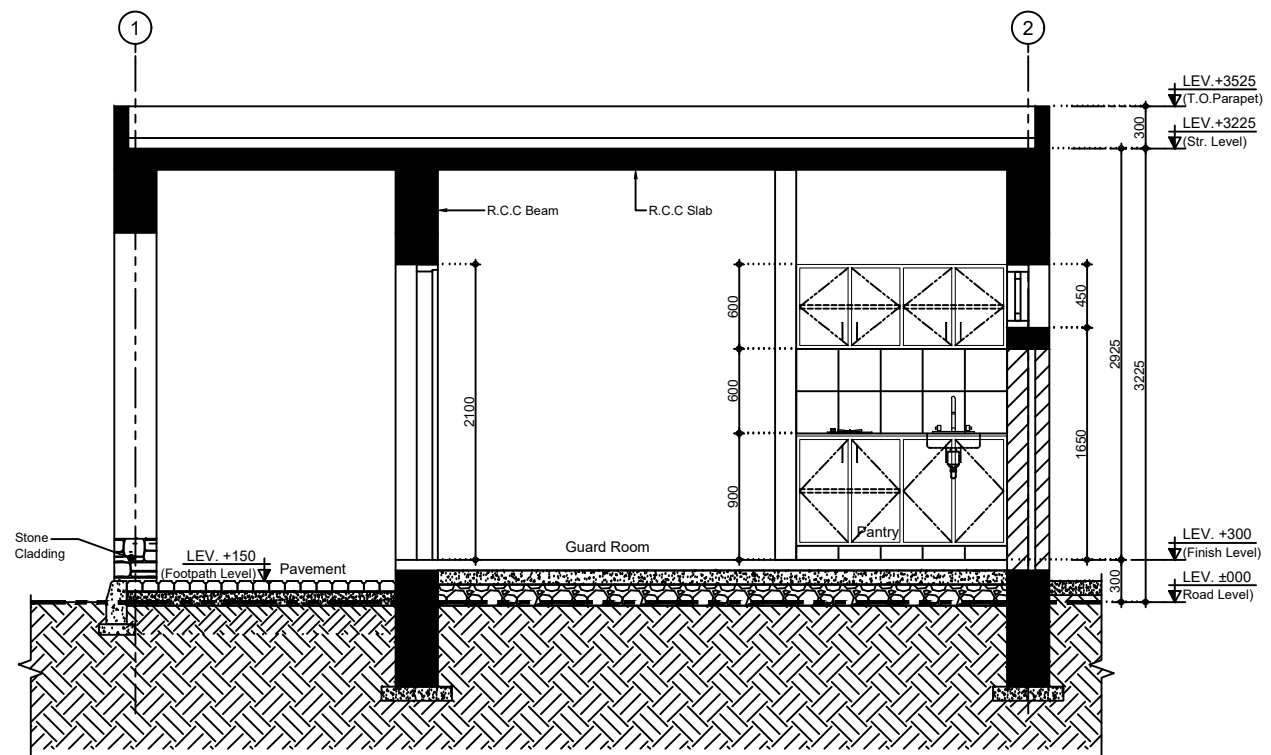
Status: **TENDER**

Building Name:
**EXTERNAL DEVELOPMENT
BOUNDARY WALL & GUARD
ROOM (GIRLS HOSTEL)**

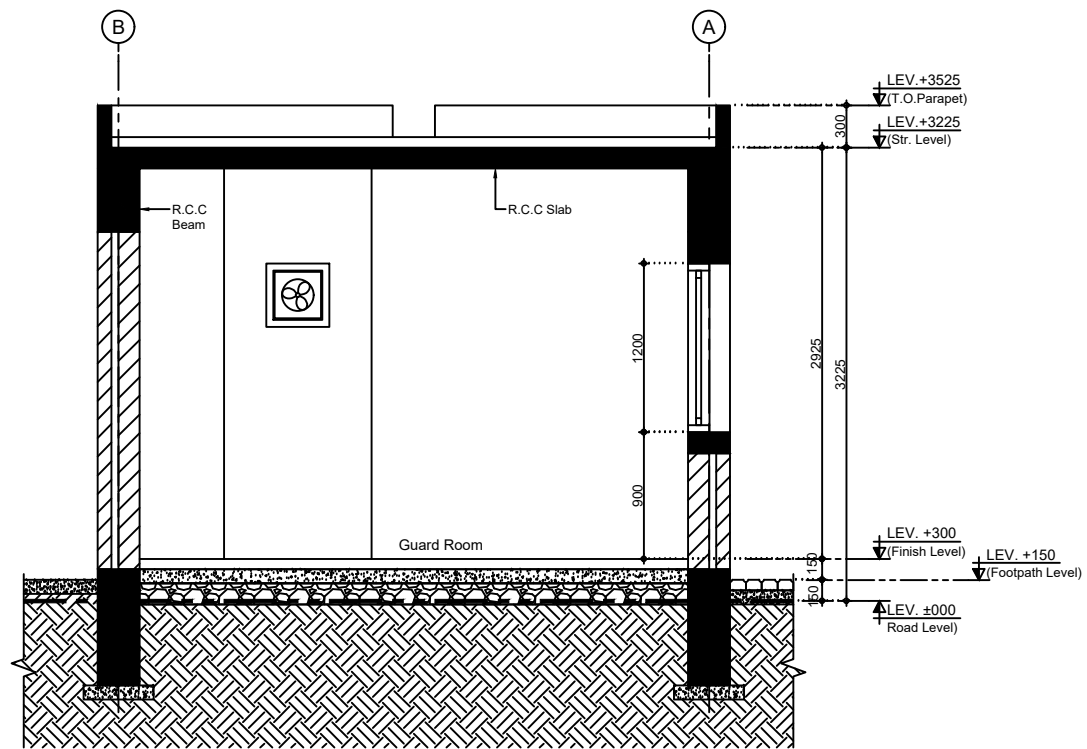
Drawing Title :
**ELEVATION 03 & 04
(GUARD ROOM)**

Designed :	Checked :	Approved :
MR	MR	AK
Drawn :	Date :	Scale / Sheet :
MAE	July 2022	1:50 @ A3 1:25 @ A1
Project Code :	01067	Rev. : 00

Drawing No. :
EA-01067-UBGT-A3-0020




SECTION B-B



SECTION A-A

Client :



Consultant :

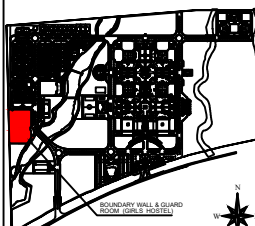


EA Consulting Pvt Ltd
 Head Office-AL-9, 15th Lane, Khayaban-e-Hilal, Phase 7,
 Defence Housing Authority, Karachi - 75500 - Pakistan
 Phone No. : 11-111-584, Fax No. : 584-1825
 Email : info@eaworld.com | www.eaworld.com

Project :

**UNIVERSITY OF
TURBAT
BALOCHISTAN PAKISTAN
PHASE - II**


Key Plan :



Note:

- All dimensions to be checked and verified on site.
- Only written dimensions to be followed. Do not scale any drawing.
- All dimensions are in metre / millimetre unless otherwise specified.
- All Structural And MEP drawings to be read in conjunction with Architecture drawings.
- The Architect / Engineer shall be notified of any discrepancy immediately.

North:



Obtain direction of Turbat, Balochistan, Pakistan is 212.88876 Degree from North Clockwise.

Rev. No.	DATE	DESCRIPTION

Rev. No.	DATE	DESCRIPTION

Date of Issue	May 2024
Issued To	Client
Issued For	Tender

ARCHITECTURE

Status:

TENDER

Building Name:

**EXTERNAL DEVELOPMENT
BOUNDARY WALL & GUARD
ROOM (GIRLS HOSTEL)**

Drawing Title :

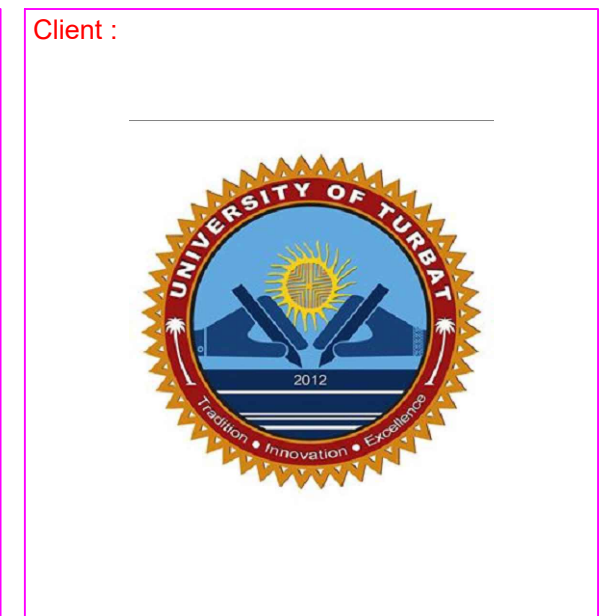
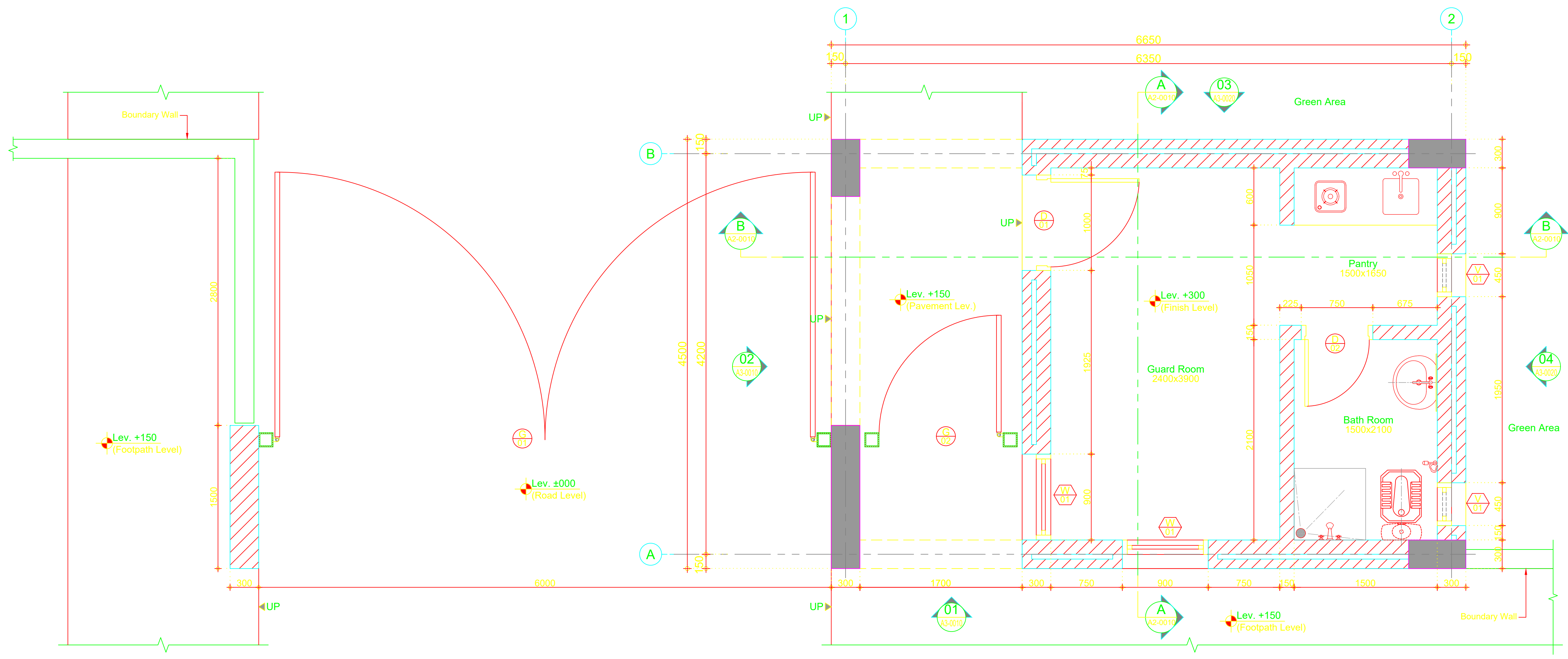
**SECTION A-A & B-B
(GUARD ROOM)**

Designed : MR Checked : MR Approved : AK
 Drawn : MAE Date : July 2022 Scale / Sheet : 1:50 @ A3
 Project Code : 01067 Rev. : 00

Drawing No. :
EA-01067-UBGT-A2-0010

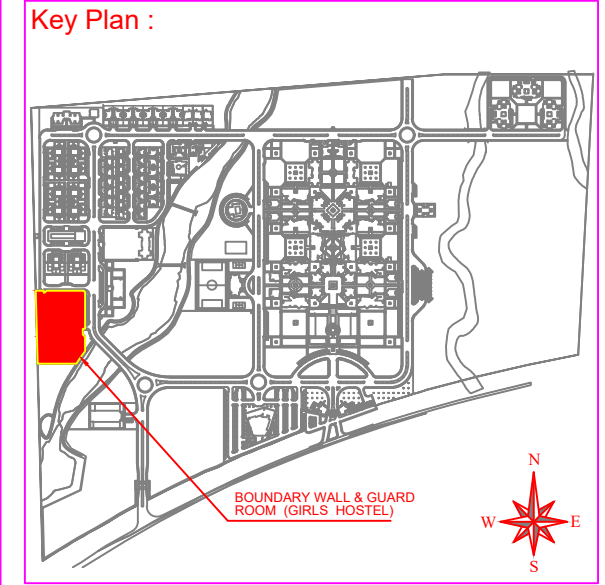
NOTE :

1. FLOOR FINISH LEVEL: + 300 = +164.150
2. PAVEMENT LEVEL: + 150 = +164.000



Project :

**UNIVERSITY OF TURBAT
 BALUCHISTAN PAKISTAN
 PHASE - II**



Note:

- All dimensions to be checked and verified on Site.
- Only written dimensions to be followed. Do not scale any drawing.
- All dimensions are in **metre / millimetre** unless otherwise specified.
- All Structural And MEP drawings to be read in conjunction with Architecture drawings.
- The Architect / Engineer shall be notified of any discrepancy immediately.

North:

Qiblah direction of Turbat, Balochistan Pakistan is 252.88765 Degree from North Clockwise.

Rev. No.	DATE	DESCRIPTION
REVISIONS		

Date of Issue: **May 2024**
 Issued to: **Client**
 Issued For: **Tender**

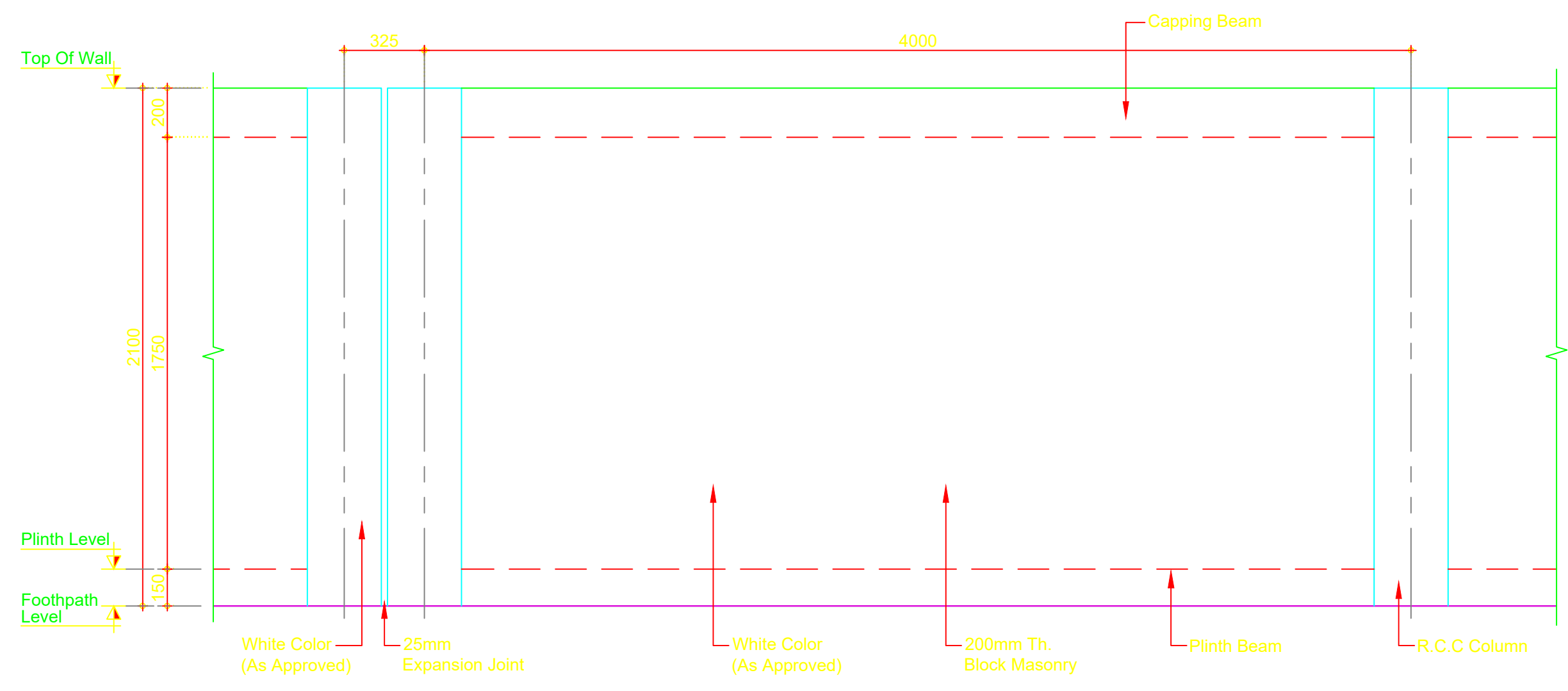
ARCHITECTURE

Status: **TENDER**

Building Name:
**EXTERNAL DEVELOPMENT
 BOUNDARY WALL & GUARD ROOM (GIRLS HOSTEL)**

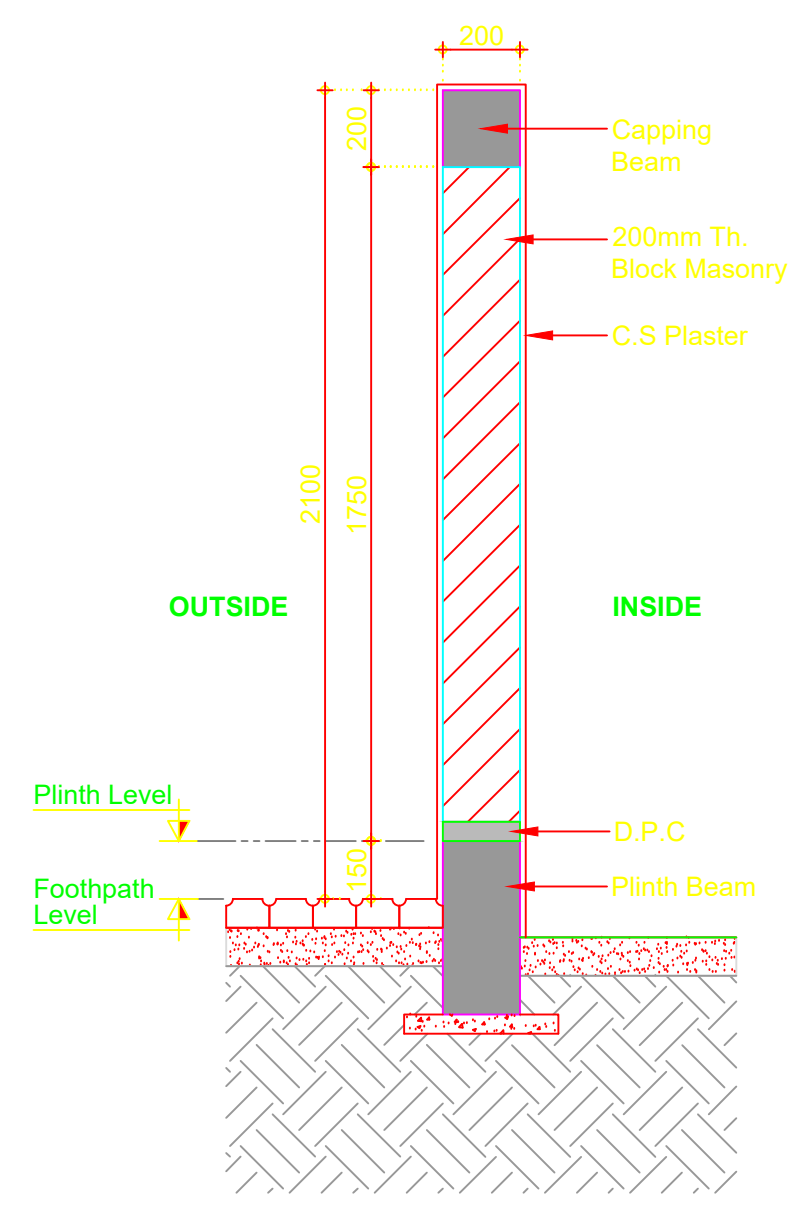
Drawing Title :
**GROUND FLOOR PLAN
 (GUARD ROOM)**

Designed :	Checked :	Approved :
MR	MR	AK
Drawn :	Date :	Scale / Sheet :
MAB	July 2022	1:50 @ A3 1:25 @ A1
Project Code :	Rev. :	
	01067	00
Drawing No. :	EA-01067-UBGT-A1-0300	



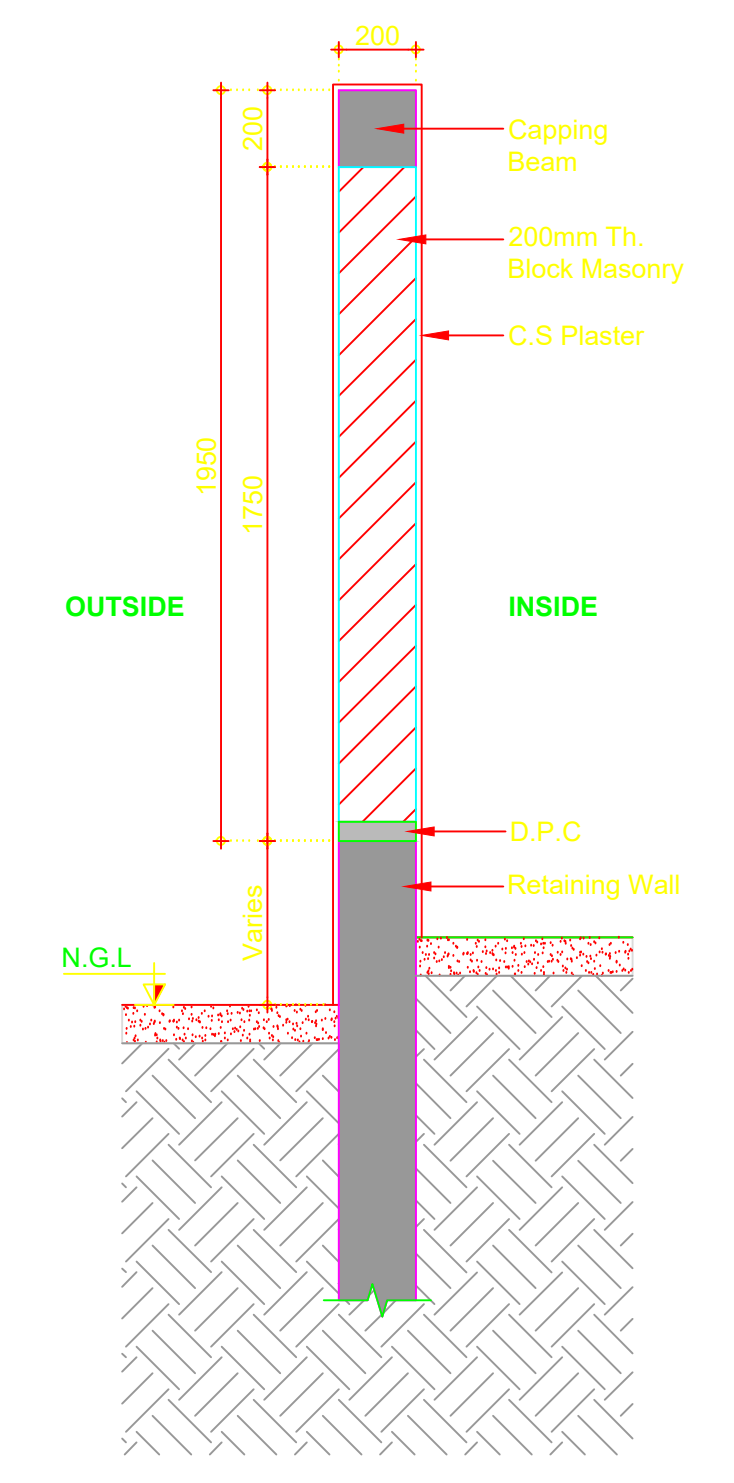
DETAIL - 02 (ELEVATION)

Scale = 1:20



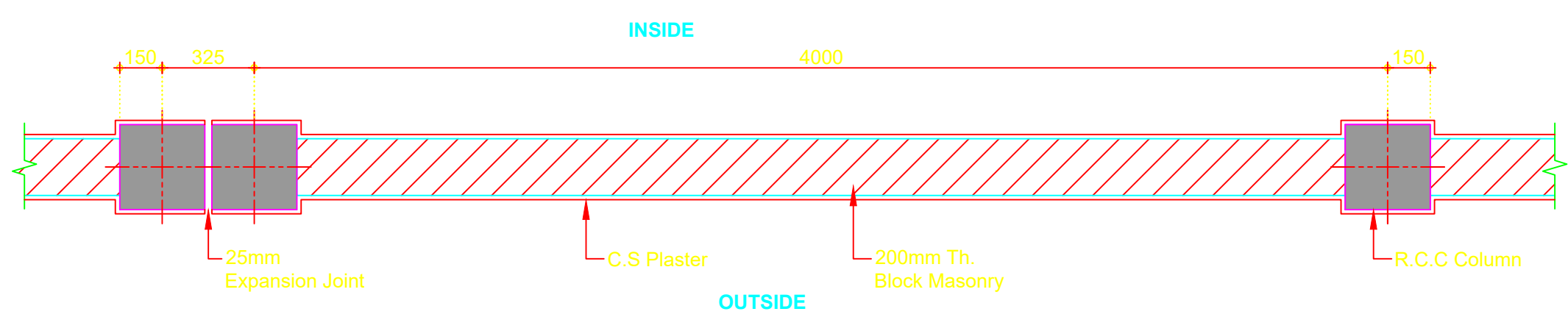
SECTION - A

Scale = 1:20



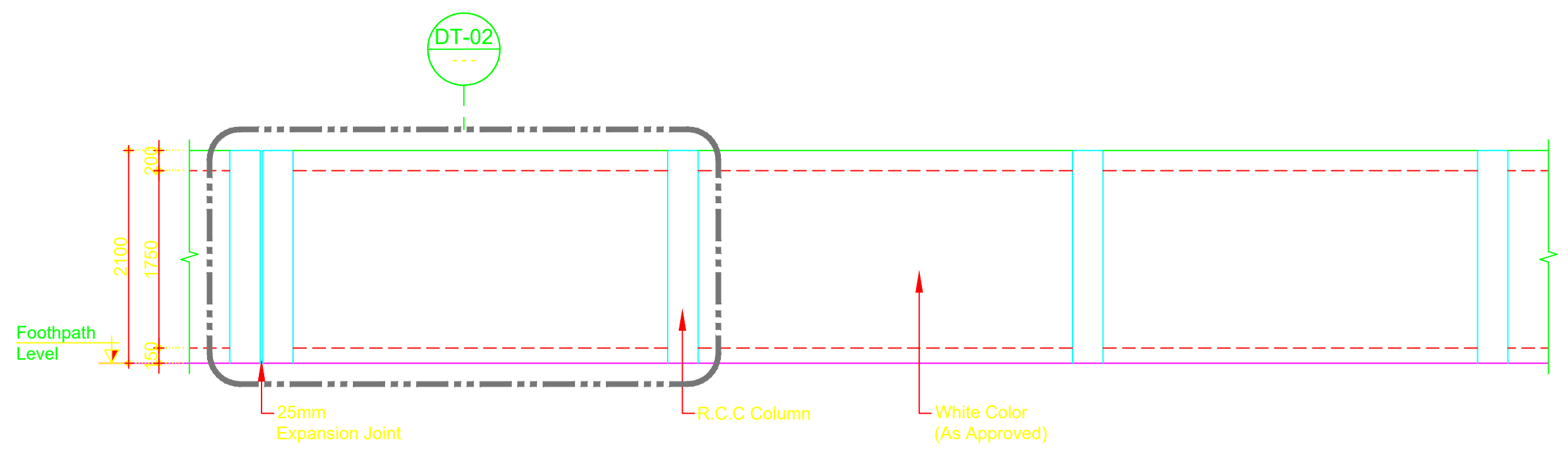
SECTION - B

Scale = 1:20



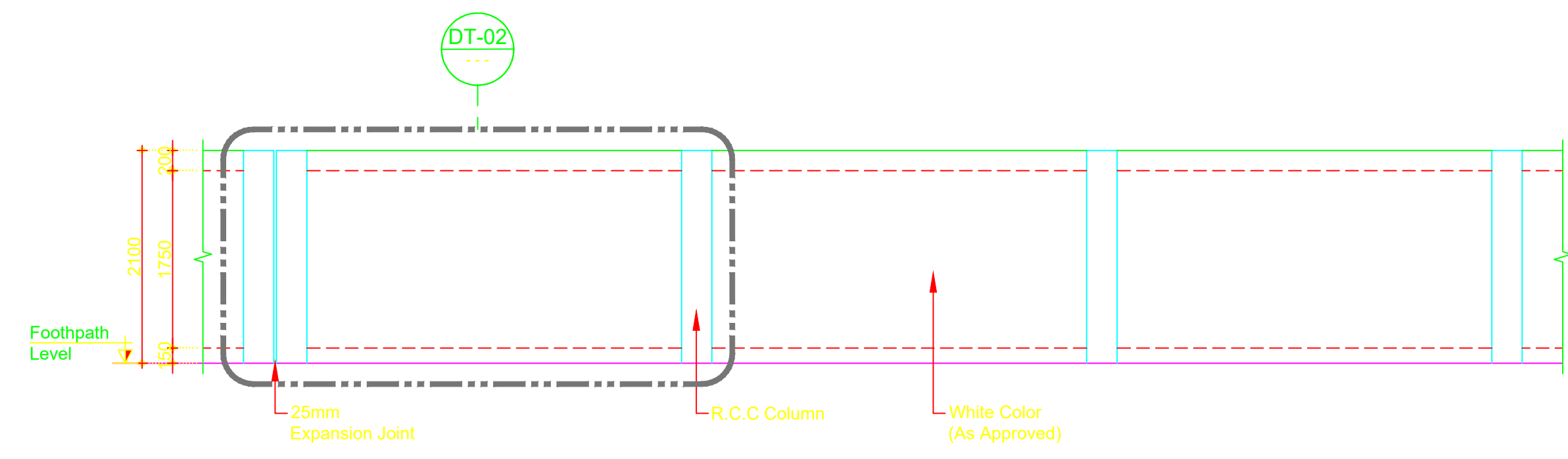
DETAIL - 01 (PLAN)

Scale = 1:20



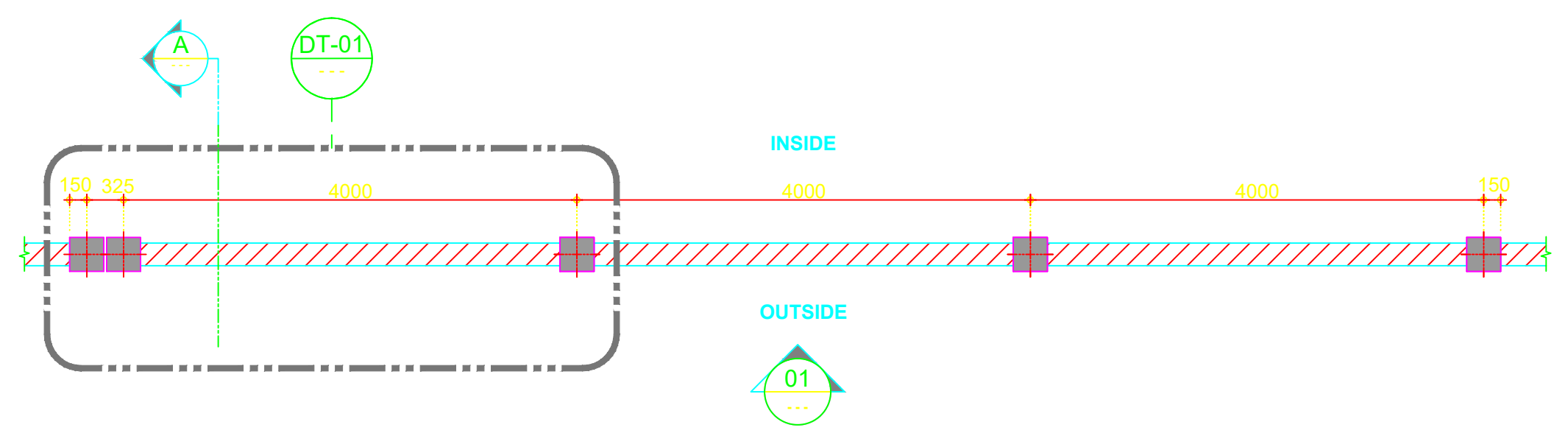
ELEVATION NO. 01

Scale = 1:50



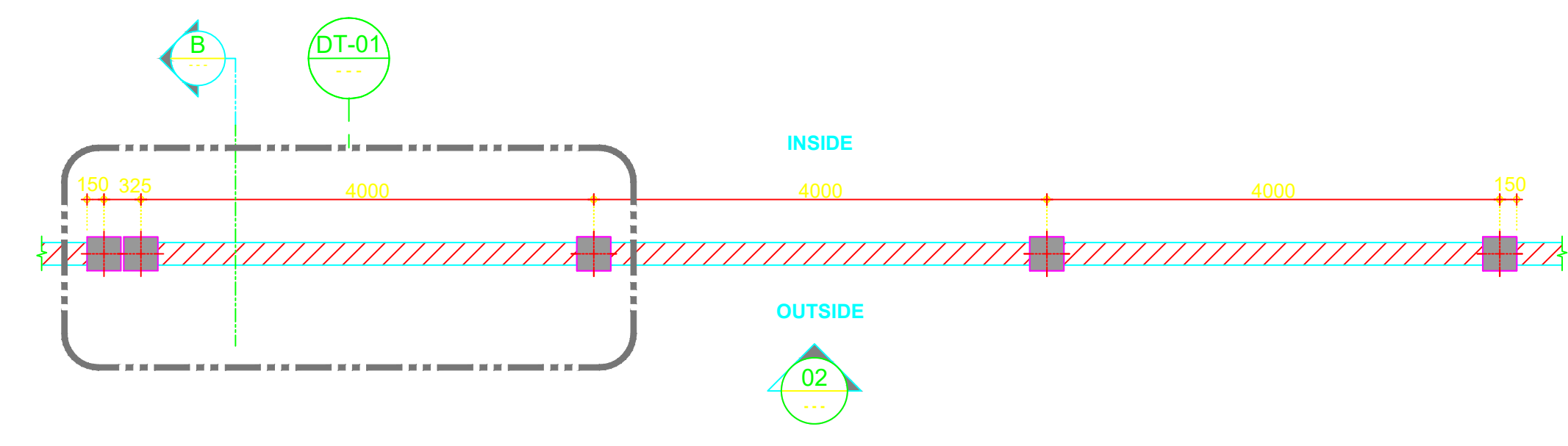
ELEVATION NO. 02

Scale = 1:50



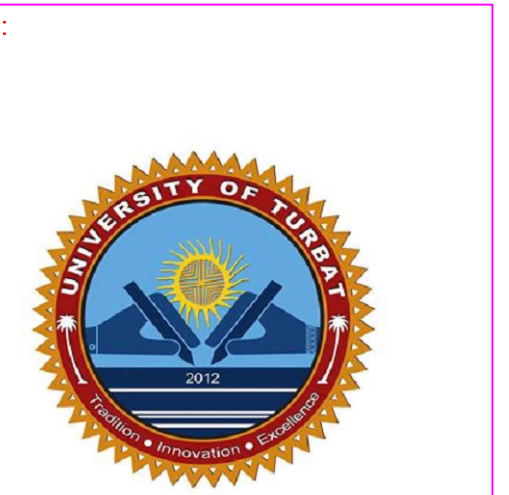
PLAN (BD - 01)

Scale = 1:50



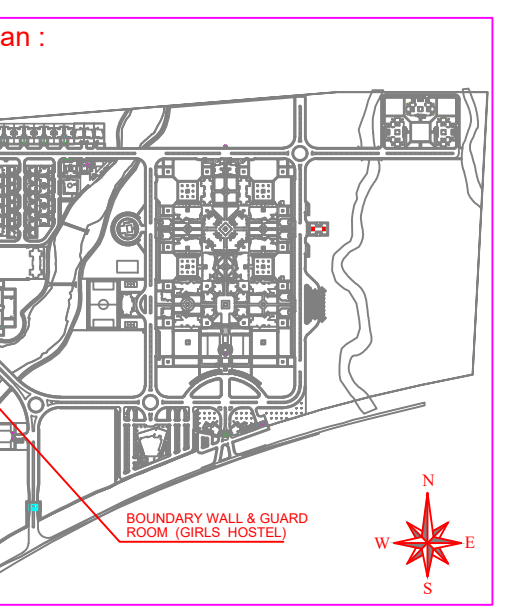
PLAN (BD - 02)

Scale = 1:50



Client :
 Consultant :
EA Consulting Pvt Ltd
 Head Office AL-9, 15th Lane, Khayaban-e-Hilal, Phase 7,
 Defence Housing Authority, Karachi. 75500 - Pakistan
 Phone No : 111-111-554 Fax No : 554-1825
 Email : info@eaworld.com | www.eaworld.com

Project :
UNIVERSITY OF TURBAT
BALUCHISTAN PAKISTAN
PHASE - II



Note:
 • All dimensions to be checked and verified on site.
 • Only written dimensions to be followed. Do not scale any drawing.
 • All dimensions are in **metre / millimetre** unless otherwise specified.
 • All Structural And MEP drawings to be read in conjunction with Architecture drawings.
 • The Architect / Engineer shall be notified of any discrepancy immediately.

North:
 Qiblah direction of Turbat, Balochistan, Pakistan is 262.886785 Degrees from North Clockwise.

Rev. No.	DATE	DESCRIPTION
REVISIONS		

Date of Issue	May 2024
Issued To	Client
Issued For	Tender

ARCHITECTURE

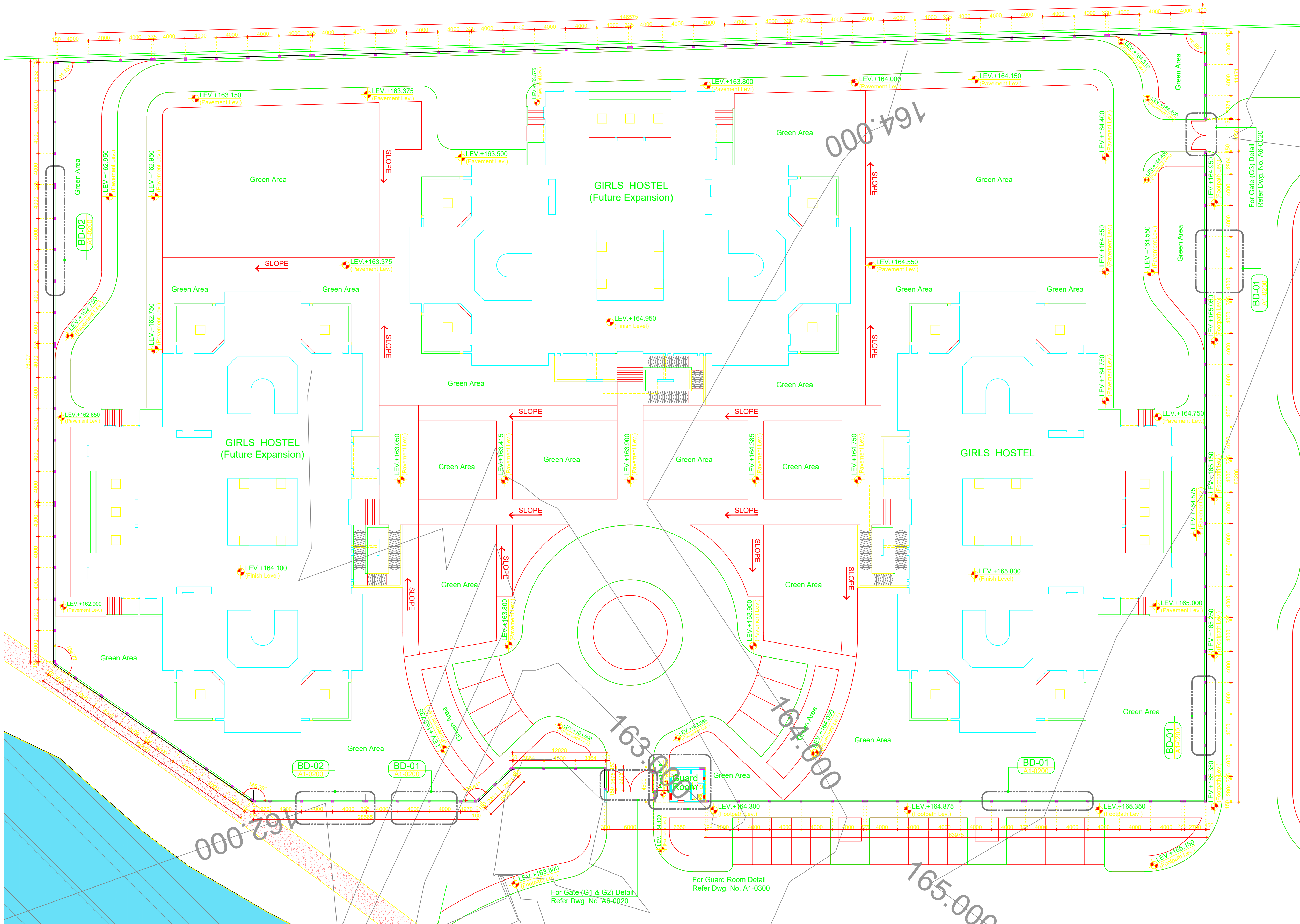
Status:
TENDER

Building Name:
EXTERNAL DEVELOPMENT BOUNDARY WALL & GUARD ROOM (GIRLS HOSTEL)

Drawing Title :
**BD - 01 & BD - 02
 DETAIL OF BOUNDARY WALL**

Designed :	Checked :	Approved :
MR	MR	AK
Drawn :	Date :	Scale / Sheet :
WA	July 2022	As Shown@A1
Project Code :	Rev. :	
	01067	

Drawing No. :
EA-01067-UBGT- A1-0200



Client :



Consultant :

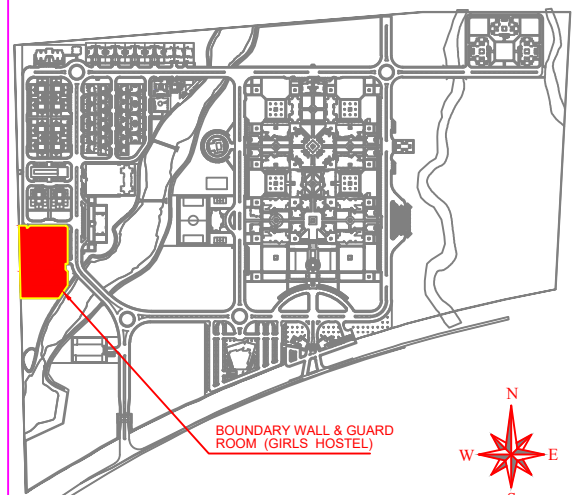


EA Consulting Pvt Ltd
 Head Office: AL-9, 15th Lane, Khayaban-e-Hilal, Phase 7,
 Defence Housing Authority, Karachi, 75500 - Pakistan
 Phone No. : 11-11-584 Fax No. : 584-1825
 Email : info@eaworld.com | www.eaworld.com

Project :

**UNIVERSITY OF
 TURBAT
 BALOCHISTAN PAKISTAN
 PHASE - II**

Key Plan :



Note:
 • All dimensions to be checked and verified on Site.
 • Only written dimensions to be followed. Do not scale any drawing.
 • All dimensions are in metre / millimetre unless otherwise specified.
 • All Structural And MEP drawings to be read in conjunction with Architecture drawings.
 • The Architect / Engineer shall be notified of any discrepancy immediately.

North:

 Obtain direction of Turbat, Balochistan, Pakistan is 282.886785 Degree from North Clockwise.

Rev. No.	DATE	DESCRIPTION
REVISIONS		

Date of Issue	May 2024
Issued To	Client
Issued For	Tender

ARCHITECTURE

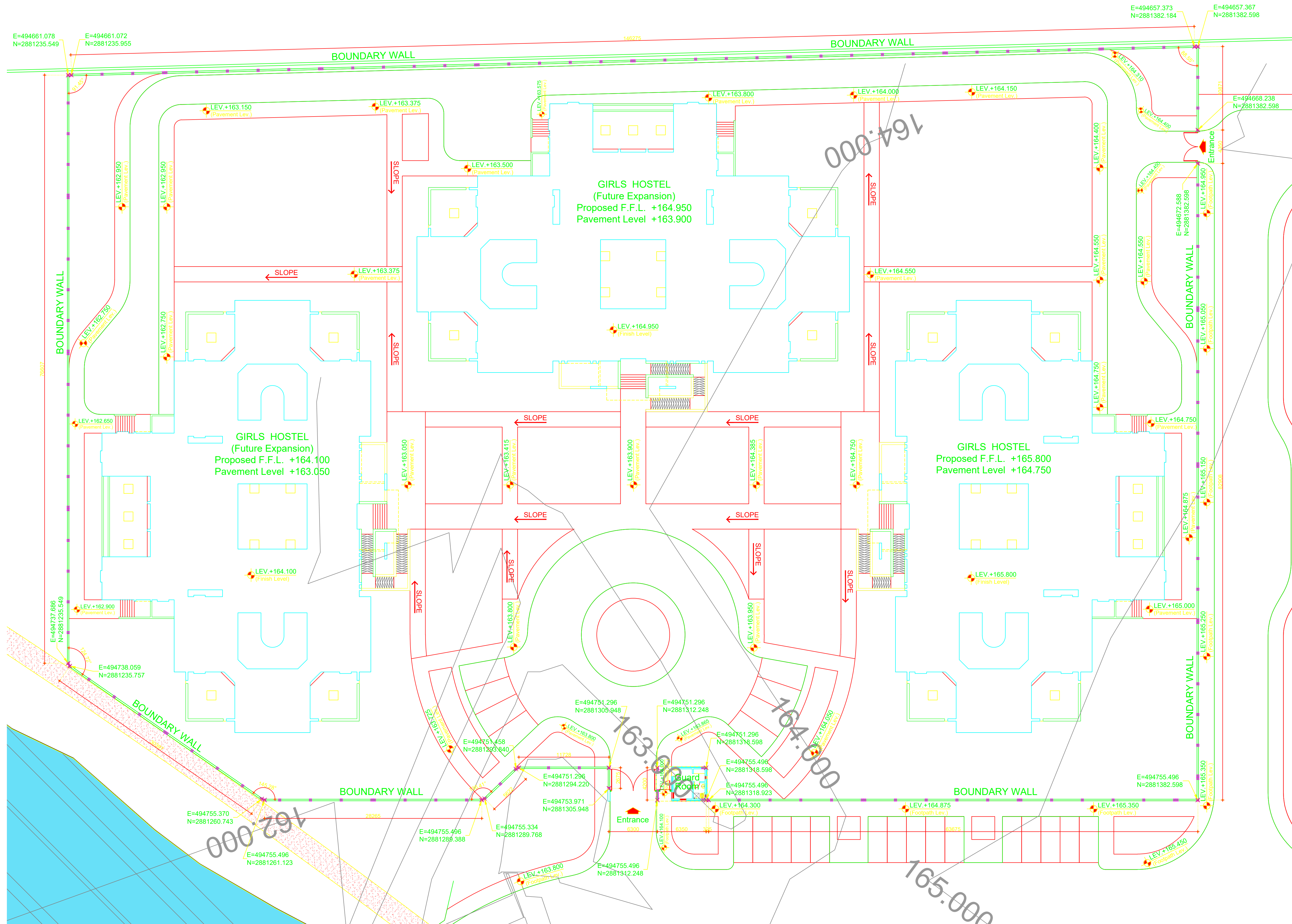
Status: **TENDER**

Building Name:
**EXTERNAL DEVELOPMENT
 BOUNDARY WALL & GUARD
 ROOM (GIRLS HOSTEL)**

Drawing Title :

**LAYOUT PLAN
 (BOUNDARY WALL)**

Designed :	Checked :	Approved :
MR	MR	AK
Drawn :	Date :	Scale / Sheet :
MAB	July 2022	1:500 @ A3 1:250 @ A1
Project Code :	Rev. :	
	01067	00
Drawing No. :	EA-01067-UBGT- A1-0100	



Client :



Consultant :

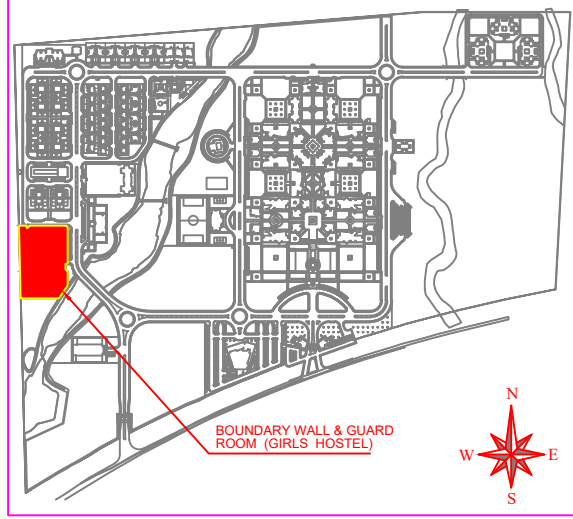


EA Consulting Pvt Ltd
 Head Office: AL-9, 15th Lane, Khayaban-e-Hilal, Phase 7,
 Defence Housing Authority, Karachi, 75500 - Pakistan
 Phone No. : 11-111-594 Fax No. : 664-1925
 Email : info@eaworld.com | www.eaworld.com

Project :

**UNIVERSITY OF
 TURBAT
 BALOCHISTAN PAKISTAN
 PHASE - II**

Key Plan :



Note:
 • All dimensions to be checked and verified on site.
 • Only written dimensions to be followed. Do not scale any drawing.
 • All dimensions are in metre / millimetre unless otherwise specified.
 • All Structural And MEP drawings to be read in conjunction with Architecture drawings.
 • The Architect / Engineer shall be notified of any discrepancy immediately.

North:

 Obtain direction of Turbat, Balochistan, Pakistan is 282.88785 Degree from North Clockwise.

Rev. No.	DATE	DESCRIPTION

Rev. No.	DATE	DESCRIPTION

Date of Issue: **May 2024**
 Issued To: **Client**
 Issued For: **Tender**

ARCHITECTURE

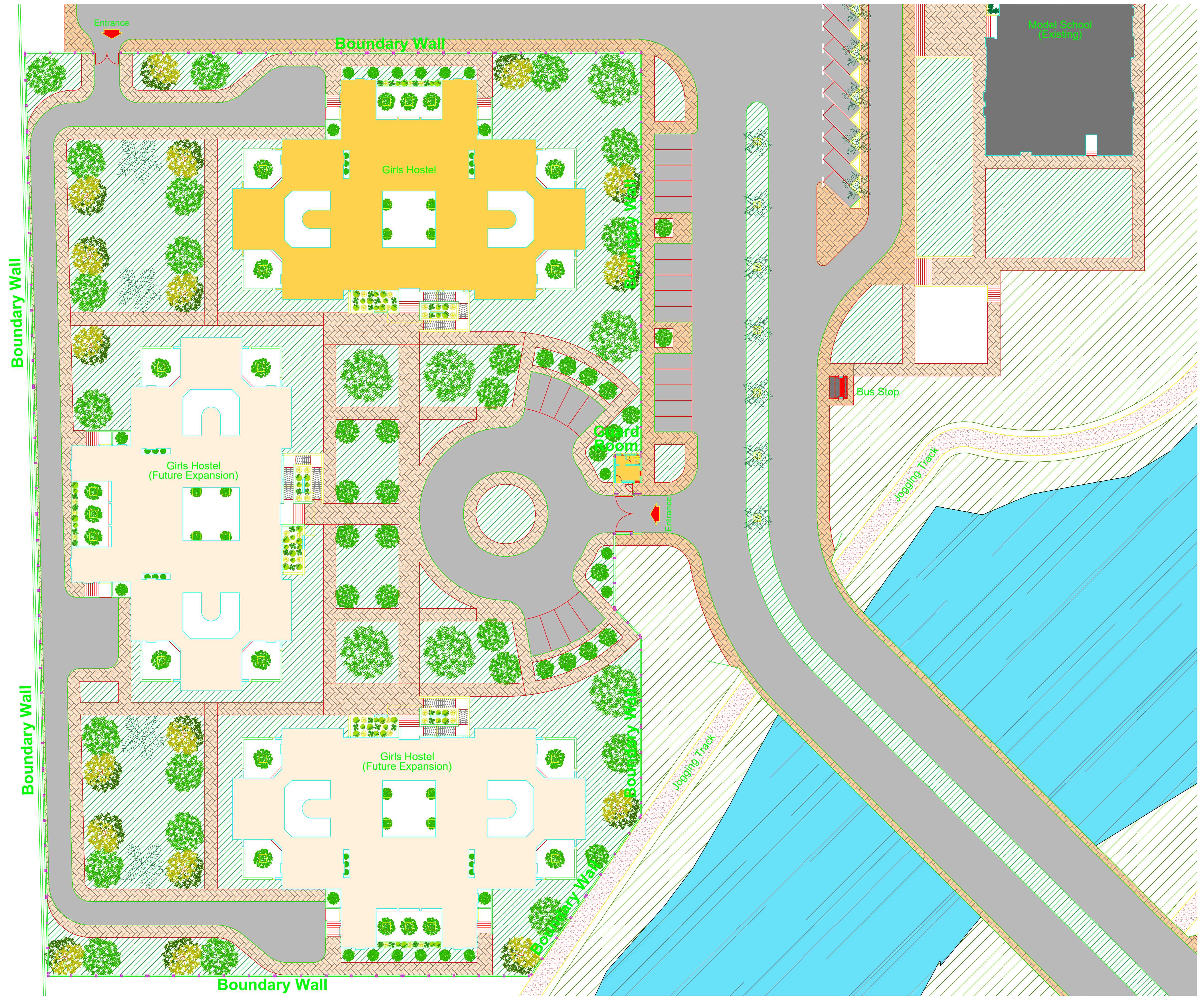
Status: **TENDER**

Building Name: **EXTERNAL DEVELOPMENT
 BOUNDARY WALL & GUARD ROOM (GIRLS HOSTEL)**

Drawing Title :

**S.O.P.
 (SETTING OUT PLAN)**

Designed :	Checked :	Approved :
MR	MR	AK
Drawn :	Date :	Scale / Sheet :
MAB	July 2022	1:500 @ A3 1:250 @ A1
Project Code :	Rev. :	
	01067	00
Drawing No. :	EA-01067-UBGT- A0-0004	



Client :



Consultant :

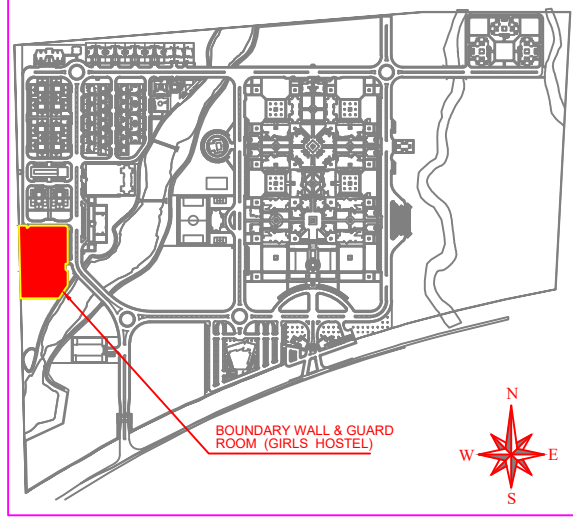


EA Consulting Pvt Ltd
 Head Office: AL-9, 15th Lane, Khayaban-e-Hilal Phase 7,
 Defence Housing Authority, Karachi, 75500 - Pakistan
 Phone No. : 111-11-584 | Fax No. : 584-1825
 Email : info@eaworld.com | www.eaworld.com

Project :

**UNIVERSITY OF
 TURBAT
 BALOCHISTAN PAKISTAN
 PHASE - II**

Key Plan :



Note:

- All dimensions to be checked and verified on site.
- Only written dimensions to be followed. Do not scale any drawing.
- All dimensions are in **metre / millimetre** unless otherwise specified.
- All Structural And MEP drawings to be read in conjunction with Architecture drawings.
- The Architect / Engineer shall be notified of any discrepancy immediately.

North:

Rev. No.	DATE	DESCRIPTION

Date of Issue	May 2024
Issued To	Client
Issued For	Tender

ARCHITECTURE

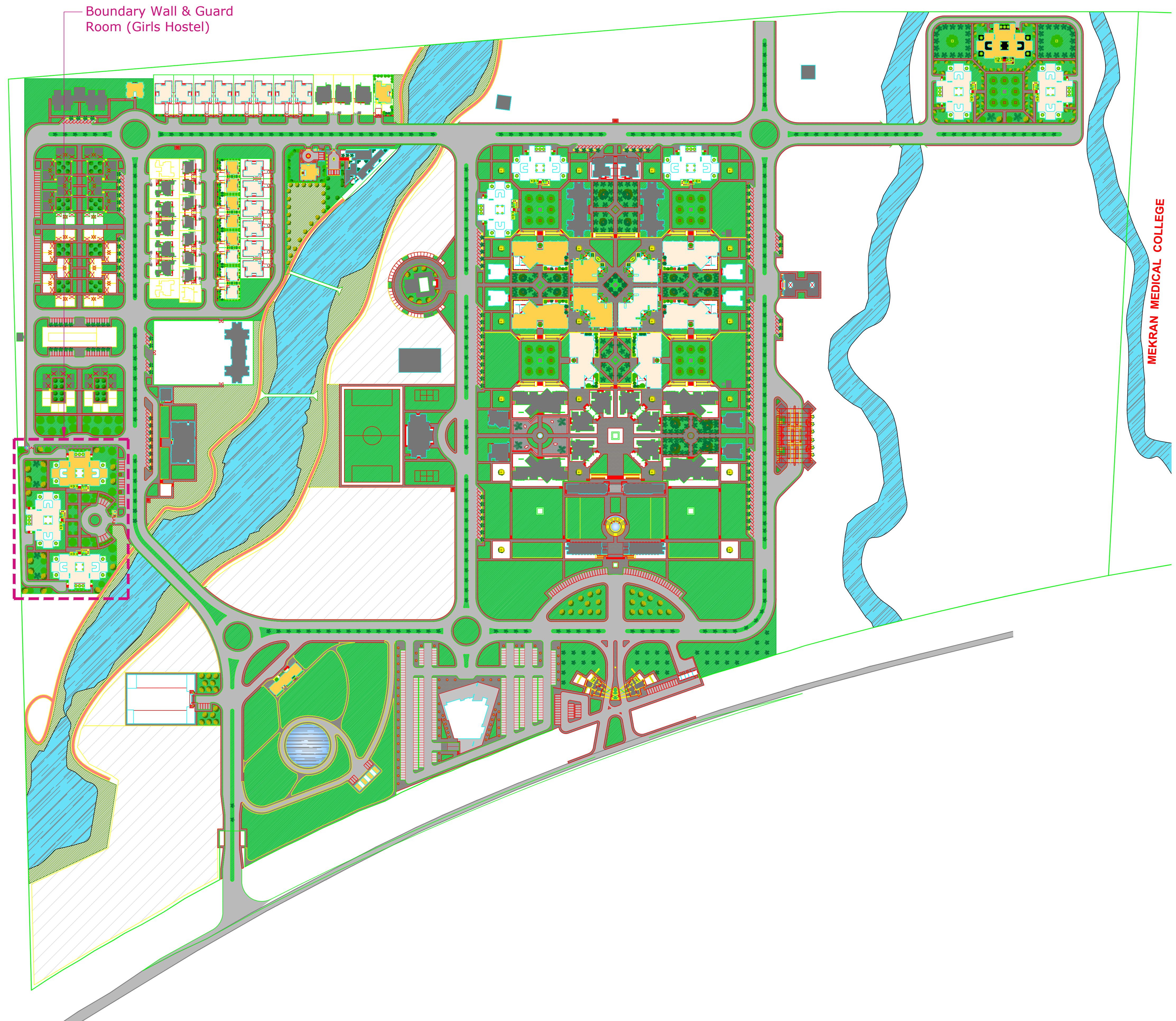
Status: **TENDER**

Building Name:
**EXTERNAL DEVELOPMENT
 BOUNDARY WALL & GUARD
 ROOM (GIRLS HOSTEL)**

Drawing Title :

SITE PLAN


Designed :	Checked :	Approved :
MR	MR	AK
Drawn :	Date :	Scale / Sheet :
MAB	July 2022	1:300 @ A3 1:300 @ A1
Project Code :	Rev. :	
	01067	00
Drawing No. :	EA-01067-UBGT- A0-0003	



Boundary Wall & Guard Room (Girls Hostel)

MEKHRAN MEDICAL COLLEGE

Client :



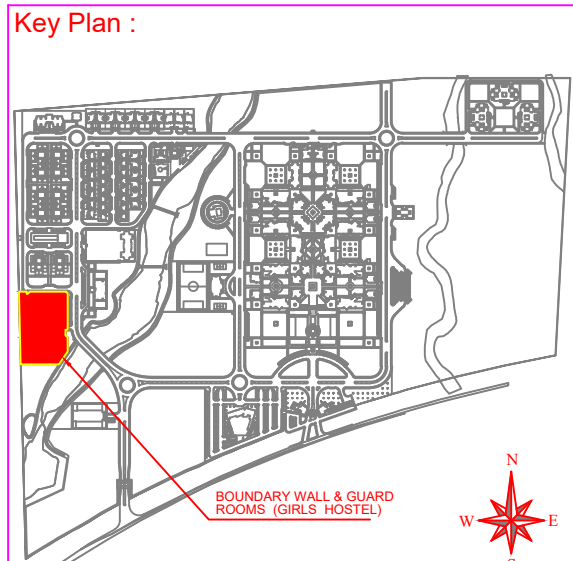
Consultant :



EA Consulting Pvt Ltd
 Head Office: AL-9, 15th Lane, Khayaban-e-Hilal, Phase 7,
 Defence Housing Authority, Karachi, 75500 - Pakistan
 Phone No. : 111-11-594 | Fax No. : 554-1925
 Email : info@eaworld.com | www.eaworld.com

Project :

**UNIVERSITY OF
 TURBAT
 BALOCHISTAN PAKISTAN
 PHASE - II**



Note:

- All dimensions to be checked and verified on Site.
- Only written dimensions to be followed. Do not scale any drawing.
- All dimensions are in metre / millimetre unless otherwise specified.
- All Structural And MEP drawings to be read in conjunction with Architecture drawings.
- The Architect / Engineer shall be notified of any discrepancy immediately.

North:

Qiblah direction of Turbat, Balochistan, Pakistan is 282.886785 Degrees from North Clockwise.

Rev. No.	DATE	DESCRIPTION
REVISIONS		

Date of Issue	May 2024
Issued To	Client
Issued For	Tender

ARCHITECTURE

Status: **TENDER**

Building Name:
**EXTERNAL DEVELOPMENT
 BOUNDARY WALL & GUARD
 ROOMS (GIRLS HOSTEL)**

Drawing Title :

LOCATION PLAN

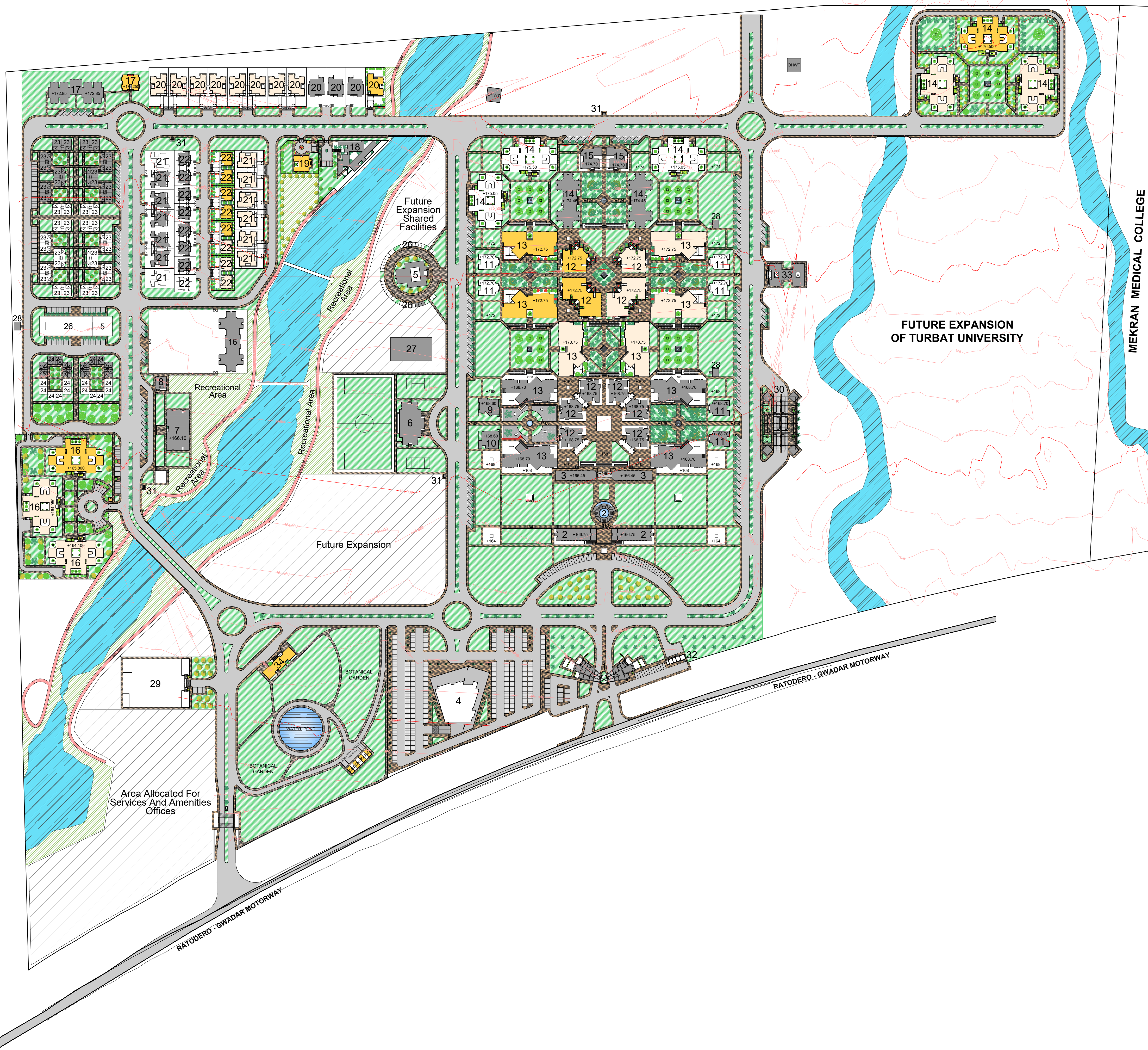
Designed :	Checked :	Approved :
MR	MR	AK
Drawn :	Date :	Scale / Sheet :
MAB	July 2022	1:2000 @ A1
Project Code :	Rev. :	
	01067	00
Drawing No. : EA-01067-UBGT- A0-0002		

TURBAT UNIVERSITY

LEGEND

1. GATE HOUSE
2. ADMIN BLOCK
3. LIBRARY
4. AUDITORIUM
5. MASJID
6. GYMNASIUM
7. MODEL SCHOOL
8. DISPENSARY
9. CAFETERIA
10. STUDENT SERVICE CENTRE
11. LARGE LECTURE HALL
12. SMALL L.T. / SEMINAR & FACULTY OFFICE
13. ACADEMIC BLOCK
14. BOYS HOSTEL
15. MESS
16. GIRLS HOSTEL
17. BACHELOR HOSTEL
18. VC HOUSE
19. PRO-VC HOUSE
20. CATEGORY HOUSE - A
21. CATEGORY HOUSE - B
22. CATEGORY HOUSE - C
23. CATEGORY HOUSE - D
24. CATEGORY HOUSE - E
25. GUEST HOUSE
26. MARKET
27. MULTIPURPOSE HALL
28. GENERATOR ROOM
29. BUS WORKSHOP
30. BUS TERMINAL
31. BUS STOP
32. SUB STATION
33. QEC BUILDING
34. TISSUE CULTURAL LAB

- EXISTING BUILDINGS
- PROPOSED BUILDINGS (PHASE - II)
- FUTURE BUILDINGS



Client :



Consultant :

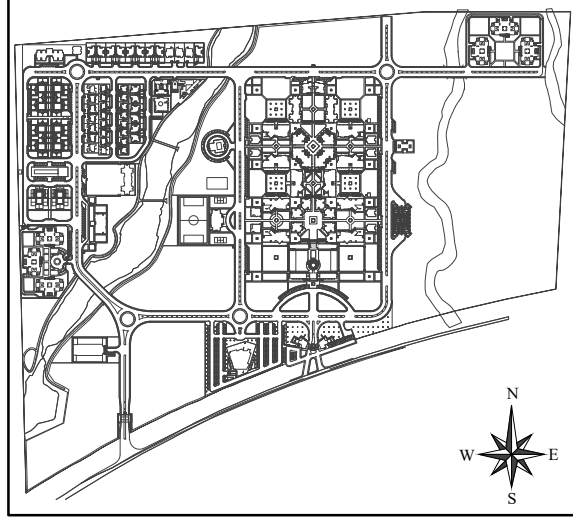


EA Consulting Pvt Ltd
 Head Office: AL-9, 15th Lane, Khayaban-e-Hilal, Phase 7,
 Defence Housing Authority, Karachi, 75500 - Pakistan
 Phone No. : 111-11-584 Fax No. : 584-1825
 Email : info@eaworld.com | www.eaworld.com

Project :

**UNIVERSITY OF
 TURBAT
 BALOCHISTAN PAKISTAN
 PHASE - II**

Key Plan :



Note:
 • All dimensions to be checked and verified on site.
 • Only written dimensions to be followed. Do not scale any drawing.
 • All dimensions are in feet / inch unless otherwise specified.
 • All Structural And MEP drawings to be read in conjunction with Architecture drawings.
 • The Architect / Engineer shall be notified of any discrepancy immediately.

North:

 (Scale: 1:2000 @ A1)

Rev. No.	DATE	DESCRIPTION
REVISIONS		

Date of Issue	May 2023
Issued To	Client
Issued For	Construction

ARCHITECTURE

Status:
CONSTRUCTION

Building Name:
MASTER PLAN

Drawing Title:
MASTER PLAN

Designed :	Checked :	Approved :
MR	MR	AK
Drawn :	Date :	Scale / Sheet :
MAB	July 2021	1:2000 @ A1
Project Code :	01067	Rev. : 00
Drawing No. : EA-01067-UMPT- A1-0100		